9-12 Math Curriculum

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STCHARLESR6

Grades 9-12 Math Curriculum Committee

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9-12 Math Curriculum
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District Mission

The City of St. Charles School District will REACH, TEACH, and EMPOWER all students by providing a challenging, diverse, and innovative education.

District Vision

The City of St. Charles School District will be an educational leader recognized for high performance and academic excellence that prepares students to succeed in an ever-changing global society.

District Values

We, the City of St. Charles School District community of students, parents, staff, and patrons, value:

- High quality education for all students which includes:
    - Lifelong learning from early childhood through adult education
    - Rigorous learning experiences that challenge all students
    - Instruction that meets the needs of a diverse community
    - Respect for all
    - Real world, critical thinking and problem-solving skills to prepare students for the 21st Century
    - Developing caring, productive, and responsible citizens
    - Strong engagement of family and community
    - A safe, secure, and nurturing school environment

- Achievement through:
    - Celebration of individual success
    - Collaboration with parents and community stakeholders
    - Exploration, Innovation, and creativity

- High quality staff by:
    - Hiring and retaining highly qualified and invested employees
    - Providing professional development and collaboration focused on increasing student achievement
    - Empowering staff to use innovative resources and practices

- Informed decisions that are:
    - Student-centered
    - Focused on student achievement
    - Data Driven
    - Considerate of all points of view
    - Fiscally responsible

District Goals

For planning purposes, five overarching goals have been developed. These goals are statements of the key functions of the school district.

1. Student Performance
   - Develop and enhance the quality educational/instructional programs to improve student performance and enable students to meet their personal, academic, and career goals.
2. Highly qualified staff
   - Recruit, attract, develop, and retain highly qualified staff to carry out the District's mission, vision, goals, and objectives.
3. Facilities, Support, and Instructional Resource
   - Provide and maintain appropriate instructional resources, support services, and functional and safe facilities.
4. Parent and Community Involvement
   - Promote, facilitate and enhance parent, student, and community involvement in district educational programs.
5. Governance
   - Govern the district in an efficient and effective manner providing leadership and representation to benefit the students, staff, and patrons of the district.

School District Philosophical Foundations

Teachers in the School District of the City of St. Charles share in and ascribe to a philosophy that places children at the heart of the educational process. We feel that it is our professional responsibility to strive to be our best at all times and to maximize our efforts by ensuring that the following factors are present in our classrooms and our schools.

1. Learning is developed within the personal, physical, social, and intellectual contexts of the learner.
2. A strong educational program should provide developmental continuity.
3. The successful learner is motivated, strategic, knowledgeable, and interactive.
4. Children learn best when they have real purposes and can make connections to real life.
5. Effective learning is a combination of student exploration and teacher and mentor modeling.
6. Assessment is an ongoing and multidimensional process that is an integral part of instruction.
7. Making reading and writing connections across multiple sources and curricula facilitates meaning.
8. Literacy for the future means literacy in multiple technologies.
9. Education must respond to society's diverse population and serve all children.
10. Interactions among students, teachers, parents, and community form the network that supports learning.

9-12 Math Philosophy

It is the goal of the Secondary Math Department of the City of St. Charles School District to foster a deep understanding of mathematical concepts. As math educators, we will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have mathematical literacy, a complete mathematical skill set, and an understanding of the real life applications of mathematics. In order to ensure that these goals are met for students, it is the philosophy of the City of St. Charles School District to provide ongoing professional development and support for teachers.

9-12 Math Course Description

PreAlgebra

Our Pre-Algebra course is an introduction to basic algebra concepts and a review of arithmetic algorithms. The course emphasizes the concepts necessary to be successful in Algebra I and II. The course helps students develop good mathematical study skills and learning strategies. Students will explore algebraic expressions and integers, solve one-step equations and inequalities, decimals and equations, factors, fractions, exponents, operations with fractions, ratios, proportions, percents, linear functions and graphing, spatial thinking, area and volume, right triangles in Algebra, data analysis and probability, and nonlinear functions and polynomials.

Algebra 1

The fundamental purpose of this course is to formalize and extend the mathematics that students learned in the earlier grades. Students will explore many examples of functions, compare key characteristics of these functions, and translate between graphical, numerical and symbolic representations of them. They will create and solve equations and inequalities, and systems of equations involving linear and quadratic expressions, extend the laws of exponents to rational exponents and compare/contrast linear, exponential, and quadratic functions.

GEOMETRY

The focus of Geometry includes using critical thinking, perseverance, collaboration, problem-solving, and communication throughout the course to develop a deep understanding of logic and reasoning, angle relationships, perpendicular lines, parallel lines and planes, triangles, quadrilaterals, similar polygons, circles, construction, coordinate geometry, transformations, right triangle trigonometry, areas of 2D figures, and surface areas and volumes of 3D solids.

HONORS GEOMETRY

Honors Geometry is a rigorous proof-based course covering traditional Geometry topics at a deeper level. The course is designed to develop spatial reasoning, logic, and precise mathematical language. All units in this course will tie together geometric and previous advanced algebraic content knowledge such as systems of equations, factoring and solving quadratic equations. The intent of this course is to prepare students for advanced coursework and mathematics study at the college level.

ALGEBRA 2

Algebra 2 includes a more advanced study of the functions introduced in Algebra 1. The number system will be extended to include the complex numbers. The course will include advanced operations, solving, graphing, and writing the following: systems of equations, polynomial, radical, exponential, logarithmic, and rational functions. Purchase of a graphing calculator is strongly recommended.

HONORS ALGEBRA 2

Honors Algebra 2 is a challenging course, which includes a more advanced study of the functions introduced in Algebra 1. Students will also extend their knowledge of functions to include polynomial, rational, radical, exponential and logarithmic functions. Students will work in depth to model real-world situations, analyze and graph these functions, in addition to solving equations over the set of complex numbers. Emphasis will be placed on the relationships between quadratic, polynomial and rational functions, as well as using more technology to analyze these functions. The intent of this course is to prepare students for advanced coursework and mathematics study at the college level. Purchase of a graphing calculator is strongly recommended.

INTEGRATED MATH

Integrated Math 1 is a Semester long course in which students will gain experience with Geometry, Trigonometry, and Advanced Algebraic Concepts. This class is designed to enhance a students skills in college and career readiness.

AP STATISTICS

The AP Statistics course is a non-calculus-based college-level course in statistics. The course introduces students to the major concepts and tools for collecting, analyzing, and drawing conclusions from data. There are four themes in the AP Statistics course: exploring data, sampling and experimentation, anticipating patterns, and statistical inference. Students use technology, investigations, problem solving, and writing as they build conceptual understanding.

HONORS PRE-CALCULUS

Pre-calculus is an advanced course emphasizing a wide variety of functions including polynomials, exponential, logarithm mic, rational, inverse, and trigonometric. Other topics include matrices, conic sections, complex and polar coordinates, sequences, and combinatorics. The intent of this course is to prepare students for Calculus and mathematics study at the college level. A graphing calculator is required.

COLLEGE ALGEBRA

College Algebra is a college-level course analyzing and solving polynomial, exponential, logarithmic, rational, piecewise and absolute value functions, including but not limited to transformations, operations, compositions, and inverses. Other topics consist of rates of change, systems of equations and inequalities, matrix operations, and applications of discussed topics.

CALCULUS

This is an intensive full year course in the calculus of a single variable. This course provides an introduction to differential and integral calculus. Topics will include an introduction to limits, continuity, derivatives, related rates, Newton’s Method, the Mean-Value Theorem, Max-Min problems, the integral, the Fundamental Theorem of Integral Calculus,a exponential and logarithmic functions, curve sketching, areas, volumes, and average values. Graphing calculators will be utilized throughout the course. A student may earn college credit for the successful completion of this course or by attaining the required score on the advanced placement test

9-12 Math Program Goals

This curriculum was developed with the belief that each student has the capability of understanding and applying mathematical practices in a variety of ways to real world problems. Guaranteeing a viable mathematics curriculum for each student in the City of St. Charles School District is ensured through continuous professional development for teachers, supporting students' individual mathematics learning style, and continuous review of best practices in mathematics. From the onset, this curriculum was developed with the overarching transfer goals of critical thinking, perseverance, collaboration, problem-solving, and communication. It is through these practices that students will be able to utilize their mathematics skills beyond the classroom, and apply them in real world situations. This curriculum will continue to be reviewed through assessment data collection, review of best practices, and ongoing teacher input and collaboration. The structural integrity of this secondary mathematics curriculum prepares the students of the City of St. Charles School District for mathematical success in college, career, and life.

Essential Learning Outcomes

PreAlgebra

In Math 8/PreAlgebra, students will focus on enhancing skills for readiness in Algebra I and Algebra II. Using instructional practices to promote critical thinking, perseverance, collaboration, problem-solving, and communication, students will:

- Apply concepts of slope and y-intercept to graphs, equations and proportional relationships.
- Solve linear equations and inequalities in one variable.
- Use the Pythagorean Theorem to determine unknown side lengths in right triangles in problems in two- and three-dimensional contexts.
- Solve problems involving surface area and volume.
- Interpret the parameters of a linear model of bivariate measurement data to solve problems
- Describe the effect of dilations, translations, rotations and reflections on two-dimensional figures using coordinates.
- Explore angle relationships and establish informal arguments.
- Solve systems of two linear equations.

Algebra 1

In Algebra 1, students learn to formalize and apply their previous mathematical learning, preparing for Geometry and Algebra II. Using instructional practices to promote critical thinking, perseverance, collaboration, problem-solving, and communication, students will:

- Construct linear, quadratic and exponential equations given graphs, verbal descriptions or tables.
- Extend and use properties of rational exponents.
- Solve problems involving quadratic equations.
- Solve systems of equations

Geometry/Honors Geometry

In Geometry and Honors Geometry, students learn to synthesize their previous mathematical knowledge and apply it to spatial relationships. This course prepares students for more advanced mathematics courses. Using instructional practices to promote critical thinking, perseverance, collaboration, problem-solving, and communication, students will:

- Experiment with transformations in the plane.
- Understand congruence in terms of rigid motions.
- Prove geometric theorems.
- Prove theorems involving similarity.
- Define trigonometric ratios, and solve problems involving right triangles.
- Understand and apply theorems about circles.
- Explain volume formulas and use them to solve problems.

Algebra II/Honors Algebra II

In Algebra II and Honors Algebra II, students use the concepts learned in Algebra I at a more complex level. This course deepens students' problem solving and analytical skills. Using instructional practices to promote critical thinking, perseverance, collaboration, problem-solving, and communication, students will:

- Extend and use the relationship between rational exponents and radicals.
- Use complex numbers.
- Define and use logarithms.
- Solve equations and inequalities.
- Solve general systems of equations and inequalities.
- Perform operations on polynomials and rational expressions.
- Use and interpret functions.
- Create new functions from existing functions.
- Use functions to model real-world problems.

Integrated Math

In this course, students apply a variety of mathematical concepts to real world problems, in preparation for college and career readiness. Using instructional practices to promote critical thinking, perseverance, collaboration, problem-solving, and communication, students will:

- Use functions to model real-world problems.
- Use and interpret functions.
- Define trigonometric ratios, and solve problems involving right triangles.
- Apply geometric concepts in modeling situations.
- Perform operations on polynomials and rational expressions.

AP Statistics

In this course, students will apply the four themes of AP Statistics: exploring data, sampling and experimentation, anticipating patterns, and statistical inference. Using instructional practices to promote critical thinking, perseverance, collaboration, problem-solving, and communication, students will:

- Explore Data: Describing patterns and departures from patterns.
- Understand Sampling and Experimentation: Planning and conducting a study.
- Anticipate Patterns: Exploring random phenomena using probability and simulation.
- Understand Statistical Inference: Estimating population parameters and testing hypotheses.

Honors Pre-Calculus

In this course, students will learn the essential skills to prepare them for advanced mathematics courses, particularly Calculus. Using instructional practices to promote critical thinking, perseverance, collaboration, problem-solving, and communication, students will:

- Learn the foundations of functions
- Analyze functions
- Learn algebraic reasoning

College Algebra

In this course, students will advance their algebraic knowledge at the collegiate level. Using instructional practices to promote critical thinking, perseverance, collaboration, problem-solving, and communication, students will:

- Learn the foundations of functions
- Analyze functions
- Learn algebraic reasoning

Calculus

In this course, students have the opportunity to culminate their mathematical knowledge at a complex level. Synthesizing a variety of mathematical concepts, students will look at real world mathematical problems at a high level. Using instructional practices to promote critical thinking, perseverance, collaboration, problem-solving, and communication, students will:

- Reasoning with definitions and theorems
- Connecting concepts
- Implementing algebraic/computational processes
- Connecting multiple representations
- Building notational fluency
- Communicating

9-12 Math Scope & Sequence

Topics	Algebra 1	Geometry	Algebra 2	Integrated Math	College Algebra	AP Statistics	Honors PreCalculus	Calculus
Number and Quantity	R		M		RM		RM	
Seeing Structure in Expressions	R	R	M		RM		RM	
Creating Equations	R		M		RM		RM	
Reasoning with Equations and Inequalities	IR		M		RM		RM	
Arithmetic with Polynomials and Rational Expressions	I		RM		RM		RM	
Interpreting Functions	IR		RM		RM		RM	
Building Functions	I		RM		RM		RM	
Modeling	I		RM		RM		RM	
Linear, Quadratic, and Exponential Models	IR		RM		RM		RM	
Probability & Simulation	I		I		I	IRM		
Statistical Inference			I			IRM		
Data and Statistical Analysis	I		I			IRM		
Congruence		IR						
Similarity, Right Triangles, and Trigonometry		IR					M	
Circles		IR			RM		RM	
Exploring Geometric Properties with Equations	I	RM	R		R		RM	
Geometric Measurement and Dimension		RM	R		R		R	

Modeling with Geometry		RM	R		R		R	
Conic Sections			I		IRM		IRM	
Sequence and Series					I		I	RM
Limits							I	RM
Continuity							I	RM
Applications of the Derivative								IRM
The Definite Integral								IRM
Techniques of Integration								IRM
Applications of the Definite Integral						R		IRM
Techniques of Differentiation								IRM
Parametric/Polar Equations							IRM	M

Pre-Algebra Course Overview	
Grade level(s): 9	**Credits earned:** 1
Course Rationale	**Course Description**
Mathematics provides the conceptual basis for the structure of many things around us. This course is an extension of the middle school math curriculum. Topics that were first introduced in middle school will be built upon and applied to problems that require higher order thinking skills. Pre-Algebra builds an essential foundation of mathematics for those students going on to Algebra 1 and 2 and/or students who are college bound. Along with many colleges, a majority of careers require a successful completion of an Algebra 1 course and this course helps student reach that goal.	Our Pre-Algebra course is an introduction to basic algebra concepts and a review of arithmetic algorithms. The course emphasizes the concepts necessary to be successful in Algebra I and II. The course helps students develop good mathematical study skills and learning strategies. Students will explore algebraic expressions and integers, solve one-step equations and inequalities, decimals and equations, factors, fractions, exponents, operations with fractions, ratios, proportions, percents, linear functions and graphing, spatial thinking, area and volume, right triangles in Algebra, data analysis and probability, and nonlinear functions and polynomials.
Transfer Goals/Big Ideas	
Students will be able to independently use their learning to… We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have: 1) Mathematical literacy. 2) A complete mathematical skill set. 3) An understanding of the real life applications of mathematics.	

Priority Missouri Learning Standards/National Standards

- 7.NS.A Apply and extend previous understandings of operations to add, subtract, multiply and divide rational numbers.
- 8.NS.A Know that there are numbers that are not rational, and approximate them by rational numbers.

Unit 1: Real Number System
Desired Results

Standards	**Transfer Goal(s) /Big Ideas**	
• 7.NS.A	Students will be able to independently use their learning to… We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have: 1) Mathematical literacy. 2) A complete mathematical skill set. 3) An understanding of the real life applications of mathematics Students will have an understanding of real number system and be able to compute with them.	
	Enduring Understandings	**Essential Questions**
	Students will understand that… Operations and real number system are essential to the comprehension of all math skills.	Students will consider… How can algebraic and numerical expressions be evaluated and simplified? How are integers used to represent real-life situations? How are integers used to represent real-life situations?

Learning Targets
Students will… ➢ Students will understand the vocabulary and relationships of all real numbers. Students will understand the difference and be able to identify rational and irrational numbers. ➢ Students will be able to use order of operations with all integers and fractions. ➢ Students will use the number line to compare all real numbers. Students will use written examples of integers to compare all real numbers. Ie. write the integer for the following: 19 miles below sea level. Students will show an understanding of comparing all real numbers by showing they can convert fractions, decimals, and percentages to each other.
Unit Duration:
4 weeks

Pre-Algebra Course Overview	
Grade level(s): 9	**Credits earned:** 1
Course Rationale	**Course Description**
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Transfer Goals/Big Ideas	
Students will be able to independently use their learning to… We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have: 1) Mathematical literacy. 2) A complete mathematical skill set. 3) An understanding of the real life applications of mathematics.	
Priority Missouri Learning Standards/National Standards	
● 8.DSP.A Investigate patterns of association in bivariate data. ● 8.GM.A.3 Describe the effect of dilations, translations, rotations and reflections on two-dimensional figures using coordinates. ● 6.GM.A.3 Solve problems by graphing points in all four quadrants of the Cartesian coordinate plane.	

Unit 2: Coordinate Plane
Desired Results

Standards	Transfer Goal(s) /Big Ideas	
8.DSP.A	Students will be able to independently use their learning to… We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have: 1) Mathematical literacy. 2) A complete mathematical skill set. 3) An understanding of the real life applications of mathematics. Students will understand the coordinate plane and use it to graph, find patterns, and perform transformations.	
	Enduring Understandings	**Essential Questions**
	Students will understand that… The coordinate plane can be used for plotting, creating patterns, understanding correlations, and transforming images.	Students will consider… How can the coordinate plane be used to make predictions? How is the study of patterns in math applicable in real life?

Learning Targets
Students will… ➢ Students will show an understanding of coordinates in relation to a coordinate plane and will be able to label points and plot points. ➢ Students will be able to apply transformations of points and shapes. ➢ Students will show and understanding of coordinates in relation to a table. ➢ Students will show an understanding of scatterplots. They will be able to identify key features, interpret the meaning of the scatterplot, and use the given information to predict other information. Ie. Given a table, create a scatterplot and predict the height of a 12 year old.
Unit Duration:
3 weeks

Pre-Algebra Course Overview	
Grade level(s): 9	**Credits earned:** 1
Course Rationale	**Course Description**
Mathematics provides the conceptual basis for the structure of many things around us. This course is an extension of the middle school math curriculum. Topics that were first introduced in middle school will be built upon and applied to problems that require higher order thinking skills. Pre-Algebra builds an essential foundation of mathematics for those students going on to Algebra 1 and 2 and/or students who are college bound. Along with many colleges, a majority of careers require a successful completion of an Algebra 1 course and this course helps student reach that goal.	Our Pre-Algebra course is an introduction to basic algebra concepts and a review of arithmetic algorithms. The course emphasizes the concepts necessary to be successful in Algebra I and II. The course helps students develop good mathematical study skills and learning strategies. Students will explore algebraic expressions and integers, solve one-step equations and inequalities, decimals and equations, factors, fractions, exponents, operations with fractions, ratios, proportions, percents, linear functions and graphing, spatial thinking, area and volume, right triangles in Algebra, data analysis and probability, and nonlinear functions and polynomials.
Transfer Goals/Big Ideas	
Students will be able to independently use their learning to… [HOW THE LEARNING HELPS STUDENTS OUTSIDE OF THE CLASSROOM] Think BStudents will be able to independently use their learning to… We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have: 1) Mathematical literacy. 2) A complete mathematical skill set. 3) An understanding of the real life applications of mathematics.	
Priority Missouri Learning Standards/National Standards	
• 8.EEI.A Work with radicals and integer exponents	

Unit 3: Exponents **Desired Results**		
Standards	**Transfer Goal(s) /Big Ideas**	
8.EEI.A	Students will be able to independently use their learning to… [HOW THE LEARNING HELPS STUDENTS OUTSIDE OF THE CLASSROOM] Think BStudents will be able to independently use their learning to… We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have: 1) Mathematical literacy. 2) A complete mathematical skill set. 3) An understanding of the real life applications of mathematics. Students will use exponent rules to simplify expressions.	
	Enduring Understandings	**Essential Questions**
	Students will understand that… Exponents and radicals have rules that are used to simplify expressions. Simplifying/estimating radicals can give us a more accurate and understandable number.	Students will consider… How are the laws of exponents used to simplify expressions and roots?

Learning Targets
Students will… ➢ Students will be able to write exponents into expanded form and vice versa. ➢ Students will show an understanding of exponential laws and use them to simplify problems. ➢ Students will show an understanding of perfect squares. ➢ Students will show an understanding of roots. Students will be able to estimate roots.
Unit Duration:
3 weeks

Pre-Algebra Course Overview	
Grade level(s): 9	**Credits earned:1**
Course Rationale	**Course Description**
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Transfer Goals/Big Ideas	
Students will be able to independently use their learning to… We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have: 1) Mathematical literacy. 2) A complete mathematical skill set. 3) An understanding of the real life applications of mathematics.	
Priority Missouri Learning Standards/National Standards	

8.EEI.C Analyze and solve linear equations and inequalities and pairs of simultaneous linear equations.

Unit 4: Solving Linear Equations/Inequalities
Desired Results

Standards	Transfer Goal(s) /Big Ideas	
8.EEI.C	Students will be able to independently use their learning to… We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have: 1) Mathematical literacy. 2) A complete mathematical skill set. 3) An understanding of the real life applications of mathematics. Big Idea: Solve multi-step equations.	
	Enduring Understandings	**Essential Questions**
	Students will understand that… Using certain steps will help you solve multi-step equations. Solving equations can help solve real-world problems.	Students will consider… Why is it important to be able to model real life problems using equations and/or inequalities? How is the distributive property and the combining of like terms helpful in mathematics?

Learning Targets
Students will… ➢ Students will be able to solve one and two step equations/ inequalities. (sem 1) ➢ Students will combine like terms and use the distributive property to solve multi-step equations/inequalities. (sem 2) ➢ Students will write equations from given word problems to solve. (sem1/2) ➢ When solving inequalities, students will graph solutions on a number line. (sem1/2)
Unit Duration:
4 weeks (split)

Pre-Algebra Course Overview	
Grade level(s): 9	**Credits earned:** 1
Course Rationale	**Course Description**
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Transfer Goals/Big Ideas	
Students will be able to independently use their learning to… We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have: 1) Mathematical literacy. 2) A complete mathematical skill set. 3) An understanding of the real life applications of mathematics.	
Priority Missouri Learning Standards/National Standards	

8.EEI.B.5 Graph proportional relationships. a. Interpret the unit rate as the slope of the graph. b. Compare two different proportional relationships.

<table>
<tr><th colspan="3">Unit 5: Slope of a Line
Desired Results</th></tr>
<tr><th>Standards</th><th colspan="2">Transfer Goal(s) /Big Ideas</th></tr>
<tr><td rowspan="3">8.EEI.B.5</td><td colspan="2">Students will be able to independently use their learning to…
We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have:
1) Mathematical literacy.
2) A complete mathematical skill set.
3) An understanding of the real life applications of mathematics.
Big Idea: Successfully calculate, discover, and interpret slopes in multiple versions.</td></tr>
<tr><th>Enduring Understandings</th><th>Essential Questions</th></tr>
<tr><td>Students will understand that…
Slope is key to graphing a linear equation and can be found in a variety of ways. Change in y over change in x is the essential understanding for this concept.</td><td>Students will consider…
What is slope and how is it useful in both creating and reading graphs?
How are ratios, unit rates, and rates applicable to real life situations?</td></tr>
</table>

Learning Targets
Students will… ➢ Students will show an understanding slope. Understanding that slope is a continuous relationship of a line. Showing slope as a rate of change and being able to interpret what the slope may stand for. ➢ Students will find slope given two points, a line, and a table.
Unit Duration:
3 weeks

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Course Overview</th></tr>
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</table>

Priority Missouri Learning Standards/National Standards
8.EEI.B.6 Apply concepts of slope and y-intercept to graphs, equations and proportional relationships. a. Explain why the slope (m) is the same between any two distinct points on a non-vertical line in the Cartesian coordinate plane. b. Derive the equation y = mx for a line through the origin and the equation y = mx + b for a line intercepting the vertical axis at b.

<table>
<tr><th colspan="3">Unit 6: Graphing Linear Equations
Desired Results</th></tr>
<tr><th>Standards</th><th colspan="2">Transfer Goal(s) /Big Ideas</th></tr>
<tr><td rowspan="3">8.EEI.B.6</td><td colspan="2">Students will be able to independently use their learning to…
We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have:
1) Mathematical literacy.
2) A complete mathematical skill set.
3) An understanding of the real life applications of mathematics.
Big Idea: Graph lines from a variety of forms.</td></tr>
<tr><th>Enduring Understandings</th><th>Essential Questions</th></tr>
<tr><td>Students will understand that…
different forms (table, equation, points) can create the same line and this line can be used to interpret data.</td><td>Students will consider…
What are the benefits of using graphs to model real life situations?
What are three techniques for graphing linear equations on the coordinate plane?</td></tr>
</table>

Learning Targets
Students will… ➢ Students will be able to graph linear equations using slope intercept form, various points, and a given table. ➢ Students will be able to identify and interpret slopes and y-intercepts from a linear graphs. ➢ Students will show an understanding of functions as linear or non-linear.
Unit Duration:
3 weeks

Pre-Algebra Course Overview	
Grade level(s): 9	**Credits earned:** 1
Course Rationale	**Course Description**
Mathematics provides the conceptual basis for the structure of many things around us. This course is an extension of the middle school math curriculum. Topics that were first introduced in middle school will be built upon and applied to problems that require higher order thinking skills. Pre-Algebra builds an essential foundation of mathematics for those students going on to Algebra 1 and 2 and/or students who are college bound. Along with many colleges, a majority of careers require a successful completion of an Algebra 1 course and this course helps student reach that goal.	Our Pre-Algebra course is an introduction to basic algebra concepts and a review of arithmetic algorithms. The course emphasizes the concepts necessary to be successful in Algebra I and II. The course helps students develop good mathematical study skills and learning strategies. Students will explore algebraic expressions and integers, solve one-step equations and inequalities, decimals and equations, factors, fractions, exponents, operations with fractions, ratios, proportions, percents, linear functions and graphing, spatial thinking, area and volume, right triangles in Algebra, data analysis and probability, and nonlinear functions and polynomials.
Transfer Goals/Big Ideas	
Students will be able to independently use their learning to… We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have: 1) Mathematical literacy. 2) A complete mathematical skill set. 3) An understanding of the real life applications of mathematics.	
Priority Missouri Learning Standards/National Standards	

8.GM.C Solve problems involving volume of cones, pyramids and spheres.
8.GM.B Understand and apply the Pythagorean Theorem.
6.GM.A Solve problems involving area, surface area and volume.

Unit 7: Literal Equations
Desired Results

Standards	**Transfer Goal(s) /Big Ideas**	
6.GM.A 8.GM.B 8.GM.C	Students will be able to independently use their learning to… We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have: 1) Mathematical literacy. 2) A complete mathematical skill set. 3) An understanding of the real life applications of mathematics.	
	Enduring Understandings	**Essential Questions**
	Students will understand that… How to choose the appropriate equation to use. How to use, rearrange, and solve literal equations. Word problems can be solved by using different literal equations.	Students will consider… Why is it important to be able to model real life situations using equations? What is the procedure for using formulas to solve real life situations and why are geometric formulas especially important?

Learning Targets
Students will… ➢ Students will be able to use formulas for area, perimeter/circumference, and volume of various shapes. ➢ Students will solve word problems using formulas. ➢ Students will use the Pythagorean Theorem to solve problems.
Unit Duration:
3 weeks

Strand 1: Real Number System			
Topic: Real Number System			
Grade: 9			
Score 4.0 Advanced	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**		**Sample Activities**
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Score 3.0 Proficient	**The student:** ➢ Students will understand the vocabulary and relationships of all real numbers. Students will understand the difference and be able to identify rational and irrational numbers. ➢ Students will be able to use order of operations with all integers and fractions. ➢ Students will use the number line to compare all real numbers. Students will use written examples of integers to compare all real numbers. Ie. write the integer for the following: 19 miles below sea level. Students will show an understanding of comparing all real numbers by showing they can convert fractions, decimals, and percentages to each other. **The student exhibits no major errors or omissions.**		
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content.	
Score 2.0 Basic	**There are no major errors or omissions regarding the simpler details and processes as the student:** ➢ Students will understand the vocabulary and relationships of all real numbers. ➢ Students will be able to use order of operations with all integers. ➢ Students will use the number line to compare all real numbers. Students will use written examples of integers to compare all real numbers. Ie. write the integer for the following: 19 miles below sea level. **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**		
	1.5	Partial knowledge of the 2.0 content, but major errors or omissions regarding the 3.0 content.	
Score 1.0 Below Basic	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**		
	0.5	With help, a partial understanding of the 2.0 content, but not the 3.0 content.	

Score 0.0	**Even with help, no understanding or skill demonstrated.**	

Strand 2: Coordinate Plane			
Topic: Coordinate Plane			
Grade: 9			
Score 4.0 Advanced	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**		**Sample Activities**
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Score 3.0 Proficient	**The student:** ➢ Students will show an understanding of coordinates in relation to a coordinate plane and will be able to label points and plot points. ➢ Students will be able to apply transformations of points and shapes. ➢ Students will show and understanding of coordinates in relation to a table. ➢ Students will show an understanding of scatterplots. They will be able to identify key features, interpret the meaning of the scatterplot, and use the given information to predict other information. Ie. Given a table, create a scatterplot and predict the height of a 12 year old. **The student exhibits no major errors or omissions.**		
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content.	
Score 2.0 Basic	**There are no major errors or omissions regarding the simpler details and processes as the student:** ➢ Students will show an understanding of coordinates in relation to a coordinate plane and will be able to label points and plot points. ➢ Students will be able to apply transformations of points. ➢ Students will show and understanding of coordinates in relation to a table. **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**		
	1.5	Partial knowledge of the 2.0 content, but major errors or omissions regarding the 3.0 content.	

Score 1.0 Below Basic	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**		
	0.5	With help, a partial understanding of the 2.0 content, but not the 3.0 content.	
Score 0.0	**Even with help, no understanding or skill demonstrated.**		

Strand 3: Exponents			
Topic: Exponents			
Grade: 9			
Score 4.0 Advanced	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**		**Sample Activities**
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Score 3.0 Proficient	**The student:** Students will . . . ➢ Students will be able to write exponents into expanded form and vice versa. ➢ Students will show an understanding of exponential laws and use them to simplify problems. ➢ Students will show an understanding of perfect squares. ➢ Students will show an understanding of roots. Students will be able to estimate roots. **The student exhibits no major errors or omissions.**		
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content.	
Score 2.0 Basic	**There are no major errors or omissions regarding the simpler details and processes as the student:** Students will… ➢ Students will be able to write exponents into expanded form and vice versa. ➢ Students will show a basic understanding of exponential laws. ➢ Students will show an understanding of perfect squares. ➢ Students will show an understanding of roots. **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**		
	1.5	Partial knowledge of the 2.0 content, but major errors or omissions regarding the 3.0 content.	

Score 1.0 Below Basic	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**		
	0.5	With help, a partial understanding of the 2.0 content, but not the 3.0 content.	
Score 0.0	**Even with help, no understanding or skill demonstrated.**		

Strand 4: Solving Linear Equations/Inequalities			
Topic: Solving Linear Equations/Inequalities			
Grade: 9			
Score 4.0 Advanced	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**		**Sample Activities**
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Score 3.0 Proficient	**The student:** Students will… ➢ Students will be able to solve one and two step equations/ inequalities. (sem 1) ➢ Students will combine like terms and use the distributive property to solve multi-step equations/inequalities. (sem 2) ➢ Students will write equations from given word problems to solve. (sem1/2) ➢ When solving inequalities, students will graph solutions on a number line. (sem1/2) **The student exhibits no major errors or omissions.**		
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content.	
Score 2.0 Basic	**There are no major errors or omissions regarding the simpler details and processes as the student:** Students will… ➢ Students will be able to solve one and two step equations/ inequalities. (sem 1) ➢ Students will combine like terms and use the distributive property. (sem ½) ➢ When solving inequalities, students will graph solutions on a number line. (sem1/2) **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**		
	1.5	Partial knowledge of the 2.0 content, but major errors or omissions regarding the 3.0	

		content.	
Score 1.0 Below Basic	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**		
	0.5	With help, a partial understanding of the 2.0 content, but not the 3.0 content.	
Score 0.0	**Even with help, no understanding or skill demonstrated.**		

Strand 5: Slope of a Line			
Topic: Slope of a Line			
Grade: 9			
Score 4.0 Advanced	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**		**Sample Activities**
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Score 3.0 Proficient	**The student:** Students will… ➢ Students will show an understanding slope. Understanding that slope is a continuous relationship of a line. Showing slope as a rate of change and being able to interpret what the slope may stand for. ➢ Students will find slope given two points, a line, and a table. **The student exhibits no major errors or omissions.**		
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content.	
Score 2.0 Basic	**There are no major errors or omissions regarding the simpler details and processes as the student:** Students will… ➢ Students will show an understanding slope. Understanding that slope is a continuous relationship of a line. Showing slope as a rate of change. ➢ Students will find slope given a line and a table. **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**		
	1.5	Partial knowledge of the 2.0 content, but major errors or omissions regarding the 3.0 content.	

Score 1.0 Below Basic	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**		
	0.5	With help, a partial understanding of the 2.0 content, but not the 3.0 content.	
Score 0.0	**Even with help, no understanding or skill demonstrated.**		

Strand 6: Graphing Linear Equations			
Topic: Graphing Linear Equations			
Grade: 9			
Score 4.0 Advanced	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**		**Sample Activities**
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Score 3.0 Proficient	**The student:** ➢ Students will be able to graph linear equations using slope intercept form, various points, and a given table. ➢ Students will be able to identify and interpret slopes and y-intercepts from a linear graphs. ➢ Students will show an understanding of functions as linear or non-linear. **The student exhibits no major errors or omissions.**		
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content.	
Score 2.0 Basic	**There are no major errors or omissions regarding the simpler details and processes as the student:** ➢ Students will be able to graph linear equations using slope intercept form, various points, and a given table. ➢ Students will be able to identify slope and y-intercept from a graph. ➢ Students will identify functions as linear or non-linear. **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**		
	1.5	Partial knowledge of the 2.0 content, but major errors or omissions regarding the 3.0	

	content.	
Score 1.0 Below Basic	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**	
	0.5 With help, a partial understanding of the 2.0 content, but not the 3.0 content.	
Score 0.0	**Even with help, no understanding or skill demonstrated.**	

Topic: Literal Equations		
Grade: 9		
Score 4.0 Advanced	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**	**Sample Activities**
	3.5 In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Score 3.0 Proficient	**The student:** Students will… ➢ Students will be able to use formulas for area, perimeter/circumference, and volume of various shapes. ➢ Students will solve word problems using formulas. ➢ Students will use the Pythagorean Theorem to solve problems. **The student exhibits no major errors or omissions.**	
	2.5 No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content.	
Score 2.0 Basic	**There are no major errors or omissions regarding the simpler details and processes as the student:** Students will… ➢ Students will be able to use formulas for area, perimeter/circumference, and volume of various shapes. ➢ Students will solve word problems using area and perimeter. **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**	
	1.5 Partial knowledge of the 2.0 content, but major errors or omissions regarding the 3.0 content.	

Score 1.0 Below Basic	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**		
	0.5	With help, a partial understanding of the 2.0 content, but not the 3.0 content.	
Score 0.0	**Even with help, no understanding or skill demonstrated.**		

Algebra 1 *Course Overview*	
Grade level(s): 8th and 9th grades	**Credits earned:** 1 (½ each semester)
Course Rationale	**Course Description**
Mathematics provides the conceptual basis for the structure of many things around us. This course is an extension of the Pre-Algebra curriculum. Topics that were first introduced in Pre-Algebra will be built upon and applied to problems that require higher order thinking skills. Algebra 1 builds a foundation of mathematics for those students going on to Algebra 2 and/or students who are college bound. Along with many colleges, a majority of careers require a successful completion of an Algebra 1 course.	The fundamental purpose of this course is to formalize and extend the mathematics that students learned in the earlier grades. Students will explore many examples of functions, compare key characteristics of these functions, and translate between graphical, numerical and symbolic representations of them. They will create and solve equations and inequalities, and systems of equations involving linear and quadratic expressions, extend the laws of exponents to rational exponents and compare/contrast linear and exponential functions.
Transfer Goals/Big Ideas	
Students will be able to independently use their learning to… *We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have:* *1) Mathematical literacy.* *2) A complete mathematical skill set.* *3) An understanding of the real life applications of mathematics.*	

Priority Missouri Learning Standards/National Standards
- A1.LQE.A.3 Construct linear, quadratic and exponential equations given graphs, verbal descriptions or tables. - A1.NQ.A: Extend and use properties of rational exponents. - A1.REI.A.2 Solve problems involving quadratic equations. - A1.REI.B.1 Solve systems of equations

Unit 1: Create Linear Equations
Desired Results

Standards	Transfer Goal(s) /Big Ideas	
Priority: A1.LQE.A.3 **Supplemental:** A1.NQ.B.1 A1.NQ.B.2 A1.NQ.B.3 A1.CED.A.1 A1.CED.A.2 A1.CED.A.3 A1.CED.A.4 A1.IF.B.3 A1.DS.A.6 A1.SSE.A.1 A1.IF.A.1 A1.IF.A.2 A1.IF.B.2	*Students will be able to independently use their learning to…* *We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have:* *1) Mathematical literacy.* *2) A complete mathematical skill set.* *3) An understanding of the real life applications of mathematics.* *Big Idea:Create linear equations and inequalities.*	
	Enduring Understandings	**Essential Questions**
	Students will understand that… ● In a linear relationship, slope is the same between any two points. ● The same linear relationship can be modeled in a graph, table, equation, and context equivalently. ● A linear relationship is represented by the equation y = mx + b, where *m* is the	*Students will consider…* ● How can functions describe real-world situations, model predictions, and solve problems? ● How can relationship between two things help me make the best decision? ● What makes a linear relationship unique? ● What types of real-world applications apply

A1.DS.A.7 A1.DS.A.8	slope and *b* is the y-intercept. • Linear relationships can be represented in slope-intercept, point-slope, and standard form.	to linear equation or inequalities?

Learning Targets
Students will… ***- Graph linear equations and inequalities*** ***- Write an equation and an inequality from graph*** ***- Write an equation from a table*** ***- Write an equation from 2 ordered pairs*** ***- Write an equation and inequality given a verbal description*** ***Implied learning targets*** - *I can identify slope given any representation* - *I can identify y-intercept given any representation*
Unit Duration:
4 weeks

Unit 2: Compare Linear Functions
Desired Results

<table>
<tr><th>Standards</th><th colspan="2">Transfer Goal(s) /Big Ideas</th></tr>
<tr><td rowspan="3">Priority:
A1.IF.C.9

Supplemental:
A1.NQ.B.1
A1.NQ.B.2
A1.NQ.B.3
A1.CED.A.1
A1.CED.A.2
A1.CED.A.3
A1.CED.A.4
A1.IF.B.3
A1.DS.A.6
A1.SSE.A.1
A1.IF.A.1
A1.IF.A.2
A1.IF.B.2
A1.IF.C.7
A1.IF.C.8
A1.DS.A.7
A1.DS.A.8
A1.LQE.A.3</td><td colspan="2">Students will be able to independently use their learning to…
We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have:
1) Mathematical literacy.
2) A complete mathematical skill set.
3) An understanding of the real life applications of mathematics.

Big Idea: Linear functions can be used to make comparisons</td></tr>
<tr><th>Enduring Understandings</th><th>Essential Questions</th></tr>
<tr><td>Students will understand that…
Slope and y-intercept help us compare linear functions.
Equations can be written using function notation.</td><td>Students will consider…
How can comparing linear functions help me solve real-life problems?
How can comparing linear functions help me make decisions?</td></tr>
</table>

Learning Targets
Students will… - ***Compare two functions given different representations.*** ***Implied Learning Target(s)*** *Students will…* - *Describe the connection between equivalent forms of a function.* - *Interpret properties of a function in terms of context.* - *Graph functions using key features.*
Unit Duration:
2 weeks

Algebra 1
Course Overview

Grade level(s): 8th and 9th grades	**Credits earned:** 1 (½ each semester)
Course Rationale	**Course Description**
Mathematics provides the conceptual basis for the structure of many things around us. This course is an extension of the Pre-Algebra curriculum. Topics that were first introduced in Pre-Algebra will be built upon and applied to problems that require higher order thinking skills. Algebra 1 builds a foundation of mathematics for those students going on to Algebra 2 and/or students who are college bound. Along with many colleges, a majority of careers require a successful completion of an Algebra 1 course.	The fundamental purpose of this course is to formalize and extend the mathematics that students learned in the earlier grades. Students will explore many examples of functions, compare key characteristics of these functions, and translate between graphical, numerical and symbolic representations of them. They will create and solve equations and inequalities, and systems of equations involving linear and quadratic expressions, extend the laws of exponents to rational exponents and compare/contrast linear and exponential functions.

Transfer Goals/Big Ideas

Students will be able to independently use their learning to…
We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have:
1) Mathematical literacy.
2) A complete mathematical skill set.
3) An understanding of the real life applications of mathematics.

Priority Missouri Learning Standards/National Standards

- A1.LQE.A.3 Construct linear, quadratic and exponential equations given graphs, verbal descriptions or tables.
- A1.NQ.A: Extend and use properties of rational exponents.
- A1.REI.A.2 Solve problems involving quadratic equations.
- A1.REI.B.1 Solve systems of equations

Unit 1: Graphing Exponential Functions
Desired Results

Standards	**Transfer Goal(s) /Big Ideas**	
A1.LQE.A.3 Supporting Standards: A1.LQE.A.1 A1.LQE.A.2 A1.IF.C.7	*Students will be able to independently use their learning to…* *We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have:* *1) Mathematical literacy.* *2) A complete mathematical skill set.* *3) An understanding of the real life applications of mathematics.* Big Ideas: Graph exponential functions showing growth or decay	
	Enduring Understandings	**Essential Questions**
	Students will understand that… ● Linear functions have a constant difference, whereas exponential functions have a constant ratio. ● Real world situations can be represented symbolically and graphically.	*Students will consider…* ● What characterizes exponential growth and decay? ● What are real world models of exponential growth and decay? ● ***How do real world situations model exponential growth and decay?***

Learning Targets
Students will… - *Identify and interpret key features of exponential functions as graphs* - *Apply key features to graph exponential functions* - ***Graph exponential functions using a table***
Unit Duration:
One week

Unit 2: Constructing Exponential Functions

Desired Results

<table>
<tr><th>Standards</th><th colspan="2">Transfer Goal(s) /Big Ideas</th></tr>
<tr><td rowspan="3">A1.LQE.A.3</td><td colspan="2">Students will be able to independently use their learning to…
We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have:
1) Mathematical literacy.
2) A complete mathematical skill set.
3) An understanding of the real life applications of mathematics.

Big Idea: Construct exponential equations given multiple representations</td></tr>
<tr><th>Enduring Understandings</th><th>Essential Questions</th></tr>
<tr><td>Students will understand that…
● They can construct an exponential equation given a table, graph, and verbal description.
● They can identify a linear or exponential equation using key features.</td><td>Students will consider…
● How do exponential functions model real-world problems and their solutions?</td></tr>
</table>

Learning Targets
Students will… ***- Construct an exponential equation from a graph*** ***- Construct an exponential equation from a table*** ***- Construct an exponential equation from a verbal description*** ***- Identify when a representation is linear or exponential using key features***
Unit Duration:
2 weeks

Algebra 1 *Course Overview*	
Grade level(s): 8th and 9th grades	**Credits earned:** 1 (½ each semester)
Course Rationale	**Course Description**
Mathematics provides the conceptual basis for the structure of many things around us. This course is an extension of the Pre-Algebra curriculum. Topics that were first introduced in Pre-Algebra will be built upon and applied to problems that require higher order thinking skills. Algebra 1 builds a foundation of mathematics for those students going on to Algebra 2 and/or students who are college bound. Along with many colleges, a majority of careers require a successful completion of an Algebra 1 course.	The fundamental purpose of this course is to formalize and extend the mathematics that students learned in the earlier grades. Students will explore many examples of functions, compare key characteristics of these functions, and translate between graphical, numerical and symbolic representations of them. They will create and solve equations and inequalities, and systems of equations involving linear and quadratic expressions, extend the laws of exponents to rational exponents and compare/contrast linear and exponential functions.

Transfer Goals/Big Ideas

Students will be able to independently use their learning to…
We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have:
1) Mathematical literacy.
2) A complete mathematical skill set.
3) An understanding of the real life applications of mathematics.

Priority Missouri Learning Standards/National Standards

- A1.LQE.A.3 Construct linear, quadratic and exponential equations given graphs, verbal descriptions or tables.
- A1.NQ.A: Extend and use properties of rational exponents.
- A1.REI.A.2 Solve problems involving quadratic equations.
- A1.REI.B.1 Solve systems of equations

Unit 1: Exponent Properties and Polynomials Operations
Desired Results

<table>
<tr><th>Standards</th><th colspan="2">Transfer Goal(s) /Big Ideas</th></tr>
<tr><td rowspan="3">Priority
A1.NQ.A

Supplemental:
A1.NQ.A.1
A1.NQ.A.2
A1.SSE.A.2
A1.APR.A.1
A1.APR.A.2</td><td colspan="2">Students will be able to independently use their learning to…
We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have:
1) Mathematical literacy.
2) A complete mathematical skill set.
3) An understanding of the real life applications of mathematics.
Big Idea: Use the exponent rules to simplify expressions and polynomials</td></tr>
<tr><th>Enduring Understandings</th><th>Essential Questions</th></tr>
<tr><td>Students will understand that…
● Rules can be applied to simplified expressions with exponents and polynomials
● Solving polynomials involves the reversal of operations, the distributive property and rules of exponents</td><td>Students will consider…
● How can two algebraic expressions that appear to be different be equivalent?
● How are the properties of real numbers related to polynomials?</td></tr>
<tr><th colspan="3">Learning Targets</th></tr>
<tr><td colspan="3">Students will…
- Apply properties of exponents
- Add, subtract, and multiply polynomials
- Divide polynomials by a monomial</td></tr>
<tr><th colspan="3">Unit Duration:</th></tr>
<tr><td colspan="3">3 weeks</td></tr>
</table>

Algebra 1
Course Overview

Grade level(s): 8th and 9th grades	**Credits earned:** 1 (½ each semester)
Course Rationale	**Course Description**
Mathematics provides the conceptual basis for the structure of many things around us. This course is an extension of the Pre-Algebra curriculum. Topics that were first introduced in Pre-Algebra will be built upon and applied to problems that require higher order thinking skills. Algebra 1 builds a foundation of mathematics for those students going on to Algebra 2 and/or students who are college bound. Along with many colleges, a majority of careers require a successful completion of an Algebra 1 course.	The fundamental purpose of this course is to formalize and extend the mathematics that students learned in the earlier grades. Students will explore many examples of functions, compare key characteristics of these functions, and translate between graphical, numerical and symbolic representations of them. They will create and solve equations and inequalities, and systems of equations involving linear and quadratic expressions, extend the laws of exponents to rational exponents and compare/contrast linear and exponential functions.

Transfer Goals/Big Ideas
Students will be able to independently use their learning to… *We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have:* *1) Mathematical literacy.* *2) A complete mathematical skill set.* *3) An understanding of the real life applications of mathematics.*

Priority Missouri Learning Standards/National Standards
- A1.LQE.A.3 Construct linear, quadratic and exponential equations given graphs, verbal descriptions or tables. - A1.NQ.A: Extend and use properties of rational exponents. - A1.REI.A.2 Solve problems involving quadratic equations. - A1.REI.B.1 Solve systems of equations - A1.IF.C.7 Graph functions expressed symbolically and identify and interpret key features of the graph.

Unit 1: Graphing Quadratics
Desired Results

Standards	Transfer Goal(s) /Big Ideas	
A1.IF.C.7 Supporting standards: A1.IF.C.8 A1.IF.C9	*Students will be able to independently use their learning to…* *We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have:* *1) Mathematical literacy.* *2) A complete mathematical skill set.* *3) An understanding of the real life applications of mathematics.* **Big Idea: Graph quadratic functions using key features**	
	Enduring Understandings	**Essential Questions**
	Students will understand that… ● Depending on the form, key features can be applied to graph quadratic equations	*Students will consider…* ● What are the advantages of each form of a quadratic function?

Learning Targets
Students will… ***- Graph any quadratic equation by making an input-output table*** ***- Graph any quadratic equation in vertex form*** ***- Graph any quadratic equation in standard form*** ***- Graph any quadratic equation in intercept form***
Unit Duration:
2 weeks

Unit 2: Solving Quadratics
Desired Results

<table>
<tr><th>Standards</th><th colspan="2">Transfer Goal(s) /Big Ideas</th></tr>
<tr><td rowspan="3">A1.REI.A.2

Supplemental
A1.APR.A.1
A1.APR.A.2</td><td colspan="2">Students will be able to independently use their learning to…
We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have:
1) Mathematical literacy.
2) A complete mathematical skill set.
3) An understanding of the real life applications of mathematics.

Big Idea: Quadratics can be solved using multiple methods</td></tr>
<tr><th>Enduring Understandings</th><th>Essential Questions</th></tr>
<tr><td>Students will understand that…
● A quadratic equation in standard form can be solved in more than one way. In general, you can find a formula that gives values of x in terms of a, b, and c.
● Quadratic trinomials can be factored into products of two binomials</td><td>Students will consider…
● How is any quadratic function related to the parent quadratic function?
● How are the real solutions of a quadratic equation related to the graph of the related quadratic function?</td></tr>
</table>

Learning Targets
Students will… *- Solve quadratic equations by factoring* *- Solve quadratic equations by completing the square* *- Solve quadratic equations using the square root method* *- Solve quadratic equations using the quadratic formula* *- Apply the most efficient strategy for solving any quadratic equation*
Unit Duration:
Five weeks

Unit 3: Constructing Quadratic Equations

Desired Results

<table>
<tr><th>Standards</th><th colspan="2">Transfer Goal(s) /Big Ideas</th></tr>
<tr><td rowspan="3">A1.LQE.A.3

Supplemental standards:
A1.IF.B.3
A1.REI.A.2</td><td colspan="2">Students will be able to independently use their learning to…
We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have:
1) Mathematical literacy.
2) A complete mathematical skill set.
3) An understanding of the real life applications of mathematics.

Big Idea: Construct quadratic equations given any representation</td></tr>
<tr><th>Enduring Understandings</th><th>Essential Questions</th></tr>
<tr><td>Students will understand that…
● They can construct a quadratic equation given a table, graph, and verbal description
● Key features of quadratic functions are used to construct the equation for the representation</td><td>Students will consider…
● How do quadratic functions model real-world problems and their solutions?</td></tr>
</table>

Learning Targets
Students will… ***- Construct quadratic equation from a graph*** ***- Construct quadratic equation from a table*** ***- Construct quadratic equation from verbal description***
Unit Duration:
2 weeks

Algebra 1
Course Overview

Grade level(s): 8th and 9th grades	**Credits earned:** 1 (½ each semester)
Course Rationale	**Course Description**
Mathematics provides the conceptual basis for the structure of many things around us. This course is an extension of the Pre-Algebra curriculum. Topics that were first introduced in Pre-Algebra will be built upon and applied to problems that require higher order thinking skills. Algebra 1 builds a foundation of mathematics for those students going on to Algebra 2 and/or students who are college bound. Along with many colleges, a majority of careers require a successful completion of an Algebra 1 course.	The fundamental purpose of this course is to formalize and extend the mathematics that students learned in the earlier grades. Students will explore many examples of functions, compare key characteristics of these functions, and translate between graphical, numerical and symbolic representations of them. They will create and solve equations and inequalities, and systems of equations involving linear and quadratic expressions, extend the laws of exponents to rational exponents and compare/contrast linear and exponential functions.

Transfer Goals/Big Ideas

Students will be able to independently use their learning to…
We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have:
1) Mathematical literacy.
2) A complete mathematical skill set.
3) An understanding of the real life applications of mathematics.

Priority Missouri Learning Standards/National Standards

- A1.LQE.A.3 Construct linear, quadratic and exponential equations given graphs, verbal descriptions or tables.
  A1.NQ.A: Extend and use properties of rational exponents.
- A1.REI.A.2 Solve problems involving quadratic equations.
  A1.REI.B.1 Solve systems of equations

Unit 1: Solve Linear Equations & Inequalities
Desired Results

<table>
<tr><th>Standards</th><th colspan="2">Transfer Goal(s) /Big Ideas</th></tr>
<tr><td rowspan="3">Priority:
A1.LQE.A.3

Supplemental:
A1.REI.A.1
A1.REI.B.1
A1.REI.B.2
A1.REI.B.3
A1.REI.C.1
A1.REI.C.2
A1.REI.C.3</td><td colspan="2">Students will be able to independently use their learning to…
We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have:
1) Mathematical literacy.
2) A complete mathematical skill set.
3) An understanding of the real life applications of mathematics.
Big Idea: Solve Linear Equations and Inequalities</td></tr>
<tr><th>Enduring Understandings</th><th>Essential Questions</th></tr>
<tr><td>Students will understand that…
In order to solve an equation or an inequality, they will need to use inverse operations to isolate the variable.
The solution to a linear equation or inequality can represent a real-world meaning.</td><td>Students will consider…
How can we apply linear equations and inequalities to real-world situations?</td></tr>
</table>

Learning Targets
Students will… - ***Solve multi-step equations and inequalities involving rational numbers*** - ***Justify multi-step, and compound equations and inequalities*** - ***Graph the solution to inequalities on a number line***
Unit Duration:
4 weeks

Unit 2: Solve Systems of Linear Equations and Inequalities
Desired Results

<table>
<tr><th>Standards</th><th colspan="2">Transfer Goal(s) /Big Ideas</th></tr>
<tr><td rowspan="3">A1.REI.B.1</td><td colspan="2">Students will be able to independently use their learning to…
We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have:
1) Mathematical literacy.
2) A complete mathematical skill set.
3) An understanding of the real life applications of mathematics.

Big Idea: Create and solve systems of linear equations and inequalities</td></tr>
<tr><th>Enduring Understandings</th><th>Essential Questions</th></tr>
<tr><td>Students will understand that…
● Two or more linear equations will produce one solution, no solution, or infinitely many that satisfy both of the equations.
● A system of equations is a set of equations that have a relationship and the relationship can be solved algebraically and graphically
● Systems of equations can be used to model and solve problems</td><td>Students will consider…
● What are the advantages and disadvantages of solving a systems of equations graphically versus algebraically?
● What does the number of solutions for a systems of equations represent?
● How can we apply systems of linear equations and inequalities to real-world situations? (ex. Two rental companies that charge the same hourly rate but different startup fees represent no solution).</td></tr>
</table>

Learning Targets
Students will… - ***Solve systems of equations by graphing*** - ***Solve systems of equations using substitution*** - ***Solve systems of equations using elimination*** - ***Determine the number of solutions to a systems of equations graphically and algebraically*** - ***Construct and solve systems of linear equations to solve real world problems*** - ***Solve systems of inequalities by graphing***
Unit Duration:
4 weeks

Unit 3: Solving Nonlinear Systems

Desired Results

Standards	Transfer Goal(s) /Big Ideas	
A1.REI.B.1	*Students will be able to independently use their learning to…* *We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have:* *1) Mathematical literacy.* *2) A complete mathematical skill set.* *3) An understanding of the real life applications of mathematics.* ***Big Idea: Solving systems involving linear and quadratic functions***	
	Enduring Understandings	**Essential Questions**
	Students will understand that… ***A linear equation and a quadratic equation will produce at most two solutions that satisfy both of the equations .***	*Students will consider…* ***How can we apply our knowledge of solving systems of linear equations and solving quadratic equations to solve nonlinear systems.***

Learning Targets
Students will… - ***Solve systems involving linear and quadratic equations graphically*** - ***Solve systems involving linear and quadratic equations algebraically***
Unit Duration:
1 week

Strand 1: Linear Unit			
Topic: Construct linear equations			
Level: Algebra 1			
Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**		**Sample Activities**
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Score 3.0	**The student will:** Construct linear equations given graphs, verbal descriptions or tables. **The student exhibits no major errors or omissions.** - Recognizes or recalls specific terminology such as ● slope-intercept form, x and y-intercepts, rate of change - Performs basic processes such as: ● Identifying slope and y-intercept. ● Find the slope given any representation		
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content.	
Score 2.0	**There are no major errors or omissions regarding the simpler details and processes as the student:** - Recognizes or recalls specific terminology such as ● slope-intercept form, x and y-intercepts, rate of change - Performs basic processes such as: ● Identifying slope and y-intercept with minor error ● Find the slope given any representation with minor error ● Graph line given table or equation with minor error **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**		
	1.5	Partial knowledge of the 2.0 content, but major errors or omissions regarding the 3.0 content.	
Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**		
	0.5	With help, a partial understanding of the 2.0 content, but not the 3.0 content.	
Score 0.0	**Even with help, no understanding or skill demonstrated.**		

<table>
<tr><th colspan="4">Strand 2: Systems of Equations Unit</th></tr>
<tr><th colspan="4">Topic: Solve systems of equations and inequalities</th></tr>
<tr><th colspan="4">Level: Algebra 1</th></tr>
<tr><td>Score 4.0</td><td colspan="2">In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.</td><td>Sample Activities</td></tr>
<tr><td></td><td>3.5</td><td>In addition to score 3.0 performance, in-depth inferences and applications with partial success.</td><td></td></tr>
<tr><td>Score 3.0</td><td colspan="2">The student will:
Solve systems of equations and inequalities
The student exhibits no major errors or omissions.
- Recognizes or recalls specific terminology such as:
● solution, intersection, no solution, infinite solution, systems of equations, substitution, elimination
- Performs basic processes such as:
● determine the solution to a system of equations graphically
● determine the solution to a system of equations algebraically using substitution
● determine the solution to a system of equations algebraically using elimination
- Performs basic processes such as:
● determine the solution set to a system of inequalities graphically</td><td></td></tr>
<tr><td></td><td>2.5</td><td>No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content.</td><td></td></tr>
<tr><td>Score 2.0</td><td colspan="2">There are no major errors or omissions regarding the simpler details and processes as the student:
- Recognizes or recalls specific terminology such as:
● solution, intersection, no solution, infinite solution, systems of equations, substitution, elimination
- Performs basic processes such as:
● determine the solution to a system of equations graphically with minor error
● determine the solution to a system of equations algebraically using substitution with minor error
● determine the solution to a system of equations algebraically using elimination with minor error</td><td></td></tr>
</table>

	- Performs basic processes such as: ● determine the solution set to a system of inequalities graphically with minor error **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**		
	1.5	Partial knowledge of the 2.0 content, but major errors or omissions regarding the 3.0 content.	
Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**		
	0.5	With help, a partial understanding of the 2.0 content, but not the 3.0 content.	
Score 0.0	**Even with help, no understanding or skill demonstrated.**		

<table>
<tr><th colspan="4">Strand 3: Properties of Rational Exponents Unit</th></tr>
<tr><th colspan="4">Topic: Extend and use properties of rational exponents</th></tr>
<tr><th colspan="4">Level: Algebra 1</th></tr>
<tr><td>Score 4.0</td><td colspan="2">In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.</td><td>Sample Activities</td></tr>
<tr><td></td><td>3.5</td><td>In addition to score 3.0 performance, in-depth inferences and applications with partial success.</td><td></td></tr>
<tr><td>Score 3.0</td><td colspan="2">The student will:
Extend and use properties of rational exponents.
The student exhibits no major errors or omissions.
- Recognizes or recalls specific terminology such as:
● monomial, binomial, trinomials, polynomials, (leading) coefficient, degree
- Performs basic processes such as:
● Identify a polynomial is a monomial, binomial, or trinomial
● Determine the degree of a polynomial
● Identify the leading coefficient
● Add, subtract, and multiply simple polynomials</td><td></td></tr>
<tr><td></td><td>2.5</td><td>No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content.</td><td></td></tr>
<tr><td>Score 2.0</td><td colspan="2">There are no major errors or omissions regarding the simpler details and processes as the student:
- Recognizes or recalls specific terminology such as:
● Monomial, binomial, trinomials, polynomials, (leading) coefficient, degree
- Performs basic processes such as:
● Identify a polynomial is a monomial, binomial, or trinomial
● Determine the degree of a polynomial
● Identify the leading coefficient
● Add, subtract, and multiply simple polynomials with minor error
However, the student exhibits major errors or omissions regarding the more complex ideas and processes.</td><td></td></tr>
<tr><td></td><td>1.5</td><td>Partial knowledge of the 2.0 content, but major errors or omissions regarding the 3.0 content.</td><td rowspan="4"></td></tr>
<tr><td>Score 1.0</td><td colspan="2">With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.</td></tr>
<tr><td></td><td>0.5</td><td>With help, a partial understanding of the 2.0 content, but not the 3.0 content.</td></tr>
<tr><td>Score 0.0</td><td colspan="2">Even with help, no understanding or skill demonstrated.</td></tr>
</table>

<table>
<tr><th colspan="4">Strand 4: Quadratics Unit</th></tr>
<tr><th colspan="4">Topic: Solve problems using quadratic equations</th></tr>
<tr><th colspan="4">Level: Algebra 1</th></tr>
<tr><td rowspan="2">Score 4.0</td><td colspan="2" rowspan="2">In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.</td><td>Sample Activities</td></tr>
<tr><td></td></tr>
<tr><td></td><td>3.5</td><td>In addition to score 3.0 performance, in-depth inferences and applications with partial success.</td><td></td></tr>
<tr><td>Score 3.0</td><td colspan="2">The student will:
Solve problems involving quadratic equations.
The student exhibits no major errors or omissions.
- Solve quadratic equations by factoring
- Solve quadratic equations using the quadratic formula
- Solve quadratic equations by completing the square</td><td></td></tr>
<tr><td></td><td>2.5</td><td>No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content.</td><td></td></tr>
<tr><td>Score 2.0</td><td colspan="2">There are no major errors or omissions regarding the simpler details and processes as the student:
- Solve quadratic equations by factoring with minor error
- Solve quadratic equations using the quadratic formula with minor error
- Solve quadratic equations by completing the square with minor error
However, the student exhibits major errors or omissions regarding the more complex ideas and processes.</td><td></td></tr>
<tr><td></td><td>1.5</td><td>Partial knowledge of the 2.0 content, but major errors or omissions regarding the 3.0 content.</td><td rowspan="4"></td></tr>
<tr><td>Score 1.0</td><td colspan="2">With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.</td></tr>
<tr><td></td><td>0.5</td><td>With help, a partial understanding of the 2.0 content, but not the 3.0 content.</td></tr>
<tr><td>Score 0.0</td><td colspan="2">Even with help, no understanding or skill demonstrated.</td></tr>
</table>

Strand 5: Quadratics Unit			
Topic: Construct quadratic equations			
Level: Algebra 1			
Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**		**Sample Activities**
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Score 3.0	**The student will:** Construct quadratic equations given graphs, verbal descriptions or tables. **The student exhibits no major errors or omissions.** - Recognizes or recalls specific terminology such as: ● axis of symmetry, vertex, y-intercept, and x-intercepts - Perform basic processes such as: ● Identify the axis of symmetry, vertex, y-intercept, and x-intercepts given any representation		
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content.	
Score 2.0	**There are no major errors or omissions regarding the simpler details and processes as the student:** - Recognizes or recalls specific terminology such as: ● axis of symmetry, vertex, y-intercept, and x-intercepts - Perform basic processes such as: ● Identify the axis of symmetry, vertex, y-intercept, and x-intercepts given any representation with minor error **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**		
	1.5	Partial knowledge of the 2.0 content, but major errors or omissions regarding the 3.0 content.	
Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**		
	0.5	With help, a partial understanding of the 2.0 content, but not the 3.0 content.	
Score 0.0	**Even with help, no understanding or skill demonstrated.**		

Strand 5:			
Topic:			
Level: Algebra 1			
Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**		
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Score 3.0	**The student will:** Construct exponential equations given graphs, verbal descriptions or tables. **The student exhibits no major errors or omissions.** - Rept, and x-intercepts given any representation		
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content.	
Score 2.0	**There are no major errors or omissions regarding the simpler details and processes as the student:** - Recognizes or recalls specific terminology such as: ● exponential function, exponential growth, exponential decay - Performs basic processes such as: ● identify if a function as exponential growth or exponential decay ● identify growth factor or decay factor and y-intercept given any representation **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**		
	1.5	Partial knowledge of the 2.0 content, but major errors or omissions regarding the 3.0 content.	
Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**		
	0.5	With help, a partial understanding of the 2.0 content, but not the 3.0 content.	
Score 0.0	**Even with help, no understanding or skill demonstrated.**		

Algebra 2 Course Overview	
Grade level(s): 10, 11	**Credits earned:** 1 credit
Course Rationale	**Course Description**
Mathematics provides the conceptual basis for the structure of many things around us. This course is an extension of the Algebra 1 curriculum. Topics that were first introduced in Algebra 1 will be built upon and applied to problems that require higher order thinking skills. Algebra 2 builds a foundation of mathematics for those students going on to Pre-Calculus and/or students who are college bound. Along with many colleges, a majority of careers require a successful completion of an Algebra 2 course.	This course includes a more advanced study of the functions introduced in Algebra 1. The number system will be extended to include the complex numbers. The course will include advanced operations, solving, graphing, and writing the following: systems of equations, polynomial, radical, exponential, logarithmic, and rational functions.
Transfer Goals/Big Ideas	
Students will be able to independently use their learning to… *We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have:* *1) Mathematical literacy.* *2) A complete mathematical skill set.* *3) An understanding of the real life applications of mathematics*	
Priority Missouri Learning Standards/National Standards	
A2.NQ.A: Extend and use the relationship between rational exponents and radicals. A2.NQ.B: Use complex numbers. A2.SSE.A: Define and use logarithms. A2.REI.A: Solve equations and inequalities. A2.REI.B: Solve general systems of equations and inequalities. A2.APR.A: Perform operations on polynomials and rational expressions. A2.IF.A: Use and interpret functions. A2.BF.A: Create new functions from existing functions. A2.FM.A: Use functions to model real-world problems	

<table>
<tr><th colspan="3">Unit 1: Piecewise Functions
Desired Results</th></tr>
<tr><th>Standards</th><th colspan="2">Transfer Goal(s) /Big Ideas</th></tr>
<tr><td rowspan="3">A2.REI.A
A2.IF.A
A2.BF.A</td><td colspan="2">*We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have:*
1) Mathematical literacy.
2) A complete mathematical skill set.
3) An understanding of the real life applications of mathematics.</td></tr>
<tr><th>Enduring Understandings</th><th>Essential Questions</th></tr>
<tr><td>*Students will understand that:*
1. Domain and Range can be determined graphically, numerically and algebraically.
2. Linear piecewise functions can be analyzed using the same skills we use for linear functions.</td><td>*Students will consider…*
1. How are step functions similar to linear functions? How are they different?
2. Why is it important to define some functions over a specific interval?
3. How can piecewise-defined functions be graphed? In what situations might these functions be applied?
4. What are the most common piecewise-defined functions, and when can they be used?</td></tr>
</table>

Learning Targets
Students will… **Create and solve equations and inequalities, including those that involve absolute value.** I can write an equation or inequality to model a context. I can create step and absolute value equations. I can solve absolute value equations. I can solve absolute value inequalities. I can use algebraic and/or graphical methods to solve these problems. **Identify and interpret key characteristics of functions represented graphically with tables, and with algebraic symbolism to solve problems.** I can identify the following key characteristics of functions from graphs, tables and equations: domain, range, x- and y-intercepts, and intervals of increasing and decreasing. I can identify these key characteristics for absolute value of linear functions, simple piecewise defined, and step functions. I can represent a given function as a table, equation or graph. I can determine specific values of a function from a table, graph or equation.
Unit Duration:
2 - 4 weeks

Unit 2: Quadratic Functions
Desired Results

Standards	Transfer Goal(s) /Big Ideas
A2.NQ.B A2.REI.A A2.IF.A A2.FM.A	*We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have:* *1) Mathematical literacy.* *2) A complete mathematical skill set.* *3) An understanding of the real life applications of mathematics.*

Enduring Understandings

Students will understand that…

1. The vertex of a parabola will represent the maximum point of the function, which will help to understand maximum and minimum values in real-life situations.
2. To find the zeros of a quadratic function, you must set the equation equal to zero.
3. No matter how you choose to solve a quadratic function for real solutions, you are always looking for where the function crosses the x-axis. These points on the graph are significant in many real-world applications.
4. Solutions that exist can exist beyond the real number system.
5. All quadratic functions are a transformation on the parent function $f(x)=x^2$.
6. For any quadratic function in standard form, the values of a, b, and c provide key information about its graph.
7. The domain and range of quadratic functions can be relative to a situation.

Essential Questions

Students will consider…

1. How are quadratic functions used to model, analyze and interpret mathematical relationships?
2. What are the advantages of a quadratic function in vertex form? In standard form?
3. How is any quadratic function related to the parent quadratic function f(x)=x2 ?
4. What methods can be used to solve quadratic equations? How do you know which method is the best to use?
5. What does it mean to solve a quadratic equation?

Learning Targets
Students will… **Represent complex numbers.** I can write all numbers in the form, a + bi I can identify that a and b are real numbers and i is defined as the square root of -1 I can graph a complex number. **Add, subtract, multiply and divide complex numbers.** I can add and subtract complex numbers with answers given in a + bi form. I can multiply complex numbers with answers given in a + bi form. I can divide complex numbers with answers given in a + bi form, using conjugates to rationalize the denominator. **Create and solve equations and inequalities.** I can write an equation or inequality to model a context. I can write an equation to model a context using technology including quadratic regression, and inverse matrices on a graphing calculator. I can create quadratic equations. I can solve quadratic equations . I can solve quadratic inequalities. I can use algebraic and/or graphical methods including technology to solve quadratic equations and inequalities. **Translate between equivalent forms of functions.** I can translate between equivalent forms of quadratic functions. I can find equivalent forms of quadratic functions to highlight key characteristics. I can write a quadratic function in vertex form, standard form and/or in intercept form by factorization, completing the square and multiplication. **Create functions and use them to solve applications of quadratic function model problems** I can create quadratic equations to model problems. I can solve quadratic equations to determine solutions to problems algebraically or graphically (e.g. price-demand-cost-revenue-profit situations).
Unit Duration:
2-4 weeks

Unit 3: Systems of Equations
Desired Results

Standards	Transfer Goal(s) /Big Ideas	
A2.REI.B	*We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have:* *1) Mathematical literacy.* *2) A complete mathematical skill set.*	
	Enduring Understandings	**Essential Questions**
	Students will understand that … 1. Systems of equations can be created and solved algebraically and graphically by hand or through the use of technology.	*Students will consider…* 1. What does the number of solutions of a system of equations represent? 2. What are the advantages and disadvantages of solving a system of equations graphically versus algebraically? 3. How can systems of equations be used to represent situations and solve problems?

Learning Targets
Students will… **Create and solve systems of equations that may include non-linear equations and inequalities.** I can write a system of equations to model a context or setting that may include non-linear equations and inequalities. I can solve systems of equations, include linear-linear-linear , linear-quadratic, and quadratic-quadratic equations and inequalities.
Unit Duration:
2 - 3 weeks

Unit 4: Polynomial Functions
Desired Results

<table>
<tr><th>Standards</th><th colspan="2">Transfer Goal(s) /Big Ideas</th></tr>
<tr><td rowspan="3">A2.NQ.B
A2.REI.A
A2.APR.A
A2.BFA</td><td colspan="2">We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have:
1) Mathematical literacy.
2) A complete mathematical skill set.
3) An understanding of the real life applications of mathematics.</td></tr>
<tr><th>Enduring Understandings</th><th>Essential Questions</th></tr>
<tr><td>Students will understand that…
1. A polynomial function has distinguishing “behaviors”. You can look at its algebraic form and know something about its graph. You can look at its graph and know something about its algebraic form.
2. Knowing the zeros of a polynomial functions can help you understand the behavior of its graph.
3. If (x-a) is a factor of a polynomials, then the polynomial has value 0 when x=a. If a is a real number, then the graph of the polynomial has (a,0) as an x-intercept.
4. You can divide polynomials using steps that are similar to the long division steps that you use to divide whole numbers.
5. The degree of a polynomial equation tells you how many roots the equation has.
6. The characteristics of polynomial functions and their representations are useful in solving real-world problems.
7. The domain and range of polynomial functions can be extended to include the set of complex numbers.</td><td>Students will consider…
1. How is the system of operations for polynomials related to the system of operations for real numbers?
2. What do the solutions to a polynomial represent?</td></tr>
</table>

Learning Targets

Students will…

Create and solve equations.

I can write an equation or inequality to model a context.
I can create a polynomial equation.
I can solve a polynomial equation.

Extend the knowledge of factoring to include factors with complex coefficients.

I can factor using:

- Greatest common factor
- Difference of two squares
- Sum and difference of cubes
- Trinomials
- Grouping

I can use the quadratic formula to solve a quadratic that does not factor.
I can use the square root method to solve a quadratic.
I can recognize and find complex solutions.
I can recognize the best method for factoring a polynomial.

Understand the Remainder Theorem and use it to solve problems

I *c*an list the possible rational zeros.
I can find the rational zeros that are solutions to the polynomial using synthetic division.
I can find the remaining zeros using synthetic division, factoring or the quadratic formula.
I can recognize the best method for finding the remaining zeros.
I will identify the number of solutions to a polynomial using the Fundamental Theorem of Algebra.

Add, subtract, multiply and divide polynomial expressions.

I can find the least common multiple of two or more polynomials.
I can add and subtract polynomial expressions.
I can multiply and divide polynomial expressions where final answers should not have common factors in the numerators and denominators.

Identify zeros of polynomials when suitable factorizations are available, and use the zeros to sketch the function defined by the polynomial.

I can factor polynomials and use the zero product property to identify the zeros.
I can use the zeros and other key characteristics to sketch the function defined by the polynomial (x- and y-intercepts, end behavior, local minima and maxima).

Identify and interpret key characteristics of functions represented graphically with tables, and with algebraic symbolism to solve problems.

I can identify the following key characteristics of polynomial functions from graphs, tables and equations: domain, range, end behavior, x- and y-intercepts, local maxima and minima values, symmetries, and intervals of increasing and decreasing.

I can represent a given function as a table, equation or graph.

I can determine specific values of a function from a table, graph or equation.

I can identify key characteristics and solve polynomial functions through the use of technology.

Describe the effects of transformations algebraically and graphically; create vertical and horizontal translations, vertical and horizontal reflections and dilations (expansions/compressions) for a variety of functions (linear, quadratic, cubic, square and cube root, absolute value, exponential and logarithmic).

I can describe the effects of transformations algebraically using a, h, and k, given an equation in the form $f(x)=a(x-h)+k$, or given other general forms of the functions listed.

I can describe the effects of transformations graphically using terms such as horizontal or vertical stretch (expansion), or shrink (compression), reflection, horizontal and vertical translation and dilation.

I can create equations from the parent functions that produce a variety of transformations (linear, quadratic, cubic).

I can create graphs from the (linear, quadratic, cubic) parent graphs that demonstrate vertical stretch (expansion), or shrink (compression), reflection, horizontal and vertical translation and dilation.

Unit Duration:
4 - 6 weeks

Unit 5: Rational Exponents and Radical Functions
Desired Results

Standards	**Transfer Goal(s) /Big Ideas**	
A2.NQ.A A2.IF.A A2.BF.A	*We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have:* *1) Mathematical literacy.* *2) A complete mathematical skill set.* *3) An understanding of the real life applications of mathematics.*	
	Enduring Understandings	**Essential Questions**
	Students will understand that… 1. Corresponding to every power there is a root. 2. You can combine like radicals using properties of real numbers. 3. You can write a radical expression in an equivalent form using a fractional (rational) exponent instead of a radical sign. 4. Solving a square root equation may require that you square each side of the equation. This process can introduce extraneous solutions.	*Students will consider…* 1. Why are some forms of numbers easier to work with than other forms when performing calculations? 2. What are the differences and similarities between real numbers and complex numbers? 3. How are a function and its inverse function related? 4. How do power and radical functions model real-world problems and their solutions?

Learning Targets
Students will… **Extend the system of powers and roots to include rational exponents.** I can apply the rules of exponents to expressions that include rational exponents. I can simplify expressions including constants and variables as bases and using rational exponents, including those with integer numerators other than one. **Create and recognize equivalent expressions involving radical and exponential forms of expressions.** I can convert from radical form to rational exponent form. The student will be able to convert from rational exponent form to radical form. I can recognize that radical form and rational exponent forms are equivalent. I can simplify radical expressions. I can simplify expressions with rational exponents **Add, subtract, multiply and divide radical expressions.** I can perform operations with radical expressions, including those that require simplifying prior to combining terms. I can use conjugates to simplify rational expressions containing radicals in the denominator. **Solve equations involving rational exponents and/or radicals and identify situations where extraneous solutions may result.** I can solve equations involving rational exponents. I can solve equations involving radical expressions. I can check for and identify extraneous solutions. **Identify and interpret key characteristics of functions represented graphically with tables, and with algebraic symbolism to solve problems.** I can identify the following key characteristics of square root and cube root functions from graphs, tables and equations: domain, range, x- and y-intercepts, and intervals of increasing and decreasing. I can represent a square root and cube root function as a table, equation or graph. I can determine specific values of a function from a table, graph or equation. **Translate between equivalent forms of functions.** I can translate between equivalent forms of functions. I can find equivalent forms of functions to highlight key characteristics. **Create new functions by applying the four arithmetic operations and composition of functions (modifying the domain and range as necessary).** I can add functions to create new functions and determine the domain and range of the new function (modifying the domain and range as necessary). I can subtract functions to create new functions and determine the domain and range of the new function (modifying the domain and range as necessary). I can multiply functions to create new functions and determine the domain and range of the new function (modifying the domain and range as necessary). I can divide functions to create new function, and determine the domain and range of the new function (modifying the domain and range as necessary). I can compose functions and determine the domain and range of the new function

Derive inverses of functions and compose the inverse with the original function to show that the functions are inverses. I can derive inverses of given functions. I can compose functions to determine if they are inverses. I can compose the inverse with the original function to prove that the functions are inverses. **Describe the effects of transformations algebraically and graphically; create vertical and horizontal translations, vertical and horizontal reflections and dilations (expansions/compressions) for a variety of functions (linear, quadratic, cubic, square and cube root, absolute value, exponential and logarithmic).** I can describe the effects of transformations algebraically using a, h, and k, given an equation in the form f(x)=a(x-h)+k, or given other general forms of the functions listed. I can describe the effects of transformations graphically using terms such as horizontal or vertical stretch (expansion), or shrink (compression), reflection, horizontal and vertical translation and dilation. I can create equations from the parent functions that produce a variety of transformations (square and cube root). I can create graphs from the (square and cube root) parent graphs that demonstrate vertical stretch (expansion), or shrink (compression), reflection, horizontal and vertical translation and dilation.
Unit Duration:-
4 -6 weeks

Unit 6: Exponential and Logarithmic Functions
Desired Results

<table>
<tr><th>Standards</th><th colspan="2">Transfer Goal(s) /Big Ideas</th></tr>
<tr><td rowspan="3">A2.SSE.A
A2.REI.A
A2.IF.A
A2.FM.A
A2.BFA</td><td colspan="2">We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have:
1) Mathematical literacy.
2) A complete mathematical skill set.
3) An understanding of the real life applications of mathematics.</td></tr>
<tr><th>Enduring Understandings</th><th>Essential Questions</th></tr>
<tr><td>Students will understand that…
1. The characteristics of exponential and logarithmic functions and their representations are useful in solving real-world problems.</td><td>Students will consider…
1. How do exponential functions model real-world problems and their solutions?
2. How do logarithmic functions model real-world problems and their solutions?
3. How are expressions involving exponents and logarithms related?</td></tr>
</table>

Learning Targets

Students will…

Develop the definition of logarithms based on properties of exponents.

I can develop the definition of logarithms,
$log_b\, y = x$ if and only if $b^x = y$, based on properties of exponents.
I can convert equations from exponential to logarithmic form.
I can convert equations from logarithmic to exponential form.

Use the inverse relationship between exponents and logarithms to solve exponential and logarithmic equations.

I can use the inverse relationship between exponents and logarithms to solve simple exponential equations.
I can use the inverse relationship between exponents and logarithms to solve simple logarithmic equations.

Use properties of logarithms to solve equations or find equivalent expressions.

I can expand expressions using properties of logarithms.
I can condense expressions using properties of logarithms.
I can solve equations using properties of logarithms.

Understand why logarithmic scales are used, and use them to solve problems.

I can understand why logarithmic scales are used, and use them to solve problems.
I can use logarithmic scales to compare quantities and solve problems involving logarithms. (e.g., pH scale, earthquake intensity, light intensity and sound intensity)

Create and solve logarithmic and exponential equations.

I can solve exponential equations that do not require logarithms.
I can write an equation to model a context.
I can use algebraic and/or graphical methods to solve these problems.

Describe the effects of transformations algebraically and graphically; create vertical and horizontal translations, vertical and horizontal reflections and dilations (expansions/compressions) for a variety of functions (linear, quadratic, cubic, square and cube root, absolute value, exponential and logarithmic).

I can describe the effects of transformations algebraically using a, h, and k, given an equation in the form f(x)=a(x-h)+k, or given other general forms of the functions listed.
I can describe the effects of transformations graphically using terms such as horizontal or vertical stretch (expansion), or shrink (compression), reflection, horizontal and vertical translation and dilation.
I can create equations from the parent functions that produce a variety of transformations (exponential, and logarithmic).
I can create graphs from the (exponential, and logarithmic) parent graphs that demonstrate vertical stretch (expansion), or shrink (compression), reflection, horizontal and vertical translation and dilation.

Identify and interpret key characteristics of functions represented graphically with tables, and with algebraic symbolism to solve problems.

I can identify the following key characteristics of functions from graphs, tables and equations: domain, range, end behavior, x- and y-intercepts, local maxima and minima values, symmetries, points of discontinuity, intervals of increasing and decreasing, and horizontal and vertical asymptotes.

I can identify these key characteristics for general polynomials: exponential and logarithmic functions.

I can determine specific values of a function from a table, graph or equation.

Create functions and use them to solve applications of exponential function model problems

I can create quadratic or exponential equations to model problems.

I can solve quadratic or exponential equations to determine solutions to problems algebraically or graphically (e.g. price-demand-cost-revenue-profit situations, compound interest problems and exponential growth or decay problems).

Unit Duration:

4-6 weeks

Unit 7: Rational Functions
Desired Results

<table>
<tr><th>Standards</th><th colspan="2">Transfer Goal(s) /Big Ideas</th></tr>
<tr><td rowspan="3">A2.REI.A
A2.APR.A
A2.IF.A</td><td colspan="2">We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have:
1) Mathematical literacy.
2) A complete mathematical skill set.
3) An understanding of the real life applications of mathematics.</td></tr>
<tr><th>Enduring Understandings</th><th>Essential Questions</th></tr>
<tr><td>Students will understand that…
1. A rational function is a ratio of polynomial functions. If a rational function is in simplified form and the polynomial in the denominator is not constant, the graph of the rational function features asymptotic behavior.
2. Rational functions are found in real life phenomena that deal with rate of change.</td><td>Students will consider…
1. How can you graph rational functions?
2. How can you solve rational equations?
3. What kinds of asymptotes may exist in rational functions and why?
4. Why do rational expressions need to have a defined domain?</td></tr>
</table>

Learning Targets
Students will… **Solve rational equations where numerators and denominators are polynomials, and where extraneous solutions may result.** I can solve rational equations by various methods, including instances when the numerator and denominator are polynomials. I can check solutions and identify those that are extraneous. **Add, subtract, multiply and divide rational expressions.** I can find the least common multiple of two or more polynomials. I can add and subtract rational expressions, including those with polynomial numerators and denominators, including those with unlike denominators. I can multiply and divide rational expressions, including those with polynomial numerators and denominators. Final answers should not have common factors in the numerators and denominators. **Identify and interpret key characteristics of functions represented graphically with tables, and with algebraic symbolism to solve problems.** I can identify the following key characteristics of functions from graphs, tables and equations: domain, range, points of discontinuity, and horizontal and vertical asymptotes. I can identify these key characteristics for rational functions. I can represent a given function as a table, equation or graph. I can determine specific values of a function from a table, graph or equation.
Unit Duration:
3-5 weeks

<table>
<tr><th colspan="4">Unit 1A: <u>Solving Piecewise Functions</u></th></tr>
<tr><td colspan="4">A2.REI.A: Solve equations and inequalities. (Standard 4)</td></tr>
<tr><td colspan="4">Level: Algebra II</td></tr>
<tr><td>Score 4.0</td><td colspan="2">In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.</td><td>Sample Tasks</td></tr>
<tr><td></td><td>3.5</td><td>In addition to score 3.0 performance, in-depth inferences and applications with partial success.</td><td></td></tr>
<tr><td>Score 3.0</td><td colspan="2">The student will be able to:
• Solve a multi-step absolute value equation.
• Solve a multi-step absolute value inequality and graph the solution on a number line.
• Solve an absolute value equation/inequality with no solution or infinitely many solutions.

The student exhibits no major errors or omissions.</td><td>• Solve $|2x - 4| - 6 \geq 12$
• Solve $-2|x - 10| \leq 30$</td></tr>
<tr><td></td><td>2.5</td><td>No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content</td><td></td></tr>
<tr><td>Score 2.0</td><td colspan="2">There are no major errors or omissions regarding the simpler details and processes as the student:
• Evaluates an expression with absolute value
• Solves absolute value equations of the form $|ax + b| = c$
• Solves absolute value inequalities of the form $|ax + b| \leq c$ or $|ax + b| \geq c$

However, the student exhibits major errors or omissions regarding the more complex ideas and processes.</td><td>• $Evaluate\ 2|3x - 5y| + 2\ if\ x = -2, y = 7$
• Solve $|x + 4| = 21$
• Solve $|x + 2| \leq 5$</td></tr>
<tr><td></td><td>1.5</td><td>Partial knowledge of the 2.0 content but major errors or omissions regarding the 3.0 content</td><td></td></tr>
<tr><td>Score 1.0</td><td colspan="2">With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.</td><td></td></tr>
<tr><td></td><td>0.5</td><td>With help, a partial understanding of the 2.0 content but not the 3.0 content</td><td></td></tr>
<tr><td>Score 0.0</td><td colspan="2">Even with help, no understanding or skill demonstrated.</td><td></td></tr>
</table>

Unit 1B: Graphing Piecewise Functions			
A2.IF.A: Use and interpret functions. (Standard 7)			
Level: Algebra II			
Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**		**Sample Tasks**
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Score 3.0	**The student will be able to:** • Graph a piecewise function, including a step function. • Interpret the domain and range of an absolute value function. The student exhibits no major conceptual or computational errors or omissions.		• Graph $f(x) = \{x + 3,\ \ if\ x < 1\ 2x - 1,\ \ if\ x \geq 1\ \}$
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content	
Score 2.0	**There are no major errors or omissions regarding the simpler details and processes as the student:** • Graphs an absolute value function. • Evaluates the function for the given values given a piecewise function. **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**		• If $f(x) = \{x + 3,\ \ if\ x < 1\ 2x - 1,\ \ if\ x \geq 1\ \}$, find $f(6)$ • Graph $y = 2\|x - 4\| + 6$
	1.5	Partial knowledge of the 2.0 content but major errors or omissions regarding the 3.0 content	
Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**		
	0.5	With help, a partial understanding of the 2.0 content but not the 3.0 content	
Score 0.0	**Even with help, no understanding or skill demonstrated.**		

Unit 1C: Writing Piecewise Functions			
A2.REI.A: Solve equations and inequalities. (Standard 4)			
Level: Algebra II			
Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**		**Sample Tasks** ● Quadratic Piecewise
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Score 3.0	**The student will be able to:** ● Write a piecewise function, given a graph. ● Write an absolute value function, given a graph. **tudent exhibits no major conceptual or computational errors or omissions.**		● A plane descends from 5000ft at 250 ft/min for 6 minutes. After 6 minutes, it descends at 150ft/min. (from 3500 ft) Let t = the number of minutes and A = the altitude. Write a piecewise function for this situation. What is the plane's altitude after 12 minutes? ● Taisha uses the elliptical cross–trainer at the gym. Her general goal is to burn 280 Calories per workout, but she varies by as much as 25 Calories from this amount on any given day. Write and solve an equation to find the maximum and minimum number of Calories Taisha burns on the cross-trainer.
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content	
Score 2.0	**There are no major errors or omissions regarding the simpler details and processes as the student:** ● Writes a piecewise function with minor errors in the domain. ● Writes an absolute value inequality given the solutions, ● Writes and solves an absolute value equation or inequality, given a real-life situation. (one variable) **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**		● Ice cream should be stored at $5°F$ with an allowance of $3°$. Write and solve an equation to find the maximum and minimum temperatures at which the ice cream should be stored. ● The average depth d of an aquarium tank for dolphins is 50m. The actual depth cannot vary by more than 5m. Write and solve an absolute value inequality to determine acceptable tank depths.
	1.5	Partial knowledge of the 2.0 content but major errors or omissions regarding the 3.0 content	
Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**		
	0.5	With help, a partial understanding of the 2.0 content but not the 3.0 content	
Score 0.0	**Even with help, no understanding or skill demonstrated.**		

Unit 2A: Solving Quadratic Functions			
A2.REI.A: Solve equations and inequalities (Standard 4)			
Level: Algebra II			
Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**		**Sample Tasks**
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	

Score 3.0	**The student will be able to:**
	
	● Solve Quadratic Functions with complex roots by
	  ● Factoring
	  ● Completing the square
	  ● Using the quadratic formula
	
	The student exhibits no major conceptual or computational errors or omissions.
			● The sum of two squares
			● Example of Completing the Square:
			$2x^2 + 5x - 12 = 4$

	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content	

Score 2.0	**There are no major errors or omissions regarding the simpler details and processes as the student:**
	● Solves Quadratic Functions with real roots by
	  ● Factoring
	  ● Completing the square
	  ● Using the quadratic formula
	  ● Given a graph
	
	However, the student exhibits major errors or omissions regarding the more complex ideas and processes.
			$x^2 + 6x + 9$

	1.5	Partial knowledge of the 2.0 content but major errors or omissions regarding the 3.0 content	
Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**		
	0.5	With help, a partial understanding of the 2.0 content but not the 3.0 content	
Score 0.0	**Even with help, no understanding or skill demonstrated.**		

	Unit 2B: <u>Operations with Quadratic Functions</u>: (Complex Numbers)		
A2.NQ.B: Use complex numbers.			
Level: Algebra II			
Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**		**Sample Tasks**
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Score 3.0	**The student will:** ● Multiply and divide complex numbers ● Adds/Subtracts complex numbers ● Graphs complex number ● Simply complex numbers including powers of i. **The student exhibits no major conceptual or computational errors or omissions.**		$(2+i)(4-i)$ $(2+5i)-(3+i)$ Graph $2+3i$ Simplify $\frac{3+i}{5-3i}$ Simplify i^{35}
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content	
Score 2.0	**There are no major errors or omissions regarding the simpler details and processes as the student:** ● Adds/Subtracts complex numbers ● Graphs complex numbers **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**		
	1.5	Partial knowledge of the 2.0 content but major errors or omissions regarding the 3.0 content	
Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**		
	0.5	With help, a partial understanding of the 2.0 content but not the 3.0 content	
Score 0.0	**Even with help, no understanding or skill demonstrated.**		

<table>
<tr><th colspan="4">Unit 2C & 2D: Writing & Applying Quadratic Functions</th></tr>
<tr><td colspan="4">A2.IF.A: Use and interpret functions.
A2.FM.A: Use functions to model real-world problems</td></tr>
<tr><td colspan="4">Level: Algebra II</td></tr>
<tr><td>Score 4.0</td><td colspan="2">In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.</td><td>Sample Tasks</td></tr>
<tr><td></td><td>3.5</td><td>In addition to score 3.0 performance, in-depth inferences and applications with partial success.</td><td></td></tr>
<tr><td>Score 3.0</td><td colspan="2">The student will:
● write a quadratic equation given three points
● be able to translate between equivalent forms of functions.
● use technology to write an equation to model a context (quadratic regression, and inverse matrices on a graphing calculator)
● write and solve a quadratic equations, given a real-life situation

The student exhibits no major conceptual or computational errors or omissions.</td><td>● Write the quadratic for the equation that passes through (2, 4), (-1, 4), and (5,6)
● Vertical Motion, Pythagorean Theorem and Area
● Price-Demand-Cost-Revenue- Profit Situations</td></tr>
<tr><td></td><td>2.5</td><td>No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content</td><td></td></tr>
<tr><td>Score 2.0</td><td colspan="2">There are no major errors or omissions regarding the simpler details and processes as the student:
● solves and interprets results given an equation that models a real-life situation,

However, the student exhibits major errors or omissions regarding the more complex ideas and processes.</td><td>●</td></tr>
<tr><td></td><td>1.5</td><td>Partial knowledge of the 2.0 content but major errors or omissions regarding the 3.0 content</td><td rowspan="4"></td></tr>
<tr><td>Score 1.0</td><td colspan="2">With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.</td></tr>
<tr><td></td><td>0.5</td><td>With help, a partial understanding of the 2.0 content but not the 3.0 content</td></tr>
<tr><td>Score 0.0</td><td colspan="2">Even with help, no understanding or skill demonstrated.</td></tr>
</table>

<table>
<tr><th colspan="4">Unit 3A: Solving Systems of Functions</th></tr>
<tr><td colspan="4">A2.REI.B: Solve general systems of equations and inequalities.</td></tr>
<tr><th colspan="4">Level: Algebra II</th></tr>
<tr><td>Score 4.0</td><td colspan="2">In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.</td><td>Sample Tasks</td></tr>
<tr><td></td><td>3.5</td><td>In addition to score 3.0 performance, in-depth inferences and applications with partial success.</td><td></td></tr>
<tr><td>Score 3.0</td><td colspan="2">The student will be able to:
• Solve a system of three equations in three variables using algebra
• Solve a quadratic/quadratic system of equations using algebra
• Solve a linear/quadratic system of equations using algebra
The student exhibits no major conceptual or computational errors or omissions.</td><td>• $\begin{gathered}2x+3y-4z=10\\2x-3y+5z=8\\x+y+z=15\end{gathered}$
• $\begin{gathered}x^2+y=16\\x+y=12\end{gathered}$</td></tr>
<tr><td></td><td>2.5</td><td>No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content</td><td></td></tr>
<tr><td>Score 2.0</td><td colspan="2">There are no major errors or omissions regarding the simpler details and processes as the student:
• Solve a system of two linear equations in two variables using algebra
However, the student exhibits major errors or omissions regarding the more complex ideas and processes.</td><td>•</td></tr>
<tr><td></td><td>1.5</td><td>Partial knowledge of the 2.0 content but major errors or omissions regarding the 3.0 content</td><td rowspan="4"></td></tr>
<tr><td>Score 1.0</td><td colspan="2">With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.</td></tr>
<tr><td></td><td>0.5</td><td>With help, a partial understanding of the 2.0 content but not the 3.0 content</td></tr>
<tr><td>Score 0.0</td><td colspan="2">Even with help, no understanding or skill demonstrated.</td></tr>
</table>

Unit 3B: Graphing Systems of Functions			
A2.REI.B: Solve general systems of equations and inequalities.			
Level: Algebra II			
Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**		**Sample Tasks**
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Score 3.0	**The student will be able to:** ● Solve a system of non-linear equations and inequalities by graphing **tudent exhibits no major conceptual or computational errors or omissions.**		● Quadratic - Quadratic
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content	
Score 2.0	**There are no major errors or omissions regarding the simpler details and processes as the student:** ● Solves a system of linear equations in two variables by graphing. ● Solves a linear/quadratic system of equations by graphing. **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**		●
	1.5	Partial knowledge of the 2.0 content but major errors or omissions regarding the 3.0 content	
Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**		
	0.5	With help, a partial understanding of the 2.0 content but not the 3.0 content	
Score 0.0	**Even with help, no understanding or skill demonstrated.**		

Unit 3C: Write a System of Functions to Model a Context			
A2.REI.B: Solve general systems of equations and inequalities.			
Level: Algebra II			
Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**		**Sample Tasks**
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Score 3.0	**The student will be able to:** ● Write, graph and interpret a system of equations or inequalities, linear and/or non-linear, given a real-life situation. **The student exhibits no major conceptual or computational errors or omissions.**		● Linear Programming
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content	
Score 2.0	**There are no major errors or omissions regarding the simpler details and processes as the student:** ● Write a system of inequalities for a real-life situation, linear and/or non-linear, graph the inequalities. **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**		●
	1.5	Partial knowledge of the 2.0 content but major errors or omissions regarding the 3.0 content	
Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**		
	0.5	With help, a partial understanding of the 2.0 content but not the 3.0 content	
Score 0.0	**Even with help, no understanding or skill demonstrated.**		

Unit 4A: Operations on Polynomial Functions			
A2.APR.A: Perform operations on polynomials and rational expressions			
Level: Algebra II			
Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**		**Sample Tasks**
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Score 3.0	**The student will:** • Divide polynomial using long division • Divide polynomial using synthetic division • Multiplying binomial to a power greater than 3. **The student exhibits no major conceptual or computational errors or omissions.**		• Ex: $(2x-1)^3$
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content	
Score 2.0	**There are no major errors or omissions regarding the simpler details and processes as the student:** • Add, subtract and multiply polynomial expressions **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**		• **Division of polynomial by a monomial**
	1.5	Partial knowledge of the 2.0 content but major errors or omissions regarding the 3.0 content	
Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**		
	0.5	With help, a partial understanding of the 2.0 content but not the 3.0 content	
Score 0.0	**Even with help, no understanding or skill demonstrated.**		

<table>
<tr><th colspan="4">Unit 4B: <u>Solving Polynomial Functions</u></th></tr>
<tr><td colspan="4">A2.REI.A: Solve equations and inequalities.</td></tr>
<tr><td colspan="4">Level: Algebra II</td></tr>
<tr><td>Score 4.0</td><td colspan="2">In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.</td><td>Sample Tasks</td></tr>
<tr><td></td><td>3.5</td><td>In addition to score 3.0 performance, in-depth inferences and applications with partial success.</td><td></td></tr>
<tr><td>Score 3.0</td><td colspan="2">The student will:
• Solve polynomials of degree 3 or higher by rational root theorem
• Solve polynomials by factoring
o Difference of two squares
o Sum/Difference of cubes
o trinomial factoring
o grouping
• Solve by square rooting .
The student exhibits no major conceptual or computational errors or omissions.</td><td>• Ex: $x^3 - 8 = 0$</td></tr>
<tr><td></td><td>2.5</td><td>No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content</td><td></td></tr>
<tr><td>Score 2.0</td><td colspan="2">There are no major errors or omissions regarding the simpler details and processes as the student:
• Solving quadratics by factoring
o by finding the GCF
o when the leading coefficient is 1
However, the student exhibits major errors or omissions regarding the more complex ideas and processes.</td><td>• Ex: $x^2 - 9 = 0$</td></tr>
<tr><td></td><td>1.5</td><td>Partial knowledge of the 2.0 content but major errors or omissions regarding the 3.0 content</td><td rowspan="4"></td></tr>
<tr><td>Score 1.0</td><td colspan="2">With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.</td></tr>
<tr><td></td><td>0.5</td><td>With help, a partial understanding of the 2.0 content but not the 3.0 content</td></tr>
<tr><td>Score 0.0</td><td colspan="2">Even with help, no understanding or skill demonstrated.</td></tr>
</table>

<table>
<tr><td colspan="4">Unit 4C: <u>Polynomial Functions</u>: Graphing</td></tr>
<tr><td colspan="4">A2.IF.A: Use and interpret functions.
A2.BF.A: Create new functions from existing functions.</td></tr>
<tr><td colspan="4">Level: Algebra II</td></tr>
<tr><td>Score 4.0</td><td colspan="2">In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.</td><td>Sample Tasks</td></tr>
<tr><td></td><td>3.5</td><td>In addition to score 3.0 performance, in-depth inferences and applications with partial success.</td><td></td></tr>
<tr><td>Score 3.0</td><td colspan="2">The student will:
Graph a polynomial function
using intercept form
using vertex form
Graph a polynomial function in standard form using a graphing calculator.
Identify and interpret key characteristics of a polynomial function including:
domain & range
end behavior
x- and y- intercepts
local max and min values
intervals of increasing and decreasing
The student exhibits no major conceptual or computational errors or omissions.</td><td></td></tr>
<tr><td></td><td>2.5</td><td>No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content</td><td></td></tr>
<tr><td>Score 2.0</td><td colspan="2">There are no major errors or omissions regarding the simpler details and processes as the student:
Classify polynomial functions
Given the zeros graph a polynomial function.
Identify and interpret key characteristics
However, the student exhibits major errors or omissions regarding the more complex ideas and processes.</td><td>Identify end behavior, degree, and leading coefficient.</td></tr>
<tr><td></td><td>1.5</td><td>Partial knowledge of the 2.0 content but major errors or omissions regarding the 3.0 content</td><td rowspan="4"></td></tr>
<tr><td>Score 1.0</td><td colspan="2">With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.</td></tr>
<tr><td></td><td>0.5</td><td>With help, a partial understanding of the 2.0 content but not the 3.0 content</td></tr>
<tr><td>Score 0.0</td><td colspan="2">Even with help, no understanding or skill demonstrated.</td></tr>
</table>

<table>
<tr><th colspan="4">Unit 4D: <u>Polynomial Functions Writing</u></th></tr>
<tr><td colspan="4">1. A2.BF.A: Create new functions from existing functions.</td></tr>
<tr><td colspan="4">Level: Algebra II</td></tr>
<tr><td>Score 4.0</td><td colspan="2">In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.</td><td>Sample Tasks</td></tr>
<tr><td></td><td>3.5</td><td>In addition to score 3.0 performance, in-depth inferences and applications with partial success.</td><td></td></tr>
<tr><td>Score 3.0</td><td colspan="2">The student will:
• Write an equation in factored form with complex roots or irrational roots.
• Write an equation in vertex form given graph of a polynomial function.

The student exhibits no major conceptual or computational errors or omissions.</td><td>•</td></tr>
<tr><td></td><td>2.5</td><td>No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content</td><td></td></tr>
<tr><td>Score 2.0</td><td colspan="2">There are no major errors or omissions regarding the simpler details and processes as the student:
• Write an equation in factored form with rational roots.

However, the student exhibits major errors or omissions regarding the more complex ideas and processes.</td><td>•</td></tr>
<tr><td></td><td>1.5</td><td>Partial knowledge of the 2.0 content but major errors or omissions regarding the 3.0 content</td><td></td></tr>
<tr><td>Score 1.0</td><td colspan="2">With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.</td><td></td></tr>
<tr><td></td><td>0.5</td><td>With help, a partial understanding of the 2.0 content but not the 3.0 content</td><td></td></tr>
<tr><td>Score 0.0</td><td colspan="2">Even with help, no understanding or skill demonstrated.</td><td></td></tr>
</table>

<table>
<tr><th colspan="4">Unit 5A-C: <u>Operations with Radical Expressions</u></th></tr>
<tr><td colspan="4">A2.NQ.A: Extend and use the relationship between rational exponents and radicals.</td></tr>
<tr><th colspan="4">Level: Algebra II</th></tr>
<tr><td>Score 4.0</td><td colspan="2">In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.</td><td>Sample Tasks</td></tr>
<tr><td></td><td>3.5</td><td>In addition to score 3.0 performance, in-depth inferences and applications with partial success.</td><td></td></tr>
<tr><td>Score 3.0</td><td colspan="2">The student will:
Add and subtract radical expressions
Multiply radical expressions
Rationalize a radical expression
Evaluate radical expressions using the properties of rational exponents.
The student exhibits no major conceptual or computational errors or omissions.</td><td></td></tr>
<tr><td></td><td>2.5</td><td>No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content</td><td></td></tr>
<tr><td>Score 2.0</td><td colspan="2">There are no major errors or omissions regarding the simpler details and processes as the student:
Converting between rational exponents & radical functions
Simplify rational exponent
However, the student exhibits major errors or omissions regarding the more complex ideas and processes.</td><td></td></tr>
<tr><td></td><td>1.5</td><td>Partial knowledge of the 2.0 content but major errors or omissions regarding the 3.0 content</td><td rowspan="4"></td></tr>
<tr><td>Score 1.0</td><td colspan="2">With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.</td></tr>
<tr><td></td><td>0.5</td><td>With help, a partial understanding of the 2.0 content but not the 3.0 content</td></tr>
<tr><td>Score 0.0</td><td colspan="2">Even with help, no understanding or skill demonstrated.</td></tr>
</table>

<table>
<tr><th colspan="4">Unit 5D: <u>Radical Functions</u> Solving</th></tr>
<tr><td colspan="4">A2.NQ.A: Extend and use the relationship between rational exponents and radicals.</td></tr>
<tr><td colspan="4">Level: Algebra II</td></tr>
<tr><td>Score 4.0</td><td colspan="2">In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.</td><td>Sample Tasks</td></tr>
<tr><td></td><td>3.5</td><td>In addition to score 3.0 performance, in-depth inferences and applications with partial success.</td><td></td></tr>
<tr><td>Score 3.0</td><td colspan="2">The student will:
Solve a multi-step radical equation including those with extraneous solutions.
Solve a multi-step equation with rational exponents including those with extraneous solutions.
Solve a radical inequality.
The student exhibits no major conceptual or computational errors or omissions.</td><td></td></tr>
<tr><td></td><td>2.5</td><td>No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content</td><td></td></tr>
<tr><td>Score 2.0</td><td colspan="2">There are no major errors or omissions regarding the simpler details and processes as the student:
Solves a radical equation in which the radical is isolated.
Solves a simple rational exponent equation.
However, the student exhibits major errors or omissions regarding the more complex ideas and processes.</td><td></td></tr>
<tr><td></td><td>1.5</td><td>Partial knowledge of the 2.0 content but major errors or omissions regarding the 3.0 content</td><td rowspan="4"></td></tr>
<tr><td>Score 1.0</td><td colspan="2">With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.</td></tr>
<tr><td></td><td>0.5</td><td>With help, a partial understanding of the 2.0 content but not the 3.0 content</td></tr>
<tr><td>Score 0.0</td><td colspan="2">Even with help, no understanding or skill demonstrated.</td></tr>
</table>

Unit 5E: Graphing Radical Functions			
A2.IF.A: Use and interpret functions. A2.BF.A: Create new functions from existing functions.			
Level: Algebra II			
Scor e 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**		**Sample Tasks**
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Scor e 3.0	**The student will:** ● Graph a square root function ● Graph a cube root function ● Graph a square root inequality ● Identify transformations of a square root function. ● Identify domain, range, x-intercept, y-intercept, and intervals on increasing and decreasing. ● Graph a function and its inverse on the same coordinate plane **The student exhibits no major conceptual or computational errors or omissions.**		●
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content	
Scor e 2.0	**There are no major errors or omissions regarding the simpler details and processes as the student:** ● Graphs a square root function with minor mistakes ● Graphs a cube root function with minor mistakes ● Identifies domain and range of square root and cube root functions **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**		●
	1.5	Partial knowledge of the 2.0 content but major errors or omissions regarding the 3.0 content	
Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**		
	0.5	With help, a partial understanding of the 2.0 content but not the 3.0 content	
Score 0.0	**Even with help, no understanding or skill demonstrated.**		

<table>
<tr><th colspan="4">Unit 5F: Writing <u>Radical Functions</u></th></tr>
<tr><td colspan="4">A2.BF.A: Create new functions from existing functions.</td></tr>
<tr><td colspan="4">Level: Algebra II</td></tr>
<tr><td>Score 4.0</td><td colspan="2">In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.</td><td>Sample Tasks</td></tr>
<tr><td></td><td>3.5</td><td>In addition to score 3.0 performance, in-depth inferences and applications with partial success.</td><td></td></tr>
<tr><td>Score 3.0</td><td colspan="2">The student will:
Use composition of functions to verify that two equations are inverses.
Create new functions by adding, subtracting, multiplying, and dividing two functions.
Identify the domain of a function algebraically.
Write the inverse of a non-linear equation. .
The student exhibits no major conceptual or computational errors or omissions.</td><td>•</td></tr>
<tr><td></td><td>2.5</td><td>No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content</td><td></td></tr>
<tr><td>Score 2.0</td><td colspan="2">There are no major errors or omissions regarding the simpler details and processes as the student:
Writes the inverse of a linear equation.
Graphs a linear function and its inverse on the same coordinate plane.
However, the student exhibits major errors or omissions regarding the more complex ideas and processes.</td><td>•</td></tr>
<tr><td></td><td>1.5</td><td>Partial knowledge of the 2.0 content but major errors or omissions regarding the 3.0 content</td><td></td></tr>
<tr><td>Score 1.0</td><td colspan="2">With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.</td><td></td></tr>
<tr><td></td><td>0.5</td><td>With help, a partial understanding of the 2.0 content but not the 3.0 content</td><td></td></tr>
<tr><td>Score 0.0</td><td colspan="2">Even with help, no understanding or skill demonstrated.</td><td></td></tr>
</table>

Unit 6A & 6C: Properties of Exponential and Logarithmic Functions

A2.SSE.A: Define and use logarithms.

Level: Algebra II

Score		Description	Sample Tasks
Score 4.0		**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**	
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Score 3.0		**The student will:** • Use the properties of logarithms to condense and expand. • Develop the definition of a log based on the properties of exponents (convert between log & exponential form) • Apply the change of base formula to evaluate logs. • Evaluate a logarithm without a calculator. **The student exhibits no major conceptual or computational errors or omissions.**	• Condense $6 + 2x$ into a single logarithm •
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content	
Score 2.0		**There are no major errors or omissions regarding the simpler details and processes as the student:** • Rewrite expressions in logarithmic or exponential forms. **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**	• Evaluate 6 using common logarithms
Using	**1.5**	Partial knowledge of the 2.0 content but major errors or omissions regarding the 3.0 content	
Score 1.0		**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**	
	0.5	With help, a partial understanding of the 2.0 content but not the 3.0 content	
Score 0.0		**Even with help, no understanding or skill demonstrated.**	

Unit 6B & 6D & 6F: Solving Exponential and Logarithmic Functions			
A2.SSE.A: Define and use logarithms. A2.REI.A: Solve equations and inequalities			
Level: Algebra II			
Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**		**Sample Tasks**
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Score 3.0	**The student will:** • Solve exponential & logarithmic equations using the inverse relationship • Solve equations using properties of logarithms. • Solve an exponential equation by rewriting the equation with the same base. **The student exhibits no major conceptual or computational errors or omissions.**		• Solve $x = \frac{3}{2}$
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content	
Score 2.0	**There are no major errors or omissions regarding the simpler details and processes as the student:** • Solve simple exponential equations that do no require logarithms **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**		• **Solve** $2^x = 8$
	1.5	Partial knowledge of the 2.0 content but major errors or omissions regarding the 3.0 content	
Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**		
	0.5	With help, a partial understanding of the 2.0 content but not the 3.0 content	
Score 0.0	**Even with help, no understanding or skill demonstrated.**		

<table>
<tr><td colspan="4">Unit 6G: <u>Graph Exponential and Logarithmic Functions</u></td></tr>
<tr><td colspan="4">A2.IF.A: Use and interpret functions.
A2.BF.A: Create new functions from existing functions.</td></tr>
<tr><td colspan="4">Level: Algebra II</td></tr>
<tr><td>Score 4.0</td><td colspan="2">In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.</td><td>Sample Tasks</td></tr>
<tr><td></td><td>3.5</td><td>In addition to score 3.0 performance, in-depth inferences and applications with partial success.</td><td></td></tr>
<tr><td>Score 3.0</td><td colspan="2">The student will:
● Graph a logarithmic function using vertex form.
● Graph an exponential function using vertex form.
● Identify key characteristics of an exponential and logarithmic function including:
o Domain and range
o Horizontal and vertical asymptotes
o Growth vs. decay
The student exhibits no major conceptual or computational errors or omissions.</td><td>●</td></tr>
<tr><td></td><td>2.5</td><td>No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content</td><td></td></tr>
<tr><td>Score 2.0</td><td colspan="2">There are no major errors or omissions regarding the simpler details and processes as the student:
● Graph a logarithmic function using vertex form with minor mistakes
● Graph an exponential function using vertex form with minor mistakes.
However, the student exhibits major errors or omissions regarding the more complex ideas and processes.</td><td>●</td></tr>
<tr><td></td><td>1.5</td><td>Partial knowledge of the 2.0 content but major errors or omissions regarding the 3.0 content</td><td></td></tr>
<tr><td>Score 1.0</td><td colspan="2">With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.</td><td></td></tr>
<tr><td></td><td>0.5</td><td>With help, a partial understanding of the 2.0 content but not the 3.0 content</td><td></td></tr>
<tr><td>Score 0.0</td><td colspan="2">Even with help, no understanding or skill demonstrated.</td><td></td></tr>
</table>

Unit 6 E: **Applying Exponential and Logarithmic Functions**			
A2.SSE.A: Define and use logarithms. A2.REI.A: Solve equations and inequalities.			
Level: Algebra II			
Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**		**Sample Tasks**
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Score 3.0	**The student will:** ● Solve an application problem involving growth & decay by finding missing information, given the ending amount ● Write an exponential function, given data. ● Compare quantities and solve application problems involving logarithms. **The student exhibits no major conceptual or computational errors or omissions.**		● pH scale, earthquake intensity, light intensity and sound intensity
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content	
Score 2.0	**There are no major errors or omissions regarding the simpler details and processes as the student:** ● Solves an application problem involving growth & decay using the growth and decay models **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**		● **Compound interest, half-life**
	1.5	Partial knowledge of the 2.0 content but major errors or omissions regarding the 3.0 content	
Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**		
	0.5	With help, a partial understanding of the 2.0 content but not the 3.0 content	
Score 0.0	**Even with help, no understanding or skill demonstrated.**		

Unit 7A: <u>Operations on Rational Functions</u>			
A2.APR.A: Perform operations on polynomials and rational expressions.			
Level: Algebra II			
Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**		**Sample Tasks**
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Score 3.0	**The student will:** • Add, subtract, multiply, and divide rational expressions. **The student exhibits no major conceptual or computational errors or omissions.**		•
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content	
Score 2.0	**There are no major errors or omissions regarding the simpler details and processes as the student:** • Add or subtract simple rational expressions. • Multiply and/or divide monomial expressions **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**		• $\frac{2x+3}{x+3}+\frac{x}{x-2}$ • $\frac{36x}{9x^2}\cdot\frac{12x^7}{2x}\cdot\frac{5}{x^2}$
	1.5	Partial knowledge of the 2.0 content but major errors or omissions regarding the 3.0 content	
Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**		
	0.5	With help, a partial understanding of the 2.0 content but not the 3.0 content	
Score 0.0	**Even with help, no understanding or skill demonstrated.**		

<table>
<tr><td colspan="4">Unit 7B: <u>Solve Rational Functions</u></td></tr>
<tr><td colspan="4">A2.REI.A: Solve equations and inequalities.</td></tr>
<tr><td colspan="4">Level: Algebra II</td></tr>
<tr><td>Score 4.0</td><td colspan="2">In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.</td><td>Sample Tasks</td></tr>
<tr><td></td><td>3.5</td><td>In addition to score 3.0 performance, in-depth inferences and applications with partial success.</td><td></td></tr>
<tr><td>Score 3.0</td><td colspan="2">The student will:
• Solve a rational equation where numerators and denominators are polynomials, and where extraneous solutions may result.
The student exhibits no major conceptual or computational errors or omissions.</td><td>• $\frac{2x}{x+5} - \frac{x^2-x-10}{x^2+8x+15} = \frac{3}{x+3}$</td></tr>
<tr><td></td><td>2.5</td><td>No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content</td><td></td></tr>
<tr><td>Score 2.0</td><td colspan="2">There are no major errors or omissions regarding the simpler details and processes as the student:
• Solve a rational equation that can be solved as a proportion.
However, the student exhibits major errors or omissions regarding the more complex ideas and processes.</td><td>$\frac{x+2}{3x} = \frac{x+4}{x-2}$
•</td></tr>
<tr><td></td><td>1.5</td><td>Partial knowledge of the 2.0 content but major errors or omissions regarding the 3.0 content</td><td></td></tr>
<tr><td>Score 1.0</td><td colspan="2">With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.</td><td></td></tr>
<tr><td></td><td>0.5</td><td>With help, a partial understanding of the 2.0 content but not the 3.0 content</td><td></td></tr>
<tr><td>Score 0.0</td><td colspan="2">Even with help, no understanding or skill demonstrated.</td><td></td></tr>
</table>

Unit 7C: Graph Rational Functions			
A2.IF.A: Use and interpret functions.			
Level: Algebra II			
Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**		**Sample Tasks**
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Score 3.0	**The student will:** • Convert a rational function to vertex form then graph the rational function using vertex form. • Identify key characteristics including: o domain and range o vertical and horizontal asymptotes **The student exhibits no major conceptual or computational errors or omissions.**		• Graph $f(x) = \frac{x-1}{x^2-4x+3}$
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content	
Score 2.0	**There are no major errors or omissions regarding the simpler details and processes as the student:** • Graph a rational function that is written in vertex form. **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**		• **Graph** $f(x) = \frac{1}{x+2}$
	1.5	Partial knowledge of the 2.0 content but major errors or omissions regarding the 3.0 content	
Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**		
	0.5	With help, a partial understanding of the 2.0 content but not the 3.0 content	
Score 0.0	**Even with help, no understanding or skill demonstrated.**		

GEOMETRY
Course Overview

Grade level(s): 9-10	**Credits earned:** 1 Math
Course Rationale	**Course Description**
Geometry provides students with experimental and modeling tools that allow them to investigate geometric patterns.	The focus of Geometry includes using critical thinking, perseverance, collaboration, problem-solving, and communication throughout the course to develop a deep understanding of logic and reasoning, angle relationships, perpendicular lines, parallel lines and planes, triangles, quadrilaterals, similar polygons, circles, construction, coordinate geometry, transformations, right triangle trigonometry, areas of 2D figures, and surface areas and volumes of 3D solids.

Transfer Goals/Big Ideas

Students will use critical thinking, perseverance, collaboration, problem-solving, and communication to:
1) Understand geometric vocabulary, symbols and figures.
2) Understand angle measure, logical reasoning, lines and transversals, properties of triangles, similarity, right triangles, trigonometry, circles, surface area and volume.
3) Understand real life applications of geometry.

Priority Missouri Learning Standards/National Standards

CO.A Experiment with transformations in the plane.
CO.B Understand congruence in terms of rigid motions.
CO.C Prove geometric theorems.
SRT.B Prove theorems involving similarity.
SRT.C Define trigonometric ratios, and solve problems involving right triangles.
C.A Understand and apply theorems about circles.
GMD.A Explain volume formulas and use them to solve problems.

Unit 1: Basics of Geometry
Desired Results

<table>
<tr><th>Standards</th><th colspan="2">Transfer Goal(s) /Big Ideas</th></tr>
<tr><td rowspan="3">G.CO.A.1</td><td colspan="2">Students will use critical thinking, perseverance, collaboration, problem-solving, and communication to:
1) Understand geometric vocabulary, symbols and figures.
2) Understand angle measure.
3) Understand real life applications of geometry.</td></tr>
<tr><th>Enduring Understandings</th><th>Essential Questions</th></tr>
<tr><td>Students will understand that…
● Images of points, lines, planes, etc. must be modeled and interpreted using key terms and symbols.
● Algebraic equations can be written using betweenness of points, congruent segments, and segment bisectors.
● The length and midpoint of a segment on can be calculated using the coordinate plane.
● Algebraic equations can be written and solved using angle addition, congruent angles, and angle bisectors.
● Concepts of adjacent angles, vertical angles, a linear pair, complementary angles, supplementary angles, and perpendicular lines can be applied to model geometric relationships.</td><td>Students will consider…
● How can essential geometric concepts such as angles, segments, and rays be defined using undefined terms?
● How can angle relationships, the betweenness of points, and coordinates be used to solve real world problems?</td></tr>
</table>

Learning Targets
• *Model and interpret images of points, lines, planes, etc. using key terms and symbols.* • *Define segment and apply the Segment Addition Postulate, congruent segments, and segment bisectors.* • *Find the length and midpoint of a segment on the coordinate plane.* • *Measure and classify angles as acute, right, obtuse, or straight.* • *Define ray and angle and apply the Angle Addition Postulate and angle bisectors.* • *Find angle measures using angle relationships (vertical, supplementary, complementary, linear pair, adjacent angles, perpendicular).*
Unit Duration:
7 days

GEOMETRY
Course Overview

Grade level(s): 9-10	**Credits earned:** 1 Math
Course Rationale	**Course Description**
Geometry provides students with experimental and modeling tools that allow them to investigate geometric patterns.	The focus of Geometry includes using critical thinking, perseverance, collaboration, problem-solving, and communication throughout the course to develop a deep understanding of logic and reasoning, angle relationships, perpendicular lines, parallel lines and planes, triangles, quadrilaterals, similar polygons, circles, construction, coordinate geometry, transformations, right triangle trigonometry, areas of 2D figures, and surface areas and volumes of 3D solids.

Transfer Goals/Big Ideas

Students will use critical thinking, perseverance, collaboration, problem-solving, and communication to:
1) Understand geometric vocabulary, symbols and figures.
2) Understand angle measure, logical reasoning, lines and transversals, properties of triangles, similarity, right triangles, trigonometry, circles, surface area and volume.
3) Understand real life applications of geometry.

Priority Missouri Learning Standards/National Standards
CO.A Experiment with transformations in the plane. CO.B Understand congruence in terms of rigid motions. CO.C Prove geometric theorems. SRT.B Prove theorems involving similarity. SRT.C Define trigonometric ratios, and solve problems involving right triangles. C.A Understand and apply theorems about circles. GMD.A Explain volume formulas and use them to solve problems.

Unit 2: Reasoning and Proof
Desired Results

<table>
<tr><th>Standards</th><th colspan="2">Transfer Goal(s) /Big Ideas</th></tr>
<tr><td rowspan="3">G.CO.C.8</td><td colspan="2">Students will use critical thinking, perseverance, collaboration, problem-solving, and communication to:
1) Understand geometric vocabulary, symbols and figures.
2) Understand logical reasoning.
3) Understand real life applications of geometry.</td></tr>
<tr><th>Enduring Understandings</th><th>Essential Questions</th></tr>
<tr><td>Students will understand that…
● Conjectures are made using inductive reasoning and disproved using counterexamples.
● Statements can be written as conditionals, biconditionals, and converses and they may have different truth values.
● To prove that a statement is true, each statement must be supported with a valid reason, including a property, definition, theorem, postulate, or corollary.</td><td>Students will consider…
● Why is only one counterexample needed to prove a conjecture false?
● How does the use of biconditional statements differ from the use of conditional statements when you are constructing an argument?
● What is the thought process that you use when trying to prove statements involving segment and angle addition, congruence, and bisectors?</td></tr>
<tr><th colspan="3">Learning Targets</th></tr>
<tr><td colspan="3">Students will…
● Make conjectures using inductive reasoning and find counterexamples.
● Write and determine truth values of conditionals, biconditionals, and converses.
● Prove statements involving segment addition, segment congruence, and segment bisectors.
● Prove statements involving angle addition, angle congruence, and angle bisectors.</td></tr>
<tr><th colspan="3">Unit Duration:</th></tr>
<tr><td colspan="3">6 days</td></tr>
</table>

GEOMETRY
Course Overview

Grade level(s): 9-10	**Credits earned:** 1 Math
Course Rationale	**Course Description**
Geometry provides students with experimental and modeling tools that allow them to investigate geometric patterns.	The focus of Geometry includes using critical thinking, perseverance, collaboration, problem-solving, and communication throughout the course to develop a deep understanding of logic and reasoning, angle relationships, perpendicular lines, parallel lines and planes, triangles, quadrilaterals, similar polygons, circles, construction, coordinate geometry, transformations, right triangle trigonometry, areas of 2D figures, and surface areas and volumes of 3D solids.

Transfer Goals/Big Ideas

Students will use critical thinking, perseverance, collaboration, problem-solving, and communication to:
1) Understand geometric vocabulary, symbols and figures.
2) Understand angle measure, logical reasoning, lines and transversals, properties of triangles, similarity, right triangles, trigonometry, circles, surface area and volume.
3) Understand real life applications of geometry.

Priority Missouri Learning Standards/National Standards

CO.A Experiment with transformations in the plane.
CO.B Understand congruence in terms of rigid motions.
CO.C Prove geometric theorems.
SRT.B Prove theorems involving similarity.
SRT.C Define trigonometric ratios, and solve problems involving right triangles.
C.A Understand and apply theorems about circles.
GMD.A Explain volume formulas and use them to solve problems.

Unit 3: Parallel & Perpendicular Lines
Desired Results

Standards	Transfer Goal(s) /Big Ideas	
G.CO.A.1 *G.CO.C.8* *G.GPE.D.3*	Students will use critical thinking, perseverance, collaboration, problem-solving, and communication to: 1) Understand geometric vocabulary, symbols and figures. 2) Understand lines and transversals 3) Understand real life applications of geometry.	
	Enduring Understandings	**Essential Questions**
	Students will understand that… ● The intersections of two parallel lines with a transversal are identical, resulting in relationships between special angle pairs. ● Parallel lines have the same slope and perpendicular lines have opposite reciprocal slopes.	*Students will consider…* ● *What are some ways that you can prove that lines are parallel, perpendicular, or neither?*

Learning Targets
Students will… ● Use properties of special angle pairs formed by parallel lines and transversals to find angle measures. ● Prove theorems involving parallel lines and special angle pairs. ● Determine the slope criteria for parallel and perpendicular lines and use them to solve geometric problems. ● Determine whether two given lines are parallel, perpendicular or neither.
Unit Duration:
7 days

GEOMETRY
Course Overview

Grade level(s): 9-10	**Credits earned:** 1 Math
Course Rationale	**Course Description**
Geometry provides students with experimental and modeling tools that allow them to investigate geometric patterns.	The focus of Geometry includes using critical thinking, perseverance, collaboration, problem-solving, and communication throughout the course to develop a deep understanding of logic and reasoning, angle relationships, perpendicular lines, parallel lines and planes, triangles, quadrilaterals, similar polygons, circles, construction, coordinate geometry, transformations, right triangle trigonometry, areas of 2D figures, and surface areas and volumes of 3D solids.

Transfer Goals/Big Ideas

Students will use critical thinking, perseverance, collaboration, problem-solving, and communication to:
1) Understand geometric vocabulary, symbols and figures.
2) Understand angle measure, logical reasoning, lines and transversals, properties of triangles, similarity, right triangles, trigonometry, circles, surface area and volume.
3) Understand real life applications of geometry.

Priority Missouri Learning Standards/National Standards

CO.A Experiment with transformations in the plane.
CO.B Understand congruence in terms of rigid motions.
CO.C Prove geometric theorems.
SRT.B Prove theorems involving similarity.
SRT.C Define trigonometric ratios, and solve problems involving right triangles.
C.A Understand and apply theorems about circles.
GMD.A Explain volume formulas and use them to solve problems.

Unit 4: Congruent Triangles
Desired Results

<table>
<tr><th>Standards</th><th colspan="2">Transfer Goal(s) /Big Ideas</th></tr>
<tr><td rowspan="3">G.CO.B
G.CO.C.9</td><td colspan="2">Students will use critical thinking, perseverance, collaboration, problem-solving, and communication to:
1) Understand geometric vocabulary, symbols and figures.
2) Understand triangle classifications and angle relationships in triangles.
3) Understand real life applications of triangles.
4) Understand the properties of congruent triangles.</td></tr>
<tr><th>Enduring Understandings</th><th>Essential Questions</th></tr>
<tr><td>Students will understand that…
● The sum of the interior angles of a triangle is 180 degrees.
● If two triangles are congruent, then every pair of corresponding parts is also congruent.
● Just two or three corresponding parts may be needed to prove an entire triangle pair to be congruent.
● Geometry uses many types of proofs. The processes of proving includes a variety of activities, such as developing conjectures, considering the general case, exploring with examples, looking for structural similarities across cases, and searching for counterexamples.</td><td>Students will consider…
● What thought process do you use when proving that triangles are congruent?</td></tr>
</table>

Learning Targets
Students will… ● Classify triangles by angles and sides. Apply the properties of right, equilateral, equiangular, and isosceles triangles. ● Find angle measures by applying the Angle Sum Theorem. ● Find angle measures by applying the Exterior Angle Theorem. ● Find segment and angle measures by applying the Isosceles Triangle Theorems. ● Identify and prove congruent triangles using SAS, SSS, ASA, AAS or HL.
Unit Duration:
7 days

GEOMETRY
Course Overview

Grade level(s): 9-10	**Credits earned:** 1 Math
Course Rationale	**Course Description**
Geometry provides students with experimental and modeling tools that allow them to investigate geometric patterns.	The focus of Geometry includes using critical thinking, perseverance, collaboration, problem-solving, and communication throughout the course to develop a deep understanding of logic and reasoning, angle relationships, perpendicular lines, parallel lines and planes, triangles, quadrilaterals, similar polygons, circles, construction, coordinate geometry, transformations, right triangle trigonometry, areas of 2D figures, and surface areas and volumes of 3D solids.

Transfer Goals/Big Ideas

Students will use critical thinking, perseverance, collaboration, problem-solving, and communication to:
1) Understand geometric vocabulary, symbols and figures.
2) Understand angle measure, logical reasoning, lines and transversals, properties of triangles, similarity, right triangles, trigonometry, circles, surface area and volume.
3) Understand real life applications of geometry.

Priority Missouri Learning Standards/National Standards

CO.A Experiment with transformations in the plane.
CO.B Understand congruence in terms of rigid motions.
CO.C Prove geometric theorems.
SRT.B Prove theorems involving similarity.
SRT.C Define trigonometric ratios, and solve problems involving right triangles.
C.A Understand and apply theorems about circles.
GMD.A Explain volume formulas and use them to solve problems.

Unit 5: Relationships of Triangles & Similar Polygons
Desired Results

Standards	Transfer Goal(s) /Big Ideas	
G.CO.C.8 ***G.CO.C.9*** ***G.CO.D.11*** ***G.SRT.A***	Students will use critical thinking, perseverance, collaboration, problem-solving, and communication to: 1) Understand geometric vocabulary, symbols and figures. 2) Understand similarity. 3) Understand real life applications of geometry.	
	Enduring Understandings	**Essential Questions**
	Students will understand that… ● *Concepts of bisectors, medians, and altitudes of triangles can be applied to model geometric relationships.* ● *Constructions of bisectors, medians, and altitudes must be clearly marked in order to be accurate representations of the object.* ● *The angle-side inequality relationship that occurs within a triangle.* ● *Scale factor can be applied to create a similar shape using enlargement or reduction.* ● *Congruence and similarity criteria for triangles can be used to solve problems and prove relationships in geometric figures.* ● *Geometry theorems involving congruence and similarity can be used to show relationships between polygons and triangles.*	*Students will consider…* ● *How can you prove that polygons are similar?* ● *How can the relationship between the measures of the sides and angles of triangles be used to solve problems?*

Learning Targets
Students will… ● *Identify, use, and create bisectors, medians, and altitudes in a triangle.* ● *Recognize and apply properties of inequalities to the relationships between the angles and sides of a triangle.* ● *Use the Triangle Inequality Theorem to identify a possible range for unknown values.* ● *Prove triangles are similar using AA, SAS, and SSS Similarity Theorems.* ● *Solve problems using the proportions of similar polygons* ● *Use properties of similar triangles to solve problems.* ● *Use proportional parts within triangles including parallel lines to solve problems.*
Unit Duration:
7 days

GEOMETRY
Course Overview

Grade level(s): 9-10	**Credits earned:** 1 Math
Course Rationale	**Course Description**
Geometry provides students with experimental and modeling tools that allow them to investigate geometric patterns.	The focus of Geometry includes using critical thinking, perseverance, collaboration, problem-solving, and communication throughout the course to develop a deep understanding of logic and reasoning, angle relationships, perpendicular lines, parallel lines and planes, triangles, quadrilaterals, similar polygons, circles, construction, coordinate geometry, transformations, right triangle trigonometry, areas of 2D figures, and surface areas and volumes of 3D solids.

Transfer Goals/Big Ideas

Students will use critical thinking, perseverance, collaboration, problem-solving, and communication to:
1) Understand geometric vocabulary, symbols and figures.
2) Understand angle measure, logical reasoning, lines and transversals, properties of triangles, similarity, right triangles, trigonometry, circles, surface area and volume.
3) Understand real life applications of geometry.

Priority Missouri Learning Standards/National Standards

CO.A Experiment with transformations in the plane.
CO.B Understand congruence in terms of rigid motions.
CO.C Prove geometric theorems.
SRT.B Prove theorems involving similarity.
SRT.C Define trigonometric ratios, and solve problems involving right triangles.
C.A Understand and apply theorems about circles.
GMD.A Explain volume formulas and use them to solve problems.

Unit 6: Right Triangles & Trigonometry

Desired Results

Standards	**Transfer Goal(s) /Big Ideas**	
G.SRT.C	Students will use critical thinking, perseverance, collaboration, problem-solving, and communication to: 1) Understand geometric vocabulary, symbols and figures. 2) Understand trigonometric relationships. 3) Understand real life applications of trigonometry.	
	Enduring Understandings	**Essential Questions**
	Students will understand that… ● Special right triangles are formed by cutting an equilateral triangle in half and a square in half. ● For acute angles in a right triangle, the ratios of the sides define the trigonometric ratios and their inverses. ● The sine of an acute angle is equivalent to the cosine of its complement. ● The Pythagorean Theorem can be used to find missing sides of any right triangle. ● Trigonometric ratios can be used to find side lengths and angles of right triangles.	*Students will consider…* ● *How can right triangles be used to model real world problems?* ● *How can you find the missing sides and angles of both right triangles and oblique triangles?*

Learning Targets

Students will…

1. *Use the Pythagorean Theorem and special right triangles to solve problems involving right triangles.*
2. *Use and apply the properties of trigonometric ratios including problems involving angles of elevation and depression.*
3. *Use the Laws of Sines and Cosines to find missing parts of acute and obtuse triangles.*

Unit Duration:

10 days

GEOMETRY *Course Overview*	
Grade level(s): 9-10	**Credits earned:** 1 Math
Course Rationale	**Course Description**
Geometry provides students with experimental and modeling tools that allow them to investigate geometric patterns.	The focus of Geometry includes using critical thinking, perseverance, collaboration, problem-solving, and communication throughout the course to develop a deep understanding of logic and reasoning, angle relationships, perpendicular lines, parallel lines and planes, triangles, quadrilaterals, similar polygons, circles, construction, coordinate geometry, transformations, right triangle trigonometry, areas of 2D figures, and surface areas and volumes of 3D solids.

Transfer Goals/Big Ideas

Students will use critical thinking, perseverance, collaboration, problem-solving, and communication to:
1) Understand geometric vocabulary, symbols and figures.
2) Understand angle measure, logical reasoning, lines and transversals, properties of triangles, similarity, right triangles, trigonometry, circles, surface area and volume.
3) Understand real life applications of geometry.

Priority Missouri Learning Standards/National Standards

CO.A Experiment with transformations in the plane.
CO.B Understand congruence in terms of rigid motions.
CO.C Prove geometric theorems.
SRT.B Prove theorems involving similarity.
SRT.C Define trigonometric ratios, and solve problems involving right triangles.
C.A Understand and apply theorems about circles.
GMD.A Explain volume formulas and use them to solve problems.

Unit 7: Properties of Quadrilaterals
Desired Results

<table>
<tr><th>Standards</th><th colspan="2">Transfer Goal(s) /Big Ideas</th></tr>
<tr><td rowspan="3">G.CO.C</td><td colspan="2">Students will use critical thinking, perseverance, collaboration, problem-solving, and communication to:
1) Understand geometric vocabulary, symbols and figures.
2) Understand properties of quadrilaterals.
3) Understand real life applications of quadrilaterals and their properties.</td></tr>
<tr><th>Enduring Understandings</th><th>Essential Questions</th></tr>
<tr><td>Students will understand that…
● There is a relationship between the number of sides of a polygon and the sum of the measures of the interior angles
● There are similarities and differences between all quadrilaterals.
● Each type of quadrilateral has properties that make it unique.</td><td>Students will consider…
● What patterns exist among sides and angles of polygons?
● How is each quadrilateral unique?</td></tr>
<tr><th colspan="3">Learning Targets</th></tr>
<tr><td colspan="3">Students will…
1. Classify polygons based on their properties.
2. Determine the sum of the interior angles and the measure of each interior angle of a polygon.
3. Use the exterior angle theorem of polygons to find the measures of angles.
4. Compare and contrast the properties of parallelograms and trapezoids.
5. Use the relationships between the angles and sides of quadrilaterals to find missing angles and sides.
6. Compare and contrast the properties of quadrilaterals within the family of parallelograms and the family of trapezoids.
7. Verify that a quadrilateral is a parallelogram.</td></tr>
<tr><th colspan="3">Unit Duration:</th></tr>
<tr><td colspan="3">8 days</td></tr>
</table>

GEOMETRY
Course Overview

Grade level(s): 9-10	Credits earned: 1 Math
Course Rationale	**Course Description**
Geometry provides students with experimental and modeling tools that allow them to investigate geometric patterns.	The focus of Geometry includes using critical thinking, perseverance, collaboration, problem-solving, and communication throughout the course to develop a deep understanding of logic and reasoning, angle relationships, perpendicular lines, parallel lines and planes, triangles, quadrilaterals, similar polygons, circles, construction, coordinate geometry, transformations, right triangle trigonometry, areas of 2D figures, and surface areas and volumes of 3D solids.

Transfer Goals/Big Ideas

Students will use critical thinking, perseverance, collaboration, problem-solving, and communication to:
1) Understand geometric vocabulary, symbols and figures.
2) Understand angle measure, logical reasoning, lines and transversals, properties of triangles, similarity, right triangles, trigonometry, circles, surface area and volume.
3) Understand real life applications of geometry.

Priority Missouri Learning Standards/National Standards

CO.A Experiment with transformations in the plane.
CO.B Understand congruence in terms of rigid motions.
CO.C Prove geometric theorems.
SRT.B Prove theorems involving similarity.
SRT.C Define trigonometric ratios, and solve problems involving right triangles.
C.A Understand and apply theorems about circles.
GMD.A Explain volume formulas and use them to solve problems.

Unit 8: Properties of Circles
Desired Results

Standards	Transfer Goal(s) /Big Ideas	
G.C.A.2 *G.C.B.4* *G.GPE.A.1*	Students will use critical thinking, perseverance, collaboration, problem-solving, and communication to: 1) Understand geometric vocabulary, symbols and figures. 2) Understand circles. 3) Understand real life applications of geometry.	
	Enduring Understandings	**Essential Questions**
	Students will understand that… ● The properties of segments, lines, and angles of circles can be applied to model geometric relationships. ● There exists relationships among the inscribed angles of a circle and their corresponding intercepted arcs. ● There exists relationships between the radii, diameter, tangent lines, and chords of a circle. ● The length of the arc intercepted by an angle is proportional to the radius. ● The equation of a circle can be written using the its radius and the coordinates of its center.	*Students will consider…* ● *How can circles and their parts be defined using undefined terms?* ● *How can relationships among angles, arcs, and lines in circles be used to solve problems?* ● *How can equations be used to model circles?*

Learning Targets
Students will… ● Define a circle, identify all of the parts of a circle, and solve problems involving circumference of a circle. ● Solve problems involving arcs, inscribed and circumscribed polygons, segments, lines, and angles of circles. ● Find arc length of a circle. ● Use the graph of a circle to write its equation and use the equation to graph a circle. ● Derive the equation of a circle when given the center and a point on the circle by using the Pythagorean Theorem.
Unit Duration:
7 days

GEOMETRY
Course Overview

Grade level(s): 9-10	**Credits earned:** 1 Math
Course Rationale	**Course Description**
Geometry provides students with experimental and modeling tools that allow them to investigate geometric patterns.	The focus of Geometry includes using critical thinking, perseverance, collaboration, problem-solving, and communication throughout the course to develop a deep understanding of logic and reasoning, angle relationships, perpendicular lines, parallel lines and planes, triangles, quadrilaterals, similar polygons, circles, construction, coordinate geometry, transformations, right triangle trigonometry, areas of 2D figures, and surface areas and volumes of 3D solids.

Transfer Goals/Big Ideas

Students will use critical thinking, perseverance, collaboration, problem-solving, and communication to:
1) Understand geometric vocabulary, symbols and figures.
2) Understand angle measure, logical reasoning, lines and transversals, properties of triangles, similarity, right triangles, trigonometry, circles, surface area and volume.
3) Understand real life applications of geometry.

Priority Missouri Learning Standards/National Standards

CO.A Experiment with transformations in the plane.
CO.B Understand congruence in terms of rigid motions.
CO.C Prove geometric theorems.
SRT.B Prove theorems involving similarity.
SRT.C Define trigonometric ratios, and solve problems involving right triangles.
C.A Understand and apply theorems about circles.
GMD.A Explain volume formulas and use them to solve problems.

Unit 9: Area of Two Dimensional Figures

Desired Results

Standards	Transfer Goal(s) /Big Ideas	
G.GMD.A.1 *G.C.B.5*	Students will use critical thinking, perseverance, collaboration, problem-solving, and communication to: 1) Understand geometric vocabulary, symbols and figures. 2) Understand area. 3) Understand real life applications of geometry.	
	Enduring Understandings	**Essential Questions**
	Students will understand that… ● *Formulas can be used to find the area and perimeter of two dimensional shapes.* ● *The area of a sector of a circle can be derived using its central angle in degrees.* ● *When one figure in the plane results from another by applying a similarity transformation with scale factor k, its area is k^2 times the area of the first.* ● *Trigonometric ratios can be used to find the area of a triangle.*	*Students will consider…* ● *How can the process of finding area of two dimensional figures be used to solve problems?* ● *How do similarity transformations influence area of two dimensional figures?*

Learning Targets

Students will…

- *Use formulas to solve problems involving the area and perimeter of parallelograms, triangles, trapezoids, rhombi, and kites.*
- *Find the area of a circle and a sector of a circle.*
- *Solve problems involving area of regular polygons using composite figures.*
- *Solve problems involving area of similar figures.*
- *Use trigonometric ratios to find the area of triangles.*

Unit Duration:

6 days

GEOMETRY
Course Overview

Grade level(s): 9-10	**Credits earned:** 1 Math
Course Rationale	**Course Description**
Honors Geometry provides students with experimental and modeling tools that allow them to investigate geometric patterns.	Honors Geometry is a rigorous proof-based course covering traditional Geometry topics at a deeper level. The course is designed to develop spatial reasoning, logic, and precise mathematical language. All units in this course will tie together geometric and previous advanced algebraic content knowledge such as systems of equations, factoring, and solving quadratic equations. The intent of this course is to prepare students for advanced coursework and mathematics study at the college level.

Transfer Goals/Big Ideas

Students will use critical thinking, perseverance, collaboration, problem-solving, and communication to:
1) Understand geometric vocabulary, symbols and figures.
2) Understand angle measure, logical reasoning, lines and transversals, properties of triangles, similarity, right triangles, trigonometry, circles, surface area and volume.
3) Understand real life applications of geometry.

Priority Missouri Learning Standards/National Standards

CO.A Experiment with transformations in the plane.
CO.B Understand congruence in terms of rigid motions.
CO.C Prove geometric theorems.
SRT.B Prove theorems involving similarity.
SRT.C Define trigonometric ratios, and solve problems involving right triangles.
C.A Understand and apply theorems about circles.
GMD.A Explain volume formulas and use them to solve problems.

Unit 10: Surface Area and Volume
Desired Results

Standards	Transfer Goal(s) /Big Ideas	
G.GMD.A *G.GMD.B*	Students will use critical thinking, perseverance, collaboration, problem-solving, and communication to: 1) Understand geometric vocabulary, symbols and figures. 2) Understand surface area and volume. 3) Understand real life applications of geometry.	
	Enduring Understandings	**Essential Questions**
	Students will understand that… ● *Two dimensional cross sections can be used to model and describe three dimensional figures.* ● *Three dimensional objects are formed when two dimensional objects are rotated about an axis.* ● *Formulas can be used to find the volume, surface area, and missing measures of three dimensional figures.* ● *Surface area and volume formulas can be manipulated to determine surface area and volume of composite figures.* ● *Volumes of solid figures scale k^3 under a similarity transformation with scale factor k.*	*Students will consider…* ● *How can you explain surface area and volume formulas of three dimensional figures?* ● *How can surface area and volume formulas be utilized and manipulated to model real world figures?* ● *How do similarity transformations influence volume of three dimensional figures?*

Learning Targets
Students will… 1. Identify and describe the shape of a two dimensional cross section of a three dimensional object. 2. Identify the three dimensional object that is formed when a two dimensional object is rotated about an axis. 3. Use formulas to find surface area and volume of cylinders, prisms, pyramids, cones, and spheres. 4. Explain surface area and volume formulas. 5. Use formulas to find missing measures of three dimensional figures, including figures with regular polygons as the base. 6. Use formulas to solve problems involving surface area and volume of composite figures. 7. Solve problems involving volume of three dimensional figures using similarity. 8. Solve problems involving surface area and volume of congruent and similar figures.
Unit Duration:
6 days

<table>
<tr><th colspan="2">GEOMETRY
Course Overview</th></tr>
<tr><td>Grade level(s): 9-10</td><td>Credits earned: 1 Math</td></tr>
<tr><td>Course Rationale</td><td>Course Description</td></tr>
<tr><td>Honors Geometry provides students with experimental and modeling tools that allow them to investigate geometric patterns.</td><td>Honors Geometry is a rigorous proof-based course covering traditional Geometry topics at a deeper level. The course is designed to develop spatial reasoning, logic, and precise mathematical language. All units in this course will tie together geometric and previous advanced algebraic content knowledge such as systems of equations, factoring, and solving quadratic equations. The intent of this course is to prepare students for advanced coursework and mathematics study at the college level.</td></tr>
<tr><td colspan="2">Transfer Goals/Big Ideas</td></tr>
<tr><td colspan="2">Students will use critical thinking, perseverance, collaboration, problem-solving, and communication to:
1) Understand geometric vocabulary, symbols and figures.
2) Understand angle measure, logical reasoning, lines and transversals, properties of triangles, similarity, right triangles, trigonometry, circles, surface area and volume.
3) Understand real life applications of geometry.</td></tr>
<tr><td colspan="2">Priority Missouri Learning Standards/National Standards</td></tr>
<tr><td colspan="2">CO.A Experiment with transformations in the plane.
CO.B Understand congruence in terms of rigid motions.
CO.C Prove geometric theorems.
SRT.B Prove theorems involving similarity.
SRT.C Define trigonometric ratios, and solve problems involving right triangles.
C.A Understand and apply theorems about circles.
GMD.A Explain volume formulas and use them to solve problems.</td></tr>
</table>

Unit 11: Probability *Desired Results*	

Standards	**Transfer Goal(s) /Big Ideas**	
CP.A	Students will use critical thinking, perseverance, collaboration, problem-solving, and communication to: 1) Understand geometric vocabulary, symbols and figures. 2) Understand surface area and volume. 3) Understand real life applications of geometry.	
	Enduring Understandings	**Essential Questions**
	Students will understand that… ● *Data are collected for a purpose and have meaning in a context.* ● *Two events, A and B, are independent if the occurrence of one does not affect the probability of the occurrence of the other.* ● *The probability of one event can be affected by the occurrence of another event.* ● *The probability formulas for union and intersection are different.*	*Students will consider…* ● *How can the understanding of probability prove beneficial in the real world?* ● *What is a sample space and how do you represent it?* ● *What does it mean for events to be independent and dependent?*

Learning Targets

Students will…

1. Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events (“or,”“and,” “not”).
2. Use the fact that two events A and B are independent if the probability of A and B occurring together is the product of their probabilities to determine if they are independent.
3. Solve problems using conditional probability.
4. Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified.
5. Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations.

Unit Duration:

6 days

Strand 1: BASICS OF GEOMETRY			
Topic 1: Geometric Essential			
Grade: 9-10			
Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**		**Sample Activities**
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Score 3.0	**The student will:** ● ***Model and interpret images of points, lines, planes, etc. using key terms and symbols.*** **The student exhibits no major errors or omissions.**		Write a description of a two or three dimensional figure containing points lines and planes.
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content.	
Score 2.0	**There are no major errors or omissions regarding the simpler details and processes as the student:** recognizes or recalls specific terminology such as: *point, line, plane, collinear, coplanar, intersect* performs basic processes, such as: *applying some basic terminology and symbols* **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**		Name 3 collinear or coplanar points in a figure. Name a point, line, and plane from a picture using correct symbols and notation. Write the phrase that corresponds to a given symbol or picture.
	1.5	Partial knowledge of the 2.0 content, but major errors or omissions regarding the 3.0 content.	
Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**		
	0.5	With help, a partial understanding of the 2.0 content, but not the 3.0 content.	
Score 0.0	**Even with help, no understanding or skill demonstrated.**		

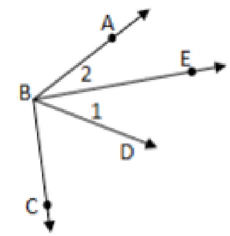
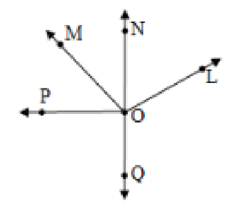
Strand 1: BASICS OF GEOMETRY			
Topic 2: Linear Measure			
Grade: 9-10			
Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**		**Sample Activities**
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Score 3.0	**The student will:** • ***Apply the Segment Addition Postulate, congruent segments, and segment bisectors.*** • ***Find the length and midpoint of a segment on the coordinate plane.*** **The student exhibits no major errors or omissions.**		Find the midpoint or length of a segment on the coordinate plane given its endpoints. Suppose Y is between X and Z. XY = 2x + 3, YZ = x - 4, and XZ = 20. Find YZ. Suppose Y is between X and Z, and YX is congruent to XZ. If XY = 5x - 3 and YZ = x + 5, find XZ. LM bisects NO at P. If NO = x + 11 and PO = 2x - 8, find NP.
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content.	
Score 2.0	**There are no major errors or omissions regarding the simpler details and processes as the student:** recognizes or recalls specific terminology such as: *line segment, betweenness of points, congruent segments, distance, midpoint, segment bisector* performs basic processes, such as: *finding the length and midpoint of a segment on a number line, finding the length and midpoint of a segment on the coordinate plane with some errors, writing and solving algebraic equations using betweenness of points, congruent segments, and segment bisectors with some errors* **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**		Find the length of an object using a ruler. Find the midpoint or length of a segment on a number line given its endpoints. Given B is between A and C, AB = 5 ⅓ , and AC = 15, find BC.
	1.5	Partial knowledge of the 2.0 content, but major errors or omissions regarding the 3.0 content.	
Score	**With help, a partial understanding of some of the simpler details and processes**		

1.0	**and some of the more complex ideas and processes.**		
	0.5	With help, a partial understanding of the 2.0 content, but not the 3.0 content.	
Score 0.0	**Even with help, no understanding or skill demonstrated.**		

Strand 1: BASICS OF GEOMETRY

Topic 3: Angle Measure

Grade: 9-10

Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**		**Sample Activities**
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Score 3.0	**The student will:** • ***Apply the Angle Addition Postulate and angle bisectors.*** • ***Find angle measures using angle relationships (vertical, supplementary, complementary, linear pair, adjacent angles, perpendicular).*** **The student exhibits no major errors or omissions.**		Find the measures of two complementary angles if the measure of the larger angle is 12 more than twice the measure of the smaller angle. In the figure, $\overrightarrow{BE}$ bisects $\angle ABD$, $m\angle 1 = 5x + 7$, and $m\angle 2 = 7x - 5$. If $\overrightarrow{BD}$bisects $\angle ABC$, find x and m$\angle ABC$.  If $\overrightarrow{OP} \perp \overleftrightarrow{NQ}$ and $m\angle MON = 35°$, then find the $m\angle POM$. 
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content.	
Score 2.0	**There are no major errors or omissions regarding the simpler details and processes as the student:** recognizes or recalls specific terminology such as: *ray, opposite ray, angle, sides, vertex, interior, exterior, degree, right, acute, obtuse, straight, angle bisector, adjacent angles, vertical angles, linear pair, complementary, supplementary, and perpendicular*		Name an angle from a figure. Using a picture, state whether each angle is acute, right, obtuse or straight. Measure an angle with a protractor. Draw and label a pair of vertical angles or a

	performs basic processes, such as: *writing and solving algebraic equations using angle addition, congruent angles, and angle bisectors with some errors, applying the concepts of adjacent angles, vertical angles, a linear pair, complementary angles, supplementary angles, and perpendicular lines with some errors, measure angles with a protractor.* **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**		linear pair.
	1.5	Partial knowledge of the 2.0 content, but major errors or omissions regarding the 3.0 content.	
Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**		
	0.5	With help, a partial understanding of the 2.0 content, but not the 3.0 content.	
Score 0.0	**Even with help, no understanding or skill demonstrated.**		

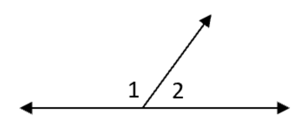
Strand 2: REASONING & PROOF			
Topic 4: Reasoning & Conjecture			
Grade: 9-10			
Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**		**Sample Activities**
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Score 3.0	**The student will:** • ***Write and determine truth values of conditionals, biconditionals, and converses.*** **The student exhibits no major errors or omissions.**		**Determine if the conjecture is true or false based on the given information. Explain your answer and give a counterexample for a false conjecture.** Given: A,B, and C are collinear and AB=BC. Prove: B is the midpoint of $\overline{AC}$ **Write the converse of the statement in if-then form. Determine if the converse is true or false. *If false, give a counterexample*.** If points are collinear, then they lie on the same line. **Given the following biconditional statement, write both the conditional and its converse. Determine the truth value of the biconditional.** Two angles are congruent iff they have the same measure.
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content.	
Score 2.0	**There are no major errors or omissions regarding the simpler details and processes as the student:** recognizes or recalls specific terminology such as: *inductive reasoning, conjecture, counterexample, negation,*		Write a conjecture that describes the pattern in the sequence. Then use your conjecture to find the next item in the sequence. 1, 4, 9, 16, 25 . . .

	conditional, biconditional, converse performs basic processes, such as: *determining the hypothesis and conclusion for a conditional statement, write a statement but not correctly determining the truth value.* **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**		**Make a conjecture the geometric relationship. List or draw some examples that support your conjecture.** segments joining opposite vertices of a rectangle **Write each statement in if-then form. Identify the hypothesis and conclusion.** A rectangle has four right angles. The intersection of two planes is a line.
	1.5	Partial knowledge of the 2.0 content, but major errors or omissions regarding the 3.0 content.	
Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**		
	0.5	With help, a partial understanding of the 2.0 content, but not the 3.0 content.	
Score 0.0	**Even with help, no understanding or skill demonstrated.**		

Strand 2: REASONING & CONJECTURE

Topic 5: Proving Geometric Relationships

Grade: 9-10

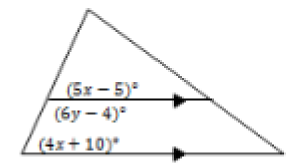
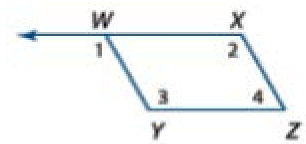
Score			Sample Activities
Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**		
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Score 3.0	**The student will:** • ***Prove statements involving segment and angle addition, congruence, and bisectors.*** **The student exhibits no major errors or omissions.**		**Complete the two-column proof, providing the missing reason for each step.** **Given:** T is between S and U, ST=7x, SU=45, and TU=5x – 3 **Prove:** ST=28 **Given:** $m\angle 1 = 30x + 3$, $m\angle 2 = 12x + 9$ **Prove:** x = 4 
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content.	
Score 2.0	**There are no major errors or omissions regarding the simpler details and processes as the student:** recognizes or recalls specific terminology such as: *proof, theorem, postulate, properties of equality* performs basic processes, such as: *justifying basic definitions and properties, but not recognizing theorems or postulates, prove algebraic relationships* **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**		**Name the property of equality or congruence that justifies each statement.** If 2(x + 3) = 14, then 2x + 6 = 14 $\angle Z \cong \angle Z$ **Complete the two-column proof, providing the missing statement or reason for each step.** **Given:** $\frac{2}{3}x + 8 = 4x - 12$ **Prove:** x = 6
	1.5	Partial knowledge of the 2.0 content, but major errors or omissions regarding the 3.0 content.	

Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**		
	0.5	With help, a partial understanding of the 2.0 content, but not the 3.0 content.	
Score 0.0	**Even with help, no understanding or skill demonstrated.**		

Strand 3: PARALLEL AND PERPENDICULAR LINES

Topic 6: Parallel and Perpendicular Lines

Grade: 9-10

Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**		**Sample Activities**
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Score 3.0	**The student will:** ● ***Determine the slope criteria for parallel and perpendicular lines and use them to solve geometric problems.*** ● ***Determine whether two given lines are parallel, perpendicular or neither***. **The student exhibits no major errors or omissions.**		Find the value of each variable and state the postulate or theorem that you used.  **Given:** $\angle 2 \cong \angle 3,\ \overline{WY} \parallel \overline{XZ}$ **Prove:** $\overline{WX} \parallel \overline{YZ}$ 
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content.	
Score 2.0	**There are no major errors or omissions regarding the simpler details and processes as the student:** performs basic processes, such as: *finding slope given two ordered pairs, determining slopes of parallel/perpendicular lines given a slope, identifying correctly graphed lines given the value of their slopes, representing the distance between a line and a point not on that line.* **However, the student exhibits major errors or omissions regarding**		Identify parallel, skew, and intersecting lines in a figure. State the transversal for two angles and identify them as alternate interior, alternate exterior, consecutive interior, or corresponding. Determine if two lines are parallel given information about the angles formed by a transversal line.

	the more complex ideas and processes.		
	1.5	Partial knowledge of the 2.0 content, but major errors or omissions regarding the 3.0 content.	
Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**		
	0.5	With help, a partial understanding of the 2.0 content, but not the 3.0 content.	
Score 0.0	**Even with help, no understanding or skill demonstrated.**		

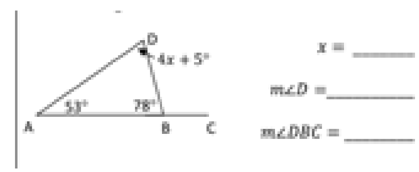
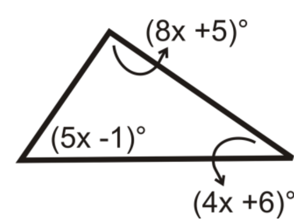
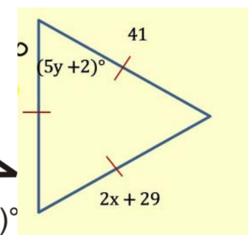
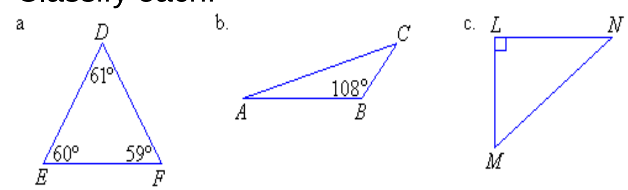
Strand 3: PARALLEL AND PERPENDICULAR LINES			
Topic 7: Lines and Transversals			
Grade: 9-10			
Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**		**Sample Activities**
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Score 3.0	**The student will:** • ***Use properties of special angle pairs formed by parallel lines and transversals to find angle measures.*** • ***Prove theorems involving parallel lines and special angle pairs.*** **The student exhibits no major errors or omissions.**		Kevin's savings account balance changed from \$1140 in January to \$1450 in April. Find the average rate of change per month. If this rate of change continues, what will the balance be in December? Determine whether lines AB and CD are parallel, perpendicular, or neither. Explain. A(-7,6),B(-6,9),C(6,3),D(3,-6) Graph the line that passes through H(8,5), perpendicular to line AG with A(-5,6) and G(-1,-2).
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content.	
Score 2.0	**There are no major errors or omissions regarding the simpler details and processes as the student:** recognizes or recalls specific terminology such as: *parallel, skew, perpendicular, transversal, equidistant* performs basic processes, such as: *Identifying key relationships of angle pairs as corresponding, consecutive interior, alternate exterior, and alternate interior in*		Graph a line with a slope of -1/2 that contains the point U(2, -2). Determine the slope of a line from a graph.

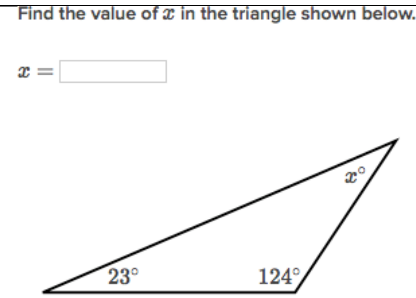
	simple diagrams, using properties of special angle pairs formed by parallel lines and transversals to find some angle measures **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**		
	1.5	Partial knowledge of the 2.0 content, but major errors or omissions regarding the 3.0 content.	
Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**		
	0.5	With help, a partial understanding of the 2.0 content, but not the 3.0 content.	
Score 0.0	**Even with help, no understanding or skill demonstrated.**		

Strand 4: CONGRUENT TRIANGLES

Topic 8: Properties of Triangles

Grade: 9-10

Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**		**Sample Activities**
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Score 3.0	**The student will:** • ***Apply the properties of right, equilateral, equiangular, and isosceles triangles.*** • ***Find missing parts of triangles by applying the Angle Sum Theorem, Exterior Angle Theorem, and Isosceles Triangle Theorem.*** **The student exhibits no major errors or omissions.**		
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content.	
Score 2.0	**There are no major errors or omissions regarding the simpler details and processes as the student:** recognizes or recalls specific terminology such as: *acute, equiangular, obtuse, right, equilateral, isosceles, and scalene triangles, exterior angles, remote interior angles, hypotenuse, vertex angle, base angles* performs basic processes, such as: *classifying triangles according to the angles and sides, finding the third angle value given two angles in a triangle, using properties of equiangular, right, equilateral, and isosceles triangles to find missing*		Classify each: 

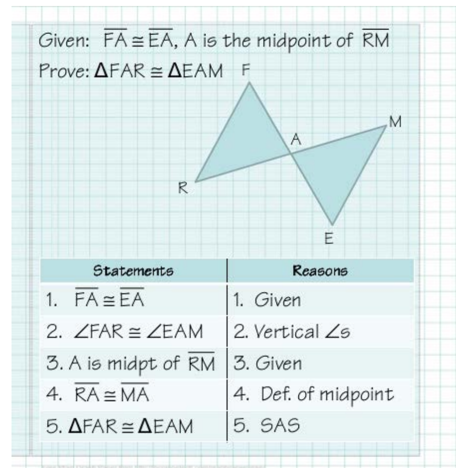
	values of angles and sides. **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**		
	1.5	Partial knowledge of the 2.0 content, but major errors or omissions regarding the 3.0 content.	
Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**		
	0.5	With help, a partial understanding of the 2.0 content, but not the 3.0 content.	
Score 0.0	**Even with help, no understanding or skill demonstrated.**		

Strand 4: CONGRUENT TRIANGLES

Topic 9: Proving Triangle Congruence

Grade: 9-10

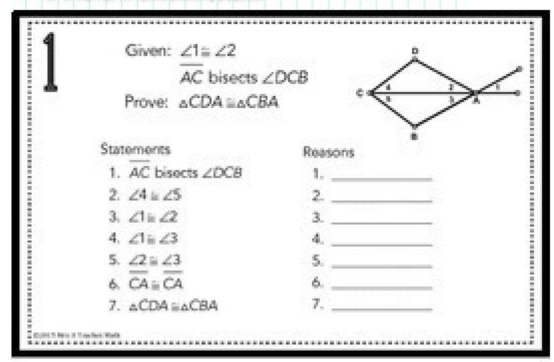
Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**		**Sample Activities**
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Score 3.0	**The student will:** ● ***Identify and prove congruent triangles using SAS, SSS, ASA, AAS or HL***. **The student exhibits no major errors or omissions.**		
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content.	



Given: $\overline{FA} \cong \overline{EA}$, A is the midpoint of $\overline{RM}$

Prove: $\Delta FAR \cong \Delta EAM$

Statements	Reasons
1. $\overline{FA} \cong \overline{EA}$	1. Given
2. $\angle FAR \cong \angle EAM$	2. Vertical $\angle$s
3. A is midpt of $\overline{RM}$	3. Given
4. $\overline{RA} \cong \overline{MA}$	4. Def. of midpoint
5. $\Delta FAR \cong \Delta EAM$	5. SAS



1

Given: $\angle 1 \cong \angle 2$

$\overline{AC}$ bisects $\angle DCB$

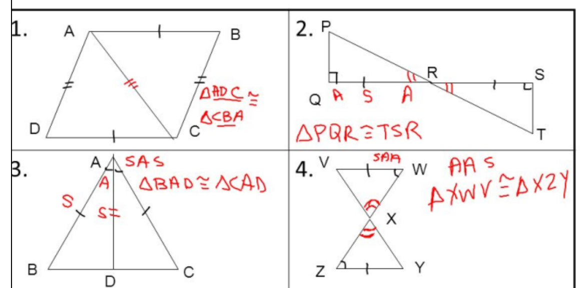
Prove: $\triangle CDA \cong \triangle CBA$

Statements	Reasons
1. $\overline{AC}$ bisects $\angle DCB$	1. ______
2. $\angle 4 \cong \angle 5$	2. ______
3. $\angle 1 \cong \angle 2$	3. ______
4. $\angle 1 \cong \angle 3$	4. ______
5. $\angle 2 \cong \angle 3$	5. ______
6. $\overline{CA} \cong \overline{CA}$	6. ______
7. $\triangle CDA \cong \triangle CBA$	7. ______

Score 2.0	**There are no major errors or omissions regarding the simpler details and processes as the student:** recognizes or recalls specific terminology such as: *included angle, included side, corresponding parts, CPCTC, indirect reasoning* performs basic processes, such as: *identifying corresponding parts of congruent triangles, naming congruent triangles and identifying the postulate or theorem used to prove they are congruent, recognizing AAA and SSA cannot be used to prove triangle congruence, identifying assumptions and partially completing an indirect proof* **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**	

Statement	Reasons
1. $\angle B \cong \angle E$ and $\overline{BC} \cong \overline{EC}$	1. Given
2. $\angle ACB \cong \angle DCE$	2. Vertical angles are congruent.
3. $\Delta ACB \cong \Delta DCE$	3. ___?___
4. $\overline{AC} \cong \overline{DC}$	4. ___?___

Determine whether the triangles are congruent by SSS, SAS, ASA or AAS.



	1.5	Partial knowledge of the 2.0 content, but major errors or omissions regarding the 3.0 content.
Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**	
	0.5	With help, a partial understanding of the 2.0 content, but not the 3.0 content.
Score 0.0	**Even with help, no understanding or skill demonstrated.**	

Strand 5: RELATIONSHIPS OF TRIANGLES AND SIMILAR POLYGONS			
Topic 10: Bisectors, Medians, and Altitudes			
Grade: 9-10			
Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**		**Sample Activities**
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Score 3.0	**The student will:** ● ***Use and create bisectors, medians, and altitudes in a triangle.*** **The student exhibits no major errors or omissions.**		
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content.	
Score 2.0	**There are no major errors or omissions regarding the simpler details and processes as the student:** *recognizes or recalls specific terminology such as: perpendicular bisector, incenter, concurrent lines, circumcenter, median, centroid, altitude, orthocenter* *performs basic processes, such as: identifying and using properties of perpendicular bisectors, angle bisectors, medians, and altitudes in triangles to find some unknown values.* **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**		
	1.5	Partial knowledge of the 2.0 content, but major errors or omissions regarding the 3.0 content.	
Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**		
	0.5	With help, a partial understanding of the 2.0 content, but not the 3.0 content.	
Score 0.0	**Even with help, no understanding or skill demonstrated.**		

Strand 5: RELATIONSHIPS OF TRIANGLES AND SIMILAR POLYGONS			
Topic 11: Inequalities in Triangles			
Grade: 9-10			
Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**		**Sample Activities**
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Score 3.0	**The student will:** • ***Recognize and apply properties of inequalities to the relationships between the angles and sides of a triangle.*** • ***Use the Triangle Inequality Theorem to identify a possible range for unknown values.*** **The student exhibits no major errors or omissions.**		
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content.	
Score 2.0	**There are no major errors or omissions regarding the simpler details and processes as the student:** *performs basic processes, such as:* *applying properties of inequalities to the relationships between the angles and sides of triangles in one triangle, determining if three side lengths form a triangle, finding the range of values for the third side of a triangle* **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**		
	1.5	Partial knowledge of the 2.0 content, but major errors or omissions regarding the 3.0 content.	
Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**		
	0.5	With help, a partial understanding of the 2.0 content, but not the 3.0 content.	
Score 0.0	**Even with help, no understanding or skill demonstrated.**		

<table>
<tr><th colspan="4">Strand 5: RELATIONSHIPS OF TRIANGLES AND SIMILAR POLYGONS</th></tr>
<tr><th colspan="4">Topic 12: Proportions and Similarity</th></tr>
<tr><th colspan="4">Grade: 9-10</th></tr>
<tr><td>Score 4.0</td><td colspan="2">In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.</td><td>Sample Activities</td></tr>
<tr><td></td><td>3.5</td><td>In addition to score 3.0 performance, in-depth inferences and applications with partial success.</td><td></td></tr>
<tr><td>Score 3.0</td><td colspan="2">The student will:
Prove triangles are similar using AA, SAS, and SSS Similarity Theorems.
Use properties of similar polygons, in particular triangles, to solve problems.
The student exhibits no major errors or omissions.</td><td></td></tr>
<tr><td></td><td>2.5</td><td>No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content.</td><td></td></tr>
<tr><td>Score 2.0</td><td colspan="2">There are no major errors or omissions regarding the simpler details and processes as the student:
recognizes or recalls specific terminology such as:
ratio, proportion, similarity, scale factor, scale model

performs basic processes, such as:
write ratios, solve simple proportions, identify similar figures, and find scale factors.
However, the student exhibits major errors or omissions regarding the more complex ideas and processes.</td><td></td></tr>
<tr><td></td><td>1.5</td><td>Partial knowledge of the 2.0 content, but major errors or omissions regarding the 3.0 content.</td><td></td></tr>
<tr><td>Score 1.0</td><td colspan="2">With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.</td><td></td></tr>
<tr><td></td><td>0.5</td><td>With help, a partial understanding of the 2.0 content, but not the 3.0 content.</td><td></td></tr>
<tr><td>Score 0.0</td><td colspan="2">Even with help, no understanding or skill demonstrated.</td><td></td></tr>
</table>

Strand 6: RIGHT TRIANGLES AND TRIGONOMETRY			
Topic 13: Right Triangles			
Grade: 9-10			
Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**		**Sample Activities**
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Score 3.0	**The student will:** ● ***Use the Pythagorean Theorem and special right triangles to solve problems involving right triangles.*** **The student exhibits no major errors or omissions.**		
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content.	
Score 2.0	**There are no major errors or omissions regarding the simpler details and processes as the student:** *recognizes or recalls specific terminology such as:* *Pythagorean Theorem, Pythagorean triples, special right triangles, rationalize* *performs basic processes, such as:* *solving simple problems involving right triangles, Pythagorean Theorem, and special right triangles* **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**		
	1.5	Partial knowledge of the 2.0 content, but major errors or omissions regarding the 3.0 content.	
Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**		
	0.5	With help, a partial understanding of the 2.0 content, but not the 3.0 content.	
Score 0.0	**Even with help, no understanding or skill demonstrated.**		

Strand 6: RIGHT TRIANGLES AND TRIGONOMETRY

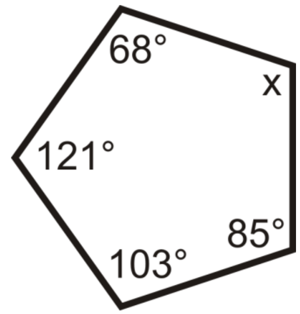
Topic 14: Trigonometry

<table>
<tr><th colspan="4">Grade: 9-10</th></tr>
<tr><td>Score 4.0</td><td colspan="2">In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.</td><td>Sample Activities</td></tr>
<tr><td></td><td>3.5</td><td>In addition to score 3.0 performance, in-depth inferences and applications with partial success.</td><td></td></tr>
<tr><td>Score 3.0</td><td colspan="2">The student will:
● Use and apply the properties of trigonometric ratios including problems involving angles of elevation and depression.
● Use the Laws of Sines and Cosines to find missing parts of acute and obtuse triangles.
The student exhibits no major errors or omissions.</td><td></td></tr>
<tr><td></td><td>2.5</td><td>No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content.</td><td></td></tr>
<tr><td>Score 2.0</td><td colspan="2">There are no major errors or omissions regarding the simpler details and processes as the student:
recognizes or recalls specific terminology such as:
trigonometric ratios, inverse trig functions, angle of elevation, angle of depression, oblique triangles
performs basic processes, such as:
finding approximate values of trig ratios, solving simple problems involving trig ratios
However, the student exhibits major errors or omissions regarding the more complex ideas and processes.</td><td></td></tr>
<tr><td></td><td>1.5</td><td>Partial knowledge of the 2.0 content, but major errors or omissions regarding the 3.0 content.</td><td rowspan="4"></td></tr>
<tr><td>Score 1.0</td><td colspan="2">With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.</td></tr>
<tr><td></td><td>0.5</td><td>With help, a partial understanding of the 2.0 content, but not the 3.0 content.</td></tr>
<tr><td>Score 0.0</td><td colspan="2">Even with help, no understanding or skill demonstrated.</td></tr>
</table>

Strand 7: PROPERTIES OF QUADRILATERALS

Topic 15: Angles of Polygons

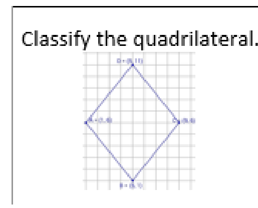
Grade: 9-10

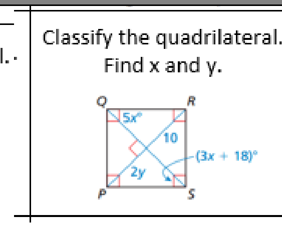
Score		In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.	Sample Activities
Score 4.0		**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**	
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Score 3.0		**The student will:** ● ***Solve problems involving the sum of the measures of the interior and exterior angles of a polygon.*** **The student exhibits no major errors or omissions.**	The sum of interior is 4320. How many sides does the polygon have? The measure of an interior angle of a regular polygon is 135. Find the number of sides. 
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content.	
Score 2.0		**There are no major errors or omissions regarding the simpler details and processes as the student:** *recognizes or recalls specific terminology such as:* *diagonals of a polygon* *performs basic processes, such as:* *find the sum of the measures of the interior and exterior angles of a polygon.* **However, the student exhibits major errors or omissions regarding**	What is the sum of exterior angles? What is the sum of interior angles of a regular polygon with 14 sides?

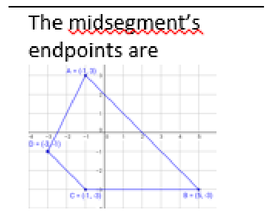
	the more complex ideas and processes.		
	1.5	Partial knowledge of the 2.0 content, but major errors or omissions regarding the 3.0 content.	
Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**		
	0.5	With help, a partial understanding of the 2.0 content, but not the 3.0 content.	
Score 0.0	**Even with help, no understanding or skill demonstrated.**		

Strand 7: PROPERTIES OF QUADRILATERALS

Topic 16: Quadrilaterals

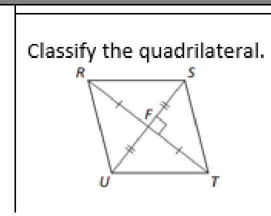
<table>
<tr><th colspan="4">Grade: 9-10</th></tr>
<tr><td>Score 4.0</td><td colspan="2">In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.</td><td>Sample Activities</td></tr>
<tr><td></td><td>3.5</td><td>In addition to score 3.0 performance, in-depth inferences and applications with partial success.</td><td></td></tr>
<tr><td>Score 3.0</td><td colspan="2">The student will:
Apply properties of quadrilaterals.
The student exhibits no major errors or omissions.</td><td>




</td></tr>
<tr><td></td><td>2.5</td><td>No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content.</td><td></td></tr>
<tr><td>Score 2.0</td><td colspan="2">There are no major errors or omissions regarding the simpler details and processes as the student:

recognizes or recalls specific terminology such as:
parallelogram, rectangle, square, rhombus, trapezoid, midsegment, isosceles trapezoid, kites

performs basic processes, such as:
identify quadrilaterals and their properties

However, the student exhibits major errors or omissions regarding the more complex ideas and processes.</td><td>

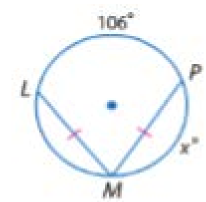
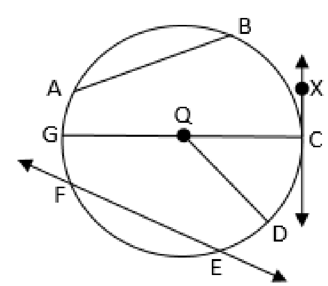
Name the properties of each quadrilateral.</td></tr>
</table>

	1.5	Partial knowledge of the 2.0 content, but major errors or omissions regarding the 3.0 content.	
Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**		
	0.5	With help, a partial understanding of the 2.0 content, but not the 3.0 content.	
Score 0.0	**Even with help, no understanding or skill demonstrated.**		

Strand 8: PROPERTIES OF CIRCLES

Topic 17: Circles

Grade: 9-10

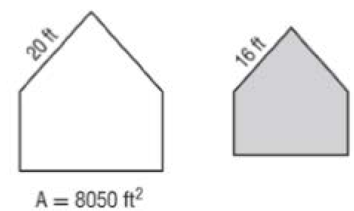
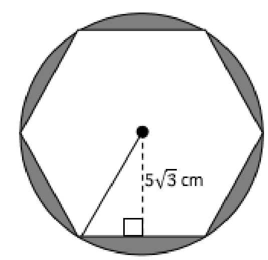
Score		Description	Sample Activities
Score 4.0		**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**	
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Score 3.0		**The student will:** • ***Solve problems involving circumference, arcs, inscribed and circumscribed polygons, segments, lines, and angles of circles.*** • ***Graph and write equations for circles.*** **The student exhibits no major errors or omissions.**	1. Find x and the measure of the inscribed angle.  2. Write the equation of and graph a circle with a center of (5,-3) and a radius of 7.
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content.	
Score 2.0		**There are no major errors or omissions regarding the simpler details and processes as the student:** *recognizes or recalls specific terminology such as: circle, center, radius, chord, diameter, concentric circles, circumference, pi, inscribed, circumscribed, central angle, arc, minor arc, major arc, semicircle, congruent arcs, adjacent arcs, arc length, inscribed angle, intercepted arc, tangent, point of tangency, common tangent*	Name a radius, chord, diameter, tangent, minor arc, and major arc in the figure. 

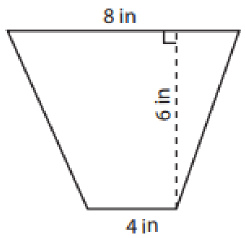
	However, the student exhibits major errors or omissions regarding the more complex ideas and processes.		
	1.5	Partial knowledge of the 2.0 content, but major errors or omissions regarding the 3.0 content.	
Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**		
	0.5	With help, a partial understanding of the 2.0 content, but not the 3.0 content.	
Score 0.0	**Even with help, no understanding or skill demonstrated.**		

Strand 9: AREA OF TWO DIMENSIONAL FIGURES

Topic 18: Area of Two Dimensional Figures

Grade: 9-10

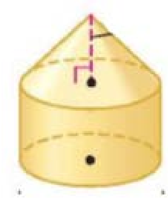
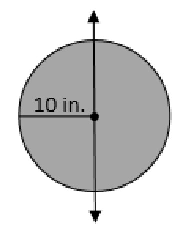
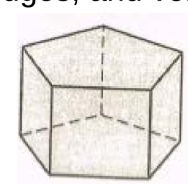
Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**		**Sample Activities**
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Score 3.0	**The student will:** • ***Find the area and perimeter of two-dimensional figures, including similar figures.*** **The student exhibits no major errors or omissions.**		1. If the figures are similar, find the area of the shaded figure.  2. Find the area of the shaded region. 
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content.	
Score 2.0	**There are no major errors or omissions regarding the simpler details and processes as the student:** *recognizes or recalls specific terminology such as: area, perimeter, composite figures* *performs basic processes, such as:*		Find the area of the figure.

	finding the area and perimeter of figures where no work is necessary to find the parts needed to calculate surface area and volume **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**		
	1.5	Partial knowledge of the 2.0 content, but major errors or omissions regarding the 3.0 content.	
Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**		
	0.5	With help, a partial understanding of the 2.0 content, but not the 3.0 content.	
Score 0.0	**Even with help, no understanding or skill demonstrated.**		

Strand 10: SURFACE AREA & VOLUME

Topic 19: Representations of 3D Figures

Grade: 9-10

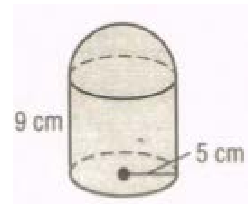
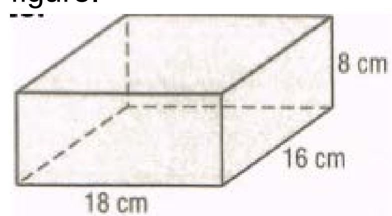
Score			Sample Activities
Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**		**Sample Activities**
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Score 3.0	**The student:** ● ***Investigate and use cross sections and two-dimensional models of three-dimensional figures, including identifying three-dimensional objects generated by rotations of two-dimensional objects.*** **The student exhibits no major errors or omissions.**		1. Describe and draw the vertical and horizontal cross sections of the figure.  2. Describe the solid that is created when the following shape is rotated about the axis. 
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content.	
Score 2.0	**There are no major errors or omissions regarding the simpler details and processes as the student:** recognizes or recalls specific terminology such as: *Polyhedron, prism, pyramid, platonic solids, net, cross section* performs basic processes, such as:		Identify the solid and give the number of bases, faces, edges, and vertices. 

	Identify solids and name the bases, faces, edges, and vertices of solids. **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**		
	1.5	Partial knowledge of the 2.0 content, but major errors or omissions regarding the 3.0 content.	
Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**		
	0.5	With help, a partial understanding of the 2.0 content, but not the 3.0 content.	
Score 0.0	**Even with help, no understanding or skill demonstrated.**		

Strand 10: SURFACE AREA AND VOLUME

Topic 20: Surface Area & Volume

Grade: 9-10

Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**		**Sample Activities**
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Score 3.0	**The student:** ● ***Derive and use surface area and volume formulas for three-dimensional figures (prisms, cylinders, pyramids, cones, spheres), including composite and similar figures.*** **The student exhibits no major errors or omissions.**		Find the surface area and volume of the figure. 
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content.	
Score 2.0	**There are no major errors or omissions regarding the simpler details and processes as the student:** recognizes or recalls specific terminology such as: *surface area, volume, right and oblique figures, slant height, similar solids, congruent solids* performs basic processes, such as: *finding surface area and volume of figures where no work is necessary to find the parts needed to calculate surface area and volume.* **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**		Find the surface area and volume of the figure. 
	1.5	Partial knowledge of the 2.0 content, but major errors or omissions regarding the 3.0 content.	
Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**		
	0.5	With help, a partial understanding of the 2.0 content, but not the 3.0 content.	
Score 0.0	**Even with help, no understanding or skill demonstrated.**		

HONORS GEOMETRY *Course Overview*	
Grade level(s): 9-10	**Credits earned:** 1 Math
Course Rationale	**Course Description**
Honors Geometry provides students with experimental and modeling tools that allow them to investigate geometric patterns.	Honors Geometry is a rigorous proof-based course covering traditional Geometry topics at a deeper level. The course is designed to develop spatial reasoning, logic, and precise mathematical language. All units in this course will tie together geometric and previous advanced algebraic content knowledge such as systems of equations, factoring, and solving quadratic equations. The intent of this course is to prepare students for advanced coursework and mathematics study at the college level.

Transfer Goals/Big Ideas

Students will use critical thinking, perseverance, collaboration, problem-solving, and communication to:
1) Understand geometric vocabulary, symbols and figures.
2) Understand angle measure, logical reasoning, lines and transversals, properties of triangles, similarity, right triangles, trigonometry, circles, surface area and volume.
3) Understand real life applications of geometry.

Priority Missouri Learning Standards/National Standards

CO.A Experiment with transformations in the plane.
CO.B Understand congruence in terms of rigid motions.
CO.C Prove geometric theorems.
SRT.B Prove theorems involving similarity.
SRT.C Define trigonometric ratios, and solve problems involving right triangles.
C.A Understand and apply theorems about circles.
GMD.A Explain volume formulas and use them to solve problems.

Unit 1A: Basics of Geometry
Desired Results

<table>
<tr><th>Standards</th><th colspan="2">Transfer Goal(s) /Big Ideas</th></tr>
<tr><td rowspan="3">G.CO.A.1</td><td colspan="2">Students will use critical thinking, perseverance, collaboration, problem-solving, and communication to:
1) Understand geometric vocabulary, symbols and figures.
2) Understand angle measure.
3) Understand real life applications of geometry.</td></tr>
<tr><th>Enduring Understandings</th><th>Essential Questions</th></tr>
<tr><td>Students will understand that…
● Images of points, lines, planes, etc. must be modeled and interpreted using key terms and symbols.
● Algebraic equations can be written using betweenness of points, congruent segments, and segment bisectors.
● The length and midpoint of a segment on can be calculated using the coordinate plane.
● Algebraic equations can be written and solved using angle addition, congruent angles, and angle bisectors.
● Concepts of adjacent angles, vertical angles, a linear pair, complementary angles, supplementary angles, and perpendicular lines can be applied to model geometric relationships.</td><td>Students will consider…
● How can essential geometric concepts such as angles, segments, and rays be defined using undefined terms?
● How can angle relationships, the betweenness of points, and coordinates be used to solve real world problems?
● How can basic geometric figures be used to model real life situations?</td></tr>
</table>

Learning Targets
• *Model and interpret images of points, lines, planes, etc. using key terms and symbols.* • *Define segment and apply the Segment Addition Postulate, congruent segments, and segment bisectors.* • *Find the length and midpoint of segments on the coordinate plane.* • *Measure and classify angles as acute, right, obtuse, or straight.* • *Define ray and angle and apply the Angle Addition Postulate and angle bisectors.* • *Find angle measures using angle relationships (vertical, supplementary, complementary, linear pair, adjacent angles, perpendicular).* • *Extend all concepts to real world situations.*
Unit Duration:
7 days

HONORS GEOMETRY
Course Overview

Grade level(s): 9-10	**Credits earned:** 1 Math
Course Rationale	**Course Description**
Honors Geometry provides students with experimental and modeling tools that allow them to investigate geometric patterns.	Honors Geometry is a rigorous proof-based course covering traditional Geometry topics at a deeper level. The course is designed to develop spatial reasoning, logic, and precise mathematical language. All units in this course will tie together geometric and previous advanced algebraic content knowledge such as systems of equations, factoring, and solving quadratic equations. The intent of this course is to prepare students for advanced coursework and mathematics study at the college level.

Transfer Goals/Big Ideas

Students will use critical thinking, perseverance, collaboration, problem-solving, and communication to:
1) Understand geometric vocabulary, symbols and figures.
2) Understand angle measure, logical reasoning, lines and transversals, properties of triangles, similarity, right triangles, trigonometry, circles, surface area and volume.
3) Understand real life applications of geometry.

Priority Missouri Learning Standards/National Standards

CO.A Experiment with transformations in the plane.
CO.B Understand congruence in terms of rigid motions.
CO.C Prove geometric theorems.
SRT.B Prove theorems involving similarity.
SRT.C Define trigonometric ratios, and solve problems involving right triangles.
C.A Understand and apply theorems about circles.
GMD.A Explain volume formulas and use them to solve problems.

<table>
<tr><th colspan="3">Unit 1B: Constructions
Desired Results</th></tr>
<tr><th>Standards</th><th colspan="2">Transfer Goal(s) /Big Ideas</th></tr>
<tr><td rowspan="3">CO.D.11</td><td colspan="2">Students will use critical thinking, perseverance, collaboration, problem-solving, and communication to:
1) Understand geometric vocabulary, symbols and figures.
2) Understand angle measure, properties of triangles, and circles.
3) Understand real life applications of geometry.</td></tr>
<tr><th>Enduring Understandings</th><th>Essential Questions</th></tr>
<tr><td>Students will understand that…
● A compass and straightedge can be used to construct basic geometric figures.</td><td>Students will consider…
● How do geometric constructions help you to understand properties of two-dimensional figures?</td></tr>
<tr><th colspan="3">Learning Targets</th></tr>
<tr><td colspan="3">● Make formal geometric constructions with a variety of tools and methods to copy a segment, copy an angle, bisect a segment, bisect an angle, construct perpendicular lines, including the perpendicular bisector of a line segment, and constructing a line parallel to a given line through a point not on the line.
● Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle.</td></tr>
<tr><th colspan="3">Unit Duration:</th></tr>
<tr><td colspan="3">3-4 days</td></tr>
</table>

HONORS GEOMETRY
Course Overview

Grade level(s): 9-10	**Credits earned:** 1 Math
Course Rationale	**Course Description**
Honors Geometry provides students with experimental and modeling tools that allow them to investigate geometric patterns.	Honors Geometry is a rigorous proof-based course covering traditional Geometry topics at a deeper level. The course is designed to develop spatial reasoning, logic, and precise mathematical language. All units in this course will tie together geometric and previous advanced algebraic content knowledge such as systems of equations, factoring, and solving quadratic equations. The intent of this course is to prepare students for advanced coursework and mathematics study at the college level.

Transfer Goals/Big Ideas

Students will use critical thinking, perseverance, collaboration, problem-solving, and communication to:

1) Understand geometric vocabulary, symbols and figures.
2) Understand angle measure, logical reasoning, lines and transversals, properties of triangles, similarity, right triangles, trigonometry, circles, surface area and volume.
3) Understand real life applications of geometry.

Priority Missouri Learning Standards/National Standards

CO.A Experiment with transformations in the plane.
CO.B Understand congruence in terms of rigid motions.
CO.C Prove geometric theorems.
SRT.B Prove theorems involving similarity.
SRT.C Define trigonometric ratios, and solve problems involving right triangles.
C.A Understand and apply theorems about circles.
GMD.A Explain volume formulas and use them to solve problems.

Unit 2: Reasoning and Proof
Desired Results

<table>
<tr><th>Standards</th><th colspan="2">Transfer Goal(s) /Big Ideas</th></tr>
<tr><td rowspan="3">G.CO.C.8</td><td colspan="2">Students will use critical thinking, perseverance, collaboration, problem-solving, and communication to:
1) Understand geometric vocabulary, symbols and figures.
2) Understand logical reasoning.
3) Understand real life applications of geometry.</td></tr>
<tr><td>Enduring Understandings</td><td>Essential Questions</td></tr>
<tr><td>Students will understand that…
● Conjectures are made using inductive reasoning and disproved using counterexamples.
● Statements can be written as conditionals, biconditionals, and converses and they may have different truth values.
● To prove that a statement is true, each statement must be supported with a valid reason, including a property, definition, theorem, postulate, or corollary.</td><td>Students will consider…
● Why is only one counterexample needed to prove a conjecture false?
● How does the use of biconditional statements differ from the use of conditional statements when you are constructing an argument?
● What is the thought process that you use when trying to prove statements involving segment and angle addition, congruence, and bisectors?</td></tr>
</table>

Learning Targets
Students will… ● Make conjectures using inductive reasoning and find counterexamples. ● Write and determine truth values of conditionals, biconditionals, and converses. ● Write geometric proofs involving segment addition, segment congruence, and segment bisectors. ● Write geometric proofs involving angle addition, angle congruence, and angle bisectors.
Unit Duration:
6 days

HONORS GEOMETRY

Course Overview

Grade level(s): 9-10	Credits earned: 1 Math
Course Rationale	**Course Description**
Honors Geometry provides students with experimental and modeling tools that allow them to investigate geometric patterns.	Honors Geometry is a rigorous proof-based course covering traditional Geometry topics at a deeper level. The course is designed to develop spatial reasoning, logic, and precise mathematical language. All units in this course will tie together geometric and previous advanced algebraic content knowledge such as systems of equations, factoring, and solving quadratic equations. The intent of this course is to prepare students for advanced coursework and mathematics study at the college level.

Transfer Goals/Big Ideas

Students will use critical thinking, perseverance, collaboration, problem-solving, and communication to:
1) Understand geometric vocabulary, symbols and figures.
2) Understand angle measure, logical reasoning, lines and transversals, properties of triangles, similarity, right triangles, trigonometry, circles, surface area and volume.
3) Understand real life applications of geometry.

Priority Missouri Learning Standards/National Standards

CO.A Experiment with transformations in the plane.
CO.B Understand congruence in terms of rigid motions.
CO.C Prove geometric theorems.
SRT.B Prove theorems involving similarity.
SRT.C Define trigonometric ratios, and solve problems involving right triangles.
C.A Understand and apply theorems about circles.
GMD.A Explain volume formulas and use them to solve problems.

Unit 3: Parallel & Perpendicular Lines
Desired Results

Standards	Transfer Goal(s) /Big Ideas	
G.CO.A.1 *G.CO.C.8* *G.GPE.D.3*	Students will use critical thinking, perseverance, collaboration, problem-solving, and communication to: 1) Understand geometric vocabulary, symbols and figures. 2) Understand lines and transversals 3) Understand real life applications of geometry.	
	Enduring Understandings	**Essential Questions**
	Students will understand that… ● The intersections of two parallel lines with a transversal are identical, resulting in relationships between special angle pairs. ● The converses of the special angles theorems can be used to prove that lines are parallel. ● Parallel lines have the same slope and perpendicular lines have opposite reciprocal slopes.	*Students will consider…* ● *What are some ways that you can prove that lines are parallel, perpendicular, or neither?* ● *How can parallel and perpendicular lines be represented as transformations of a given line?*

Learning Targets

Students will…

- Use properties of special angle pairs formed by parallel lines and transversals to find angle measures.
- Prove theorems involving parallel lines and special angle pairs while incorporating angle addition, angle congruence, and angle bisectors.
- Determine the slope criteria for parallel and perpendicular lines and use them to solve geometric problems.
- Determine whether two given lines are parallel, perpendicular or neither.
- Write equations for parallel and perpendicular lines.

Unit Duration:

7-8 days

HONORS GEOMETRY *Course Overview*	
Grade level(s): 9-10	**Credits earned:** 1 Math
Course Rationale	**Course Description**
Honors Geometry provides students with experimental and modeling tools that allow them to investigate geometric patterns.	Honors Geometry is a rigorous proof-based course covering traditional Geometry topics at a deeper level. The course is designed to develop spatial reasoning, logic, and precise mathematical language. All units in this course will tie together geometric and previous advanced algebraic content knowledge such as systems of equations, factoring, and solving quadratic equations. The intent of this course is to prepare students for advanced coursework and mathematics study at the college level.
Transfer Goals/Big Ideas	
Students will use critical thinking, perseverance, collaboration, problem-solving, and communication to: 1) Understand geometric vocabulary, symbols and figures. 2) Understand angle measure, logical reasoning, lines and transversals, properties of triangles, similarity, right triangles, trigonometry, circles, surface area and volume. 3) Understand real life applications of geometry.	
Priority Missouri Learning Standards/National Standards	
CO.A Experiment with transformations in the plane. CO.B Understand congruence in terms of rigid motions. CO.C Prove geometric theorems. SRT.B Prove theorems involving similarity. SRT.C Define trigonometric ratios, and solve problems involving right triangles. C.A Understand and apply theorems about circles. GMD.A Explain volume formulas and use them to solve problems.	

Unit 4: Congruent Triangles
Desired Results

Standards	Transfer Goal(s) /Big Ideas	
G.CO.B *G.CO.C.9*	Students will use critical thinking, perseverance, collaboration, problem-solving, and communication to: 1) Understand geometric vocabulary, symbols and figures. 2) Understand triangle classifications and angle relationships in triangles. 3) Understand real life applications of triangles. 4) Understand the properties of congruent triangles.	
	Enduring Understandings	**Essential Questions**
	Students will understand that… ● The sum of the interior angles of a triangle is 180 degrees. ● If two triangles are congruent, then every pair of corresponding parts is also congruent. ● Just two or three corresponding parts may be needed to prove an entire triangle pair to be congruent. ● Geometry uses many types of proofs. The processes of proving includes a variety of activities, such as developing conjectures, considering the general case, exploring with examples, looking for structural similarities across cases, and searching for counterexamples.	*Students will consider…* ● What thought process do you use when proving that triangles are congruent? ● How can indirect reasoning be used to prove that a statement is true?

Learning Targets
Students will… ● Classify triangles by angles and sides. Apply the properties of right, equilateral, equiangular, and isosceles triangles. ● Find angle measures by applying the Angle Sum Theorem. ● Find angle measures by applying the Exterior Angle Theorem. ● Find segment and angle measures by applying the Isosceles Triangle Theorems. ● Prove the Angle Sum, Exterior Angle, and Isosceles Triangle Theorems. ● Identify and prove congruent triangles using SAS, SSS, ASA, AAS or HL. ● Proving triangles congruent using indirect proofs.
Unit Duration:
7-8 days

HONORS GEOMETRY

Course Overview

Grade level(s): 9-10	**Credits earned:** 1 Math
Course Rationale	**Course Description**
Honors Geometry provides students with experimental and modeling tools that allow them to investigate geometric patterns.	Honors Geometry is a rigorous proof-based course covering traditional Geometry topics at a deeper level. The course is designed to develop spatial reasoning, logic, and precise mathematical language. All units in this course will tie together geometric and previous advanced algebraic content knowledge such as systems of equations, factoring, and solving quadratic equations. The intent of this course is to prepare students for advanced coursework and mathematics study at the college level.

Transfer Goals/Big Ideas

Students will use critical thinking, perseverance, collaboration, problem-solving, and communication to:
1) Understand geometric vocabulary, symbols and figures.
2) Understand angle measure, logical reasoning, lines and transversals, properties of triangles, similarity, right triangles, trigonometry, circles, surface area and volume.
3) Understand real life applications of geometry.

Priority Missouri Learning Standards/National Standards

CO.A Experiment with transformations in the plane.
CO.B Understand congruence in terms of rigid motions.
CO.C Prove geometric theorems.
SRT.B Prove theorems involving similarity.
SRT.C Define trigonometric ratios, and solve problems involving right triangles.
C.A Understand and apply theorems about circles.
GMD.A Explain volume formulas and use them to solve problems.

Unit 5: Relationships of Triangles & Similar Polygons

Desired Results

<table>
<tr><th>Standards</th><th colspan="2">Transfer Goal(s) /Big Ideas</th></tr>
<tr><td rowspan="3">G.CO.C.8
G.CO.C.9
G.CO.D.11
G.SRT.A</td><td colspan="2">Students will use critical thinking, perseverance, collaboration, problem-solving, and communication to:
1) Understand geometric vocabulary, symbols and figures.
2) Understand similarity.
3) Understand real life applications of geometry.</td></tr>
<tr><th>Enduring Understandings</th><th>Essential Questions</th></tr>
<tr><td>Students will understand that…
Concepts of bisectors, medians, and altitudes of triangles can be applied to model geometric relationships.
The points of concurrency of bisectors, medians, and altitudes of triangles have properties related to distance from the sides and vertices of the triangle.
Constructions of bisectors, medians, and altitudes must be clearly marked in order to be accurate representations of the object.
The angle-side inequality relationship that occurs within a triangle.
Scale factor can be applied to create a similar shape using enlargement or reduction.
Congruence and similarity criteria for triangles can be used to solve problems and prove relationships in geometric figures.
Geometry theorems involving congruence and similarity can be used to show relationships between polygons and triangles.</td><td>Students will consider…
How can you prove that polygons are similar?
How can the relationship between the measures of the sides and angles of triangles be used to solve problems?
How can the properties of points of concurrency be used in designing structures?</td></tr>
</table>

Learning Targets
Students will… ● *Identify, use, and create bisectors, medians, and altitudes in a triangle.* ● *Use properties of points of concurrency to solve for unknowns.* ● *Recognize and apply properties of inequalities to the relationships between the angles and sides of a triangle.* ● *Prove triangle relationships including possible triangles using the Triangle Inequality Theorem.* ● *Prove triangles are similar using AA, SAS, and SSS Similarity Theorems.* ● *Solve problems using the proportions of similar polygons* ● *Use properties of similar triangles to solve problems.* ● *Use proportional parts within triangles including parallel lines to solve problems.*
Unit Duration:
7 days

HONORS GEOMETRY
Course Overview

Grade level(s): 9-10	**Credits earned:** 1 Math
Course Rationale	**Course Description**
Honors Geometry provides students with experimental and modeling tools that allow them to investigate geometric patterns.	Honors Geometry is a rigorous proof-based course covering traditional Geometry topics at a deeper level. The course is designed to develop spatial reasoning, logic, and precise mathematical language. All units in this course will tie together geometric and previous advanced algebraic content knowledge such as systems of equations, factoring, and solving quadratic equations. The intent of this course is to prepare students for advanced coursework and mathematics study at the college level.

Transfer Goals/Big Ideas

Students will use critical thinking, perseverance, collaboration, problem-solving, and communication to:
1) Understand geometric vocabulary, symbols and figures.
2) Understand angle measure, logical reasoning, lines and transversals, properties of triangles, similarity, right triangles, trigonometry, circles, surface area and volume.
3) Understand real life applications of geometry.

Priority Missouri Learning Standards/National Standards

CO.A Experiment with transformations in the plane.
CO.B Understand congruence in terms of rigid motions.
CO.C Prove geometric theorems.
SRT.B Prove theorems involving similarity.
SRT.C Define trigonometric ratios, and solve problems involving right triangles.
C.A Understand and apply theorems about circles.
GMD.A Explain volume formulas and use them to solve problems.

Unit 6: Right Triangles & Trigonometry

Desired Results

<table>
<tr><th>Standards</th><th colspan="2">Transfer Goal(s) /Big Ideas</th></tr>
<tr><td rowspan="3">G.SRT.C</td><td colspan="2">Students will use critical thinking, perseverance, collaboration, problem-solving, and communication to:
1) Understand geometric vocabulary, symbols and figures.
2) Understand trigonometric relationships.
3) Understand real life applications of trigonometry.</td></tr>
<tr><th>Enduring Understandings</th><th>Essential Questions</th></tr>
<tr><td>Students will understand that…
● Special right triangles are formed by cutting an equilateral triangle in half and a square in half.
● For acute angles in a right triangle, the ratios of the sides define the trigonometric ratios and their inverses.
● The sine of an acute angle is equivalent to the cosine of its complement.
● The Pythagorean Theorem can be used to find missing sides of any right triangle.
● Trigonometric ratios can be used to find side lengths and angles of right triangles.</td><td>Students will consider…
● How can right triangles be used to model real world problems?
● How can you find the missing sides and angles of both right triangles and oblique triangles?</td></tr>
<tr><th colspan="3">Learning Targets</th></tr>
<tr><td colspan="3">Students will…
1. Use the Pythagorean Theorem and special right triangles to solve problems involving right triangles.
2. Classify triangles as acute, obtuse, or right using the Pythagorean Inequalities and Pythagorean Theorem.
3. Use and apply the properties of trigonometric ratios including problems involving angles of elevation and depression.
4. Use special right triangles with trigonometric ratios to solve problems with right triangles.
5. Use the Laws of Sines and Cosines to find missing parts of acute and obtuse triangles.</td></tr>
<tr><th colspan="3">Unit Duration:</th></tr>
<tr><td colspan="3">10-11 days</td></tr>
</table>

HONORS GEOMETRY ***Course Overview***	
Grade level(s): 9-10	**Credits earned:** 1 Math
Course Rationale	**Course Description**
Honors Geometry provides students with experimental and modeling tools that allow them to investigate geometric patterns.	Honors Geometry is a rigorous proof-based course covering traditional Geometry topics at a deeper level. The course is designed to develop spatial reasoning, logic, and precise mathematical language. All units in this course will tie together geometric and previous advanced algebraic content knowledge such as systems of equations, factoring, and solving quadratic equations. The intent of this course is to prepare students for advanced coursework and mathematics study at the college level.
Transfer Goals/Big Ideas	
Students will use critical thinking, perseverance, collaboration, problem-solving, and communication to: 1) Understand geometric vocabulary, symbols and figures. 2) Understand angle measure, logical reasoning, lines and transversals, properties of triangles, similarity, right triangles, trigonometry, circles, surface area and volume. 3) Understand real life applications of geometry.	
Priority Missouri Learning Standards/National Standards	
CO.A Experiment with transformations in the plane. CO.B Understand congruence in terms of rigid motions. CO.C Prove geometric theorems. SRT.B Prove theorems involving similarity. SRT.C Define trigonometric ratios, and solve problems involving right triangles. C.A Understand and apply theorems about circles. GMD.A Explain volume formulas and use them to solve problems.	

Unit 7: Properties of Quadrilaterals
Desired Results

Standards	**Transfer Goal(s) /Big Ideas**	
G.CO.C	Students will use critical thinking, perseverance, collaboration, problem-solving, and communication to: 1) Understand geometric vocabulary, symbols and figures. 2) Understand properties of quadrilaterals. 3) Understand real life applications of quadrilaterals and their properties.	
	Enduring Understandings	**Essential Questions**
	Students will understand that… ● There is a relationship between the number of sides of a polygon and the sum of the measures of the interior angles ● There are similarities and differences between all quadrilaterals. ● Each type of quadrilateral has properties that make it unique.	*Students will consider…* ● What patterns exist among sides and angles of polygons? ● How is each quadrilateral unique?

Learning Targets

Students will…

1. Classify polygons based on their properties.
2. Determine the sum of the interior angles and the measure of each interior angle of a polygon.
3. Use the exterior angle theorem of polygons to find the measures of angles.
4. Compare and contrast the properties of parallelograms and trapezoids.
5. Use the relationships between the angles and sides of quadrilaterals to find missing angles and sides.
6. Compare and contrast the properties of quadrilaterals within the family of parallelograms and the family of trapezoids.
7. Verify that a quadrilateral is a parallelogram.

Unit Duration:

6-7 days

HONORS GEOMETRY ***Course Overview***	
Grade level(s): 9-10	**Credits earned:** 1 Math
Course Rationale	**Course Description**
Honors Geometry provides students with experimental and modeling tools that allow them to investigate geometric patterns.	Honors Geometry is a rigorous proof-based course covering traditional Geometry topics at a deeper level. The course is designed to develop spatial reasoning, logic, and precise mathematical language. All units in this course will tie together geometric and previous advanced algebraic content knowledge such as systems of equations, factoring, and solving quadratic equations. The intent of this course is to prepare students for advanced coursework and mathematics study at the college level.
Transfer Goals/Big Ideas	
Students will use critical thinking, perseverance, collaboration, problem-solving, and communication to: 1) Understand geometric vocabulary, symbols and figures. 2) Understand angle measure, logical reasoning, lines and transversals, properties of triangles, similarity, right triangles, trigonometry, circles, surface area and volume. 3) Understand real life applications of geometry.	
Priority Missouri Learning Standards/National Standards	
CO.A Experiment with transformations in the plane. CO.B Understand congruence in terms of rigid motions. CO.C Prove geometric theorems. SRT.B Prove theorems involving similarity. SRT.C Define trigonometric ratios, and solve problems involving right triangles. C.A Understand and apply theorems about circles. GMD.A Explain volume formulas and use them to solve problems.	

Unit 8: Properties of Circles
Desired Results

Standards	Transfer Goal(s) /Big Ideas
G.C.A.2 *G.C.B.4* *G.GPE.A.1*	Students will use critical thinking, perseverance, collaboration, problem-solving, and communication to: 1) Understand geometric vocabulary, symbols and figures. 2) Understand circles. 3) Understand real life applications of geometry.

Enduring Understandings	Essential Questions
Students will understand that… ● The properties of segments, lines, and angles of circles can be applied to model geometric relationships. ● There exists relationships among the inscribed angles of a circle and their corresponding intercepted arcs. ● There exists relationships between the radii, diameter, tangent lines, and chords of a circle. ● The length of the arc intercepted by an angle is proportional to the radius. ● The equation of a circle can be written using the its radius and the coordinates of its center.	*Students will consider…* ● *How can circles and their parts be defined using undefined terms?* ● *How can relationships among angles, arcs, and lines in circles be used to solve problems?* ● *How can equations be used to model circles?* ● What relationships exist among the angles formed by chords, secants, and tangents?

Learning Targets
Students will… ● Define a circle, identify all of the parts of a circle, and solve problems involving circumference of a circle. ● Solve problems involving arcs, inscribed and circumscribed polygons, segments, lines, and angles of circles. ● Find arc length of a circle using degrees and radians. ● Use the graph of a circle to write its equation and use the equation to graph a circle. ● Derive the equation of a circle when given the center and a point on the circle by using the Pythagorean Theorem and completing the square. ● Find the measure of an angle formed by 2 secants, 2 tangents, or a secant and a tangent.
Unit Duration:
7 days

HONORS GEOMETRY

Course Overview

Grade level(s): 9-10	**Credits earned:** 1 Math
Course Rationale	**Course Description**
Honors Geometry provides students with experimental and modeling tools that allow them to investigate geometric patterns.	Honors Geometry is a rigorous proof-based course covering traditional Geometry topics at a deeper level. The course is designed to develop spatial reasoning, logic, and precise mathematical language. All units in this course will tie together geometric and previous advanced algebraic content knowledge such as systems of equations, factoring, and solving quadratic equations. The intent of this course is to prepare students for advanced coursework and mathematics study at the college level.

Transfer Goals/Big Ideas

Students will use critical thinking, perseverance, collaboration, problem-solving, and communication to:
1) Understand geometric vocabulary, symbols and figures.
2) Understand angle measure, logical reasoning, lines and transversals, properties of triangles, similarity, right triangles, trigonometry, circles, surface area and volume.
3) Understand real life applications of geometry.

Priority Missouri Learning Standards/National Standards

CO.A Experiment with transformations in the plane.
CO.B Understand congruence in terms of rigid motions.
CO.C Prove geometric theorems.
SRT.B Prove theorems involving similarity.
SRT.C Define trigonometric ratios, and solve problems involving right triangles.
C.A Understand and apply theorems about circles.
GMD.A Explain volume formulas and use them to solve problems.

Unit 9: Area of Two Dimensional Shapes
Desired Results

Standards	Transfer Goal(s) /Big Ideas	
G.GMD.A.1 *G.C.B.5*	Students will use critical thinking, perseverance, collaboration, problem-solving, and communication to: 1) Understand geometric vocabulary, symbols and figures. 2) Understand area. 3) Understand real life applications of geometry.	
	Enduring Understandings	**Essential Questions**
	Students will understand that… ● *Formulas can be used to find the area and perimeter of two dimensional shapes.* ● *The area of a sector of a circle can be derived using its central angle in degrees.* ● *When one figure in the plane results from another by applying a similarity transformation with scale factor k, its area is k^2 times the area of the first.* ● *Trigonometric ratios can be used to find the area of a triangle.*	*Students will consider…* ● *How can the process of finding area of two dimensional figures be used to solve problems?* ● *How do similarity transformations influence area of two dimensional figures?*

Learning Targets

Students will…

1. Use formulas to solve problems involving the area and perimeter of parallelograms, triangles, trapezoids, rhombi, and kites.
2. Find the area of a circle and a sector of a circle using degrees and radians.
3. Solve problems involving area of regular polygons using composite figures.
4. Solve problems involving area of similar figures.
5. Use trigonometric ratios to find the area of triangles.

Unit Duration:

6 days

Honors Algebra 2 Course Overview	
Grade level(s): 10, 11	**Credits earned:** 1 credit
Course Rationale	**Course Description**
Mathematics provides the conceptual basis for the structure of many things around us. This course is an extension of the Algebra 1 curriculum. Topics that were first introduced in Algebra 1 will be built upon and applied to problems that require higher order thinking skills. Honors Algebra 2 uses the same standards as Algebra 2, but instruction is at an accelerated and more in-depth level. Honors Algebra 2 builds a foundation of mathematics for those students going on to Pre-Calculus and/or students who are college bound.	This course includes a more advanced study of the functions introduced in Algebra 1, ,and is taught at an accelerated pace. The number system will be extended to include the complex numbers. The course will include advanced operations, solving, graphing, and writing the following: systems of equations, polynomial, radical, exponential, logarithmic, and rational functions.
Transfer Goals/Big Ideas	
Students will be able to independently use their learning to… *We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have:* *1) Mathematical literacy.* *2) A complete mathematical skill set.* *3) An understanding of the real life applications of mathematics.*	

Priority Missouri Learning Standards/National Standards
A2.NQ.A: Extend and use the relationship between rational exponents and radicals. A2.NQ.B: Use complex numbers. A2.SSE.A: Define and use logarithms. A2.REI.A: Solve equations and inequalities. A2.REI.B: Solve general systems of equations and inequalities. A2.APR.A: Perform operations on polynomials and rational expressions. A2.IF.A: Use and interpret functions. A2.BF.A: Create new functions from existing functions. A2.FM.A: Use functions to model real-world problems

Unit 1: Piecewise Functions
Desired Results

<table>
<tr><th>Standards</th><th colspan="2">Transfer Goal(s) /Big Ideas</th></tr>
<tr><td rowspan="3">A2.REI.A
A2.IF.A
A2.BF.A</td><td colspan="2">We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have:
1) Mathematical literacy.
2) A complete mathematical skill set.
3) An understanding of the real life applications of mathematics.</td></tr>
<tr><th>Enduring Understandings</th><th>Essential Questions</th></tr>
<tr><td>Students will understand that:
1. Domain and Range can be determined graphically, numerically and algebraically.
2. Linear piecewise functions can be analyzed using the same skills we use for linear functions.</td><td>Students will consider…
1. How are step functions similar to linear functions? How are they different?
2. Why is it important to define some functions over a specific interval?
3. How can piecewise-defined functions be graphed? In what situations might these functions be applied?
4. What are the most common piecewise-defined functions, and when can they be used?</td></tr>
</table>

Learning Targets
Students will… **Create and solve equations and inequalities, including those that involve absolute value.** I can write an equation or inequality to model a context. I can create step and absolute value equations. I can solve absolute value equations. I can solve absolute value inequalities. I can use algebraic and/or graphical methods to solve these problems. **Identify and interpret key characteristics of functions represented graphically with tables, and with algebraic symbolism to solve problems.** I can identify the following key characteristics of functions from graphs, tables and equations: domain, range, x- and y-intercepts, and intervals of increasing and decreasing. I can identify these key characteristics for absolute value of linear functions, simple piecewise defined, and step functions. I can represent a given function as a table, equation or graph. I can determine specific values of a function from a table, graph or equation.
Unit Duration:
2 - 4 weeks

Unit 2: Quadratic Functions
Desired Results

<table>
<tr><th>Standards</th><th colspan="2">Transfer Goal(s) /Big Ideas</th></tr>
<tr><td rowspan="2">A2.NQ.B
A2.REI.A
A2.IF.A
A2.FM.A</td><td colspan="2">We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have:
1) Mathematical literacy.
2) A complete mathematical skill set.
3) An understanding of the real life applications of mathematics.</td></tr>
<tr><th>Enduring Understandings</th><th>Essential Questions</th></tr>
</table>

	Students will understand that… 1. The vertex of a parabola will represent the maximum point of the function, which will help to understand maximum and minimum values in real-life situations. 2. To find the zeros of a quadratic function, you must set the equation equal to zero. 3. No matter how you choose to solve a quadratic function for real solutions, you are always looking for where the function crosses the x-axis. These points on the graph are significant in many real-world applications. 4. Solutions that exist can exist beyond the real number system. 5. All quadratic functions are a transformation on the parent function $f(x)=x^2$. 6. For any quadratic function in standard form, the values of a, b, and c provide key information about its graph. 7. The domain and range of quadratic functions can be relative to a situation.	*Students will consider…* 1. How are quadratic functions used to model, analyze and interpret mathematical relationships? 2. What are the advantages of a quadratic function in vertex form? In standard form? 3. How is any quadratic function related to the parent quadratic function f(x)=x2 ? 4. What methods can be used to solve quadratic equations? How do you know which method is the best to use? 5. What does it mean to solve a quadratic equation?

Learning Targets
Students will… **Represent complex numbers.** I can write all numbers in the form, a + bi I can identify that a and b are real numbers and i is defined as the square root of -1 **Sdd, subtract, multiply and divide complex numbers.** I can add and subtract complex numbers with answers given in a + bi form. I can multiply complex numbers with answers given in a + bi form. I can divide complex numbers with answers given in a + bi form, using conjugates to rationalize the denominator. **Create and solve equations and inequalities.** I can write an equation or inequality to model a context. I can write an equation to model a context using technology including quadratic regression, and inverse matrices on a graphing calculator. I can create quadratic equations. I can solve quadratic equations . I can solve quadratic inequalities. I can use algebraic and/or graphical methods including technology to solve quadratic equations and inequalities. **Translate between equivalent forms of functions.** I can translate between equivalent forms of quadratic functions. I can find equivalent forms of quadratic functions to highlight key characteristics. I can write a quadratic function in vertex form, standard form and/or in intercept form by factorization, completing the square and multiplication. **Create functions and use them to solve applications of quadratic function model problems** I can create quadratic equations to model problems. I can solve quadratic equations to determine solutions to problems algebraically or graphically (e.g. price-demand-cost-revenue-profit situations).
Unit Duration:
2-4 weeks

Unit 3: Systems of Equations
Desired Results

<table>
<tr><th>Standards</th><th colspan="2">Transfer Goal(s) /Big Ideas</th></tr>
<tr><td rowspan="3">A2.REI.B</td><td colspan="2">We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have:
1) Mathematical literacy.
2) A complete mathematical skill set.</td></tr>
<tr><th>Enduring Understandings</th><th>Essential Questions</th></tr>
<tr><td>Students will understand that …
1. Systems of equations can be created and solved algebraically and graphically by hand or through the use of technology.</td><td>Students will consider…
1. What does the number of solutions of a system of equations represent?
2. What are the advantages and disadvantages of solving a system of equations graphically versus algebraically?
3. How can systems of equations be used to represent situations and solve problems?</td></tr>
<tr><th colspan="3">Learning Targets</th></tr>
<tr><td colspan="3">Students will…
Create and solve systems of equations that may include non-linear equations and inequalities.
I can write a system of equations to model a context or setting that may include non-linear equations and inequalities.
I can solve systems of equations, include linear-linear-linear , linear-quadratic, and quadratic-quadratic equations and inequalities.</td></tr>
<tr><th colspan="3">Unit Duration:</th></tr>
<tr><td colspan="3">2 - 3 weeks</td></tr>
</table>

Unit 4: Polynomial Functions
Desired Results

<table>
<tr><th>Standards</th><th colspan="2">Transfer Goal(s) /Big Ideas</th></tr>
<tr><td rowspan="3">A2.NQ.B
A2.REI.A
A2.APR.A
A2.BFA</td><td colspan="2">We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have:
1) Mathematical literacy.
2) A complete mathematical skill set.
3) An understanding of the real life applications of mathematics.</td></tr>
<tr><th>Enduring Understandings</th><th>Essential Questions</th></tr>
<tr><td>Students will understand that…
1. A polynomial function has distinguishing “behaviors”. You can look at its algebraic form and know something about its graph. You can look at its graph and know something about its algebraic form.
2. Knowing the zeros of a polynomial functions can help you understand the behavior of its graph.
3. If (x-a) is a factor of a polynomials, then the polynomial has value 0 when x=a. If a is a real number, then the graph of the polynomial has (a,0) as an x-intercept.
4. You can divide polynomials using steps that are similar to the long division steps that you use to divide whole numbers.
5. The degree of a polynomial equation tells you how many roots the equation has.
6. The characteristics of polynomial functions and their representations are useful in solving real-world problems.
7. The domain and range of polynomial functions can be extended to include the set of complex numbers.</td><td>Students will consider…
1. How is the system of operations for polynomials related to the system of operations for real numbers?
2. What do the solutions to a polynomial represent?</td></tr>
</table>

Learning Targets
Students will… **Create and solve equations.** I can write an equation or inequality to model a context. I can create a polynomial equation. I can solve a polynomial equation. **Extend the knowledge of factoring to include factors with complex coefficients.** I can factor using: ● Greatest common factor ● Difference of two squares ● Sum and difference of cubes ● Trinomials ● Grouping I can use the quadratic formula to solve a quadratic that does not factor. I can use the square root method to solve a quadratic. I can recognize and find complex solutions. I can recognize the best method for factoring a polynomial. **Understand the Remainder Theorem and use it to solve problems** I can list the possible rational zeros. I can find the rational zeros that are solutions to the polynomial using synthetic division. I can find the remaining zeros using synthetic division, factoring or the quadratic formula. I can recognize the best method for finding the remaining zeros. I will identify the number of solutions to a polynomial using the Fundamental Theorem of Algebra. **Add, subtract, multiply and divide polynomial expressions.** I can find the least common multiple of two or more polynomials. I can add and subtract polynomial expressions. I can multiply and divide polynomial expressions where final answers should not have common factors in the numerators and denominators. **Identify zeros of polynomials when suitable factorizations are available, and use the zeros to sketch the function defined by the polynomial.** I can factor polynomials and use the zero product property to identify the zeros. I can use the zeros and other key characteristics to sketch the function defined by the polynomial (x- and y-intercepts, end behavior, local minima and maxima).

Identify and interpret key characteristics of functions represented graphically with tables, and with algebraic symbolism to solve problems. I can identify the following key characteristics of polynomial functions from graphs, tables and equations: domain, range, end behavior, x- and y-intercepts, local maxima and minima values, symmetries, points of discontinuity, and intervals of increasing and decreasing. I can represent a given function as a table, equation or graph. I can determine specific values of a function from a table, graph or equation. I can identify key characteristics and solve polynomial functions through the use of technology. **Describe the effects of transformations algebraically and graphically; create vertical and horizontal translations, vertical and horizontal reflections and dilations (expansions/compressions) for a variety of functions (linear, quadratic, cubic, square and cube root, absolute value, exponential and logarithmic).** I can describe the effects of transformations algebraically using a, h, and k, given an equation in the form $f(x)=a(x-h)+k$, or given other general forms of the functions listed. I can describe the effects of transformations graphically using terms such as horizontal or vertical stretch (expansion), or shrink (compression), reflection, horizontal and vertical translation and dilation. I can create equations from the parent functions that produce a variety of transformations (linear, quadratic, cubic). I can create graphs from the (linear, quadratic, cubic) parent graphs that demonstrate vertical stretch (expansion), or shrink (compression), reflection, horizontal and vertical translation and dilation.
Unit Duration:
4 - 6 weeks

Unit 5: Rational Exponents and Radical Functions

Desired Results

<table>
<tr><th>Standards</th><th colspan="2">Transfer Goal(s) /Big Ideas</th></tr>
<tr><td rowspan="3">A2.NQ.A
A2.IF.A
A2.BF.A</td><td colspan="2">We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have:
1) Mathematical literacy.
2) A complete mathematical skill set.
3) An understanding of the real life applications of mathematics.</td></tr>
<tr><th>Enduring Understandings</th><th>Essential Questions</th></tr>
<tr><td>Students will understand that…
1. Corresponding to every power there is a root.
2. You can combine like radicals using properties of real numbers.
3. You can write a radical expression in an equivalent form using a fractional (rational) exponent instead of a radical sign.
4. Solving a square root equation may require that you square each side of the equation. This process can introduce extraneous solutions.</td><td>Students will consider…
1. Why are some forms of numbers easier to work with than other forms when performing calculations?
2. What are the differences and similarities between real numbers and complex numbers?
3. How are a function and its inverse function related?
4. How do power and radical functions model real-world problems and their solutions?</td></tr>
</table>

Learning Targets
Students will… **Extend the system of powers and roots to include rational exponents.** I can apply the rules of exponents to expressions that include rational exponents. I can simplify expressions including constants and variables as bases and using rational exponents, including those with integer numerators other than one. **Create and recognize equivalent expressions involving radical and exponential forms of expressions.** I can convert from radical form to rational exponent form. The student will be able to convert from rational exponent form to radical form. I can recognize that radical form and rational exponent forms are equivalent. I can simplify radical expressions. I can simplify expressions with rational exponents **Add, subtract, multiply and divide radical expressions.** I can perform operations with radical expressions, including those that require simplifying prior to combining terms. I can use conjugates to simplify rational expressions containing radicals in the denominator. **Solve equations involving rational exponents and/or radicals and identify situations where extraneous solutions may result.** I can solve equations involving rational exponents. I can solve equations involving radical expressions. I can check for and identify extraneous solutions. **Identify and interpret key characteristics of functions represented graphically with tables, and with algebraic symbolism to solve problems.** I can identify the following key characteristics of square root and cube root functions from graphs, tables and equations: domain, range, x- and y-intercepts, and intervals of increasing and decreasing. I can represent a square root and cube root function as a table, equation or graph. I can determine specific values of a function from a table, graph or equation. **Translate between equivalent forms of functions.** I can translate between equivalent forms of functions. I can find equivalent forms of functions to highlight key characteristics. **Create new functions by applying the four arithmetic operations and composition of functions (modifying the domain and range as necessary).** I can add functions to create new functions and determine the domain and range of the new function (modifying the domain and range as necessary). I can subtract functions to create new functions and determine the domain and range of the new function (modifying the domain and range as necessary). I can multiply functions to create new functions and determine the domain and range of the new function (modifying the domain and range as necessary). I can divide functions to create new function, and determine the domain and range of the new function (modifying the domain and range as necessary). I can compose functions and determine the domain and range of the new function

Derive inverses of functions and compose the inverse with the original function to show that the functions are inverses.

I can derive inverses of given functions.

I can compose functions to determine if they are inverses.

I can compose the inverse with the original function to prove that the functions are inverses.

Describe the effects of transformations algebraically and graphically; create vertical and horizontal translations, vertical and horizontal reflections and dilations (expansions/compressions) for a variety of functions (linear, quadratic, cubic, square and cube root, absolute value, exponential and logarithmic).

I can describe the effects of transformations algebraically using a, h, and k, given an equation in the form $f(x)=a(x-h)+k$, or given other general forms of the functions listed.

I can describe the effects of transformations graphically using terms such as horizontal or vertical stretch (expansion), or shrink (compression), reflection, horizontal and vertical translation and dilation.

I can create equations from the parent functions that produce a variety of transformations (square and cube root).

I can create graphs from the (square and cube root) parent graphs that demonstrate vertical stretch (expansion), or shrink (compression), reflection, horizontal and vertical translation and dilation.

Unit Duration:-

4 -6 weeks

Unit 6: Exponential and Logarithmic Functions
Desired Results

<table>
<tr><th rowspan="2">Standards</th><th colspan="2">Transfer Goal(s) /Big Ideas</th></tr>
<tr><td colspan="2">We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have:
1) Mathematical literacy.
2) A complete mathematical skill set.
3) An understanding of the real life applications of mathematics.</td></tr>
<tr><td rowspan="2">A2.SSE.A
A2.REI.A
A2.IF.A
A2.FM.A
A2.BFA</td><th>Enduring Understandings</th><th>Essential Questions</th></tr>
<tr><td>Students will understand that…
1. The characteristics of exponential and logarithmic functions and their representations are useful in solving real-world problems.</td><td>Students will consider…
1. How do exponential functions model real-world problems and their solutions?
2. How do logarithmic functions model real-world problems and their solutions?
3. How are expressions involving exponents and logarithms related?</td></tr>
</table>

Learning Targets
Students will… **Develop the definition of logarithms based on properties of exponents.** I can develop the definition of logarithms, $log_b\, y = x$ if and only if $b^x = y$, based on properties of exponents. I can convert equations from exponential to logarithmic form. I can convert equations from logarithmic to exponential form. **Use the inverse relationship between exponents and logarithms to solve exponential and logarithmic equations.** I can use the inverse relationship between exponents and logarithms to solve simple exponential equations. I can use the inverse relationship between exponents and logarithms to solve simple logarithmic equations. **Use properties of logarithms to solve equations or find equivalent expressions.** I can expand expressions using properties of logarithms. I can condense expressions using properties of logarithms. I can solve equations using properties of logarithms. **Understand why logarithmic scales are used, and use them to solve problems.** I can understand why logarithmic scales are used, and use them to solve problems. I can use logarithmic scales to compare quantities and solve problems involving logarithms. (e.g., pH scale, earthquake intensity, light intensity and sound intensity) **Create and solve logarithmic and exponential equations.** I can solve exponential equations that do not require logarithms. I can write an equation to model a context. I can use algebraic and/or graphical methods to solve these problems. **Describe the effects of transformations algebraically and graphically; create vertical and horizontal translations, vertical and horizontal reflections and dilations (expansions/compressions) for a variety of functions (linear, quadratic, cubic, square and cube root, absolute value, exponential and logarithmic).** I can describe the effects of transformations algebraically using a, h, and k, given an equation in the form f(x)=a(x-h)+k, or given other general forms of the functions listed. I can describe the effects of transformations graphically using terms such as horizontal or vertical stretch (expansion), or shrink (compression), reflection, horizontal and vertical translation and dilation. I can create equations from the parent functions that produce a variety of transformations (linear, quadratic, cubic, square and cube root, absolute value, exponential, and logarithmic). I can create graphs from the (linear, quadratic, cubic, square and cube root, absolute value, exponential, and logarithmic) parent graphs that

demonstrate vertical stretch (expansion), or shrink (compression), reflection, horizontal and vertical translation and dilation.

Identify and interpret key characteristics of functions represented graphically with tables, and with algebraic symbolism to solve problems.

I can identify the following key characteristics of functions from graphs, tables and equations: domain, range, end behavior, x- and y-intercepts, local maxima and minima values, symmetries, points of discontinuity, intervals of increasing and decreasing, and horizontal and vertical asymptotes.

I can identify these key characteristics for general polynomials: exponential and logarithmic functions.

I can determine specific values of a function from a table, graph or equation.

Create functions and use them to solve applications of quadratic and exponential function model problems

I can create quadratic or exponential equations to model problems.

I can solve quadratic or exponential equations to determine solutions to problems algebraically or graphically (e.g. price-demand-cost-revenue-profit situations, compound interest problems and exponential growth or decay problems).

Unit Duration:

4-6 weeks

Unit 7: Rational Functions
Desired Results

<table>
<tr><th>Standards</th><th colspan="2">Transfer Goal(s) /Big Ideas</th></tr>
<tr><td rowspan="3">A2.REI.A
A2.APR.A
A2.IF.A</td><td colspan="2">We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have:
1) Mathematical literacy.
2) A complete mathematical skill set.
3) An understanding of the real life applications of mathematics.</td></tr>
<tr><th>Enduring Understandings</th><th>Essential Questions</th></tr>
<tr><td>Students will understand that…
1. A rational function is a ratio of polynomial functions. If a rational function is in simplified form and the polynomial in the denominator is not constant, the graph of the rational function features asymptotic behavior.
2. Rational functions are found in real life phenomena that deal with rate of change.</td><td>Students will consider…
1. How can you graph rational functions?
2. How can you solve rational equations?
3. What kinds of asymptotes may exist in rational functions and why?
4. Why do rational expressions need to have a defined domain?</td></tr>
</table>

Learning Targets
Students will… **Solve rational equations where numerators and denominators are polynomials, and where extraneous solutions may result.** I can solve rational equations by various methods, including instances when the numerator and denominator are polynomials. I can check solutions and identify those that are extraneous. **Add, subtract, multiply and divide rational expressions.** I can find the least common multiple of two or more polynomials. I can add and subtract rational expressions, including those with polynomial numerators and denominators, including those with unlike denominators. I can multiply and divide rational expressions, including those with polynomial numerators and denominators. Final answers should not have common factors in the numerators and denominators. **Identify and interpret key characteristics of functions represented graphically with tables, and with algebraic symbolism to solve problems.** I can identify the following key characteristics of functions from graphs, tables and equations: domain, range, end behavior, x- and y-intercepts, local maxima and minima values, symmetries, points of discontinuity, intervals of increasing and decreasing, and horizontal and vertical asymptotes. I can identify these key characteristics for rational functions. I can represent a given function as a table, equation or graph. I can determine specific values of a function from a table, graph or equation.
Unit Duration:
3-5 weeks

Unit 1A: Solving Piecewise Functions			
A2.REI.A: Solve equations and inequalities. (Standard 4)			
Level: Honors Algebra II			
Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**		**Sample Tasks**
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Score 3.0	**The student will be able to:** • Solve a multi-step absolute value equation with or without extraneous solutions. • Solve a multi-step absolute value inequality and graph the solution on a number line. • Solve an absolute value inequality with no solution or infinitely many solutions. **The student exhibits no major errors or omissions.**		• • Solve $-2\|x-10\| \leq 30$ • Solve $\|2x-4\| = x+12$ •
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content	
Score 2.0	**There are no major errors or omissions regarding the simpler details and processes as the student:** • Evaluates an expression with absolute value • Solves absolute value equations of the form $\|ax+b\| = c$ • Solve an absolute value equation with no solution. • Solves absolute value inequalities of the form $\|ax+b\| \leq c$ or $\|ax+b\| \geq c$ **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**		• $Evaluate\ 2\|3x-5y\|+2\ if\ x=-2, y=7$ • Solve $\|2x-4\|-6=12$ • Solve $10\|x+2\| \leq 20$ • Solve $\|x-4\| = -2$
	1.5	Partial knowledge of the 2.0 content but major errors or omissions regarding the 3.0 content	
Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**		
	0.5	With help, a partial understanding of the 2.0 content but not the 3.0 content	
Score 0.0	**Even with help, no understanding or skill demonstrated.**		

Unit 1B: Graphing Piecewise Functions			
A2.IF.A: Use and interpret functions. (Standard 7)			
Level: Honors Algebra II			
Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**		**Sample Tasks**
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Score 3.0	**The student will be able to:** • Graph a piecewise function, including a step function. • Interpret the domain and range of an absolute value function. The student exhibits no major conceptual or computational errors or omissions.		• Graph $f(x) = \{|x-4|,\ if\ x < 1\ 2x-1,\ if\ x \geq 1\}$
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content	
Score 2.0	**There are no major errors or omissions regarding the simpler details and processes as the student:** • Graphs an absolute value function. • Evaluates the function for the given values given a piecewise function. **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**		• If $f(x) = \{x+3,\ if\ x < 1\ 2x-1,\ if\ x \geq 1\}$, find $f(6)$ • Graph $y = 2|x-4| + 6$
	1.5	Partial knowledge of the 2.0 content but major errors or omissions regarding the 3.0 content	
Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**		
	0.5	With help, a partial understanding of the 2.0 content but not the 3.0 content	
Score 0.0	**Even with help, no understanding or skill demonstrated.**		

Unit 1C: Writing Piecewise Functions			
A2.REI.A: Solve equations and inequalities. (Standard 4)			
Level: Honors Algebra II			
Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**		**Sample Tasks** • Quadratic Piecewise
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Score 3.0	**The student will be able to:** • Write a piecewise function, given a graph o Include linear and absolute value functions • Write an absolute value function, given a graph. **tudent exhibits no major conceptual or computational errors or omissions.**		• A plane descends from 5000ft at 250 ft/min for 6 minutes. After 6 minutes, it descends at 150ft/min. (from 3500 ft) Let t = the number of minutes and A = the altitude. Write a piecewise function for this situation. What is the plane's altitude after 12 minutes? • Taisha uses the elliptical cross–trainer at the gym. Her general goal is to burn 280 Calories per workout, but she varies by as much as 25 Calories from this amount on any given day. Write and solve an equation to find the maximum and minimum number of Calories Taisha burns on the cross-trainer.
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content	
Score 2.0	**There are no major errors or omissions regarding the simpler details and processes as the student:** • Writes a piecewise function with minor errors in the domain. • Writes an absolute value inequality given the solutions, • Writes and solves an absolute value equation or inequality, given a real-life situation. (one variable) **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**		• Ice cream should be stored at $5°F$ with an allowance of $3°$. Write and solve an equation to find the maximum and minimum temperatures at which the ice cream should be stored. • The average depth d of an aquarium tank for dolphins is 50m. The actual depth cannot vary by more than 5m. Write and solve an absolute value inequality to determine acceptable tank depths.
	1.5	Partial knowledge of the 2.0 content but major errors or omissions regarding the 3.0 content	
Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**		
	0.5	With help, a partial understanding of the 2.0 content but not the 3.0 content	
Score 0.0	**Even with help, no understanding or skill demonstrated.**		

<table>
<tr><th colspan="4">Unit 2A: Solving Quadratic Functions</th></tr>
<tr><td colspan="4">A2.REI.A: Solve equations and inequalities (Standard 4)</td></tr>
<tr><td colspan="4">Level: Honors Algebra II</td></tr>
<tr><td>Score 4.0</td><td colspan="2">In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.</td><td>Sample Tasks</td></tr>
<tr><td></td><td>3.5</td><td>In addition to score 3.0 performance, in-depth inferences and applications with partial success.</td><td></td></tr>
<tr><td>Score 3.0</td><td colspan="2">The student will be able to:
• Solve Quadratic Functions with complex roots by
  • Factoring
  • Completing the square
  • Using the quadratic formula

The student exhibits no major conceptual or computational errors or omissions.</td><td>• The sum of two squares
• Example of Completing the Square:
$2x^2+5x-12=4$</td></tr>
<tr><td></td><td>2.5</td><td>No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content</td><td></td></tr>
<tr><td>Score 2.0</td><td colspan="2">There are no major errors or omissions regarding the simpler details and processes as the student:
• Solves Quadratic Functions with real roots by
  • Factoring
  • Completing the square
  • Using the quadratic formula
  • Given a graph

However, the student exhibits major errors or omissions regarding the more complex ideas and processes.</td><td>4x^2 -12x+9</td></tr>
<tr><td></td><td>1.5</td><td>Partial knowledge of the 2.0 content but major errors or omissions regarding the 3.0 content</td><td></td></tr>
<tr><td>Score 1.0</td><td colspan="2">With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.</td><td></td></tr>
<tr><td></td><td>0.5</td><td>With help, a partial understanding of the 2.0 content but not the 3.0 content</td><td></td></tr>
<tr><td>Score 0.0</td><td colspan="2">Even with help, no understanding or skill demonstrated.</td><td></td></tr>
</table>

Unit 2B: Operations with Quadratic Functions: (Complex Numbers)			
A2.NQ.B: Use complex numbers.			
Level: Honors Algebra II			
Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**		**Sample Tasks**
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Score 3.0	**The student will:** ● Divides complex numbers ● Adds/Subtracts complex numbers ● Graphs complex number ● Simply complex numbers including powers of i. **The student exhibits no major conceptual or computational errors or omissions.**		Simplify $\frac{3+i}{5-3i}$ Graph $2+3i$ Simplify i^{35}
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content	
Score 2.0	**There are no major errors or omissions regarding the simpler details and processes as the student:** ● Multiply complex numbers ● Adds/Subtracts complex numbers **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**		$(2+5i)-(3+i)$ $(2+i)(4-i)$
	1.5	Partial knowledge of the 2.0 content but major errors or omissions regarding the 3.0 content	
Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**		
	0.5	With help, a partial understanding of the 2.0 content but not the 3.0 content	
Score 0.0	**Even with help, no understanding or skill demonstrated.**		

Unit 2C & 2D: Writing & Applying Quadratic Functions			
A2.IF.A: Use and interpret functions. A2.FM.A: Use functions to model real-world problems			
Level: Honors Algebra II			
Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**		**Sample Tasks**
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Score 3.0	**The student will:** ● write a quadratic equation given three points ● be able to translate between equivalent forms of functions. ● use technology to write an equation to model a context (quadratic regression, and inverse matrices on a graphing calculator) ● write and solve a quadratic equation, given a real-life situation o Include problems with focus and directrix **The student exhibits no major conceptual or computational errors or omissions.**		● Write the quadratic for the equation that passes through (2, 4), (-1, 4), and (5,6) ● Vertical Motion, Pythagorean Theorem and Area ● Price-Demand-Cost-Revenue- Profit Situations
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content	
Score 2.0	**There are no major errors or omissions regarding the simpler details and processes as the student:** ● solves and interprets results given an equation that models a real-life situation, **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**		●
	1.5	Partial knowledge of the 2.0 content but major errors or omissions regarding the 3.0 content	
Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**		
	0.5	With help, a partial understanding of the 2.0 content but not the 3.0 content	
Score 0.0	**Even with help, no understanding or skill demonstrated.**		

Unit 3A: Solving Systems of Functions			
A2.REI.B: Solve general systems of equations and inequalities.			
Level: Honors Algebra II			
Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**		**Sample Tasks**
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Score 3.0	**The student will be able to:** • Solve a system of three equations in three variables using algebra • Solve a quadratic/quadratic system of equations using algebra • Solve a linear/quadratic system of equations using algebra **The student exhibits no major conceptual or computational errors or omissions.**		• $\begin{aligned} 2x + 3y - 4z &= 10 \\ 2x - 3y + 5z &= 8 \\ x + y + z &= 15 \end{aligned}$ • $\begin{aligned} x^2 + y &= 16 \\ x + y &= 12 \end{aligned}$
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content	
Score 2.0	**There are no major errors or omissions regarding the simpler details and processes as the student:** • Solve a system of two linear equations in two variables using algebra **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**		•
	1.5	Partial knowledge of the 2.0 content but major errors or omissions regarding the 3.0 content	
Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**		
	0.5	With help, a partial understanding of the 2.0 content but not the 3.0 content	
Score 0.0	**Even with help, no understanding or skill demonstrated.**		

Unit 3B: Graphing Systems of Functions			
A2.REI.B: Solve general systems of equations and inequalities.			
Level: Algebra II			
Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**		**Sample Tasks**
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Score 3.0	**The student will be able to:** ● Solve a system of non-linear equations and inequalities by graphing **tudent exhibits no major conceptual or computational errors or omissions.**		● Quadratic - Quadratic ● Quadratic - Absolute Value
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content	
Score 2.0	**There are no major errors or omissions regarding the simpler details and processes as the student:** ● Solves a system of linear equations in two variables by graphing. ● Solves a linear/quadratic system of equations by graphing. ● Solves a linear/absolute value system of equations by graphing. ● Solves a absolute value/absolute value system of equations by graphing. **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**		●
	1.5	Partial knowledge of the 2.0 content but major errors or omissions regarding the 3.0 content	
Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**		
	0.5	With help, a partial understanding of the 2.0 content but not the 3.0 content	
Score 0.0	**Even with help, no understanding or skill demonstrated.**		

Unit 3C: Write a System of Functions to Model a Context			
A2.REI.B: Solve general systems of equations and inequalities.			
Level: Honors Algebra II			
Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**		**Sample Tasks**
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Score 3.0	**The student will be able to:** ● Write, graph and interpret a system of equations or inequalities, linear and/or non-linear, given a real-life situation. **The student exhibits no major conceptual or computational errors or omissions.**		● Linear Programming
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content	
Score 2.0	**There are no major errors or omissions regarding the simpler details and processes as the student:** ● Write a system of inequalities for a real-life situation, linear and/or non-linear, graph the inequalities. **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**		●
	1.5	Partial knowledge of the 2.0 content but major errors or omissions regarding the 3.0 content	
Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**		
	0.5	With help, a partial understanding of the 2.0 content but not the 3.0 content	
Score 0.0	**Even with help, no understanding or skill demonstrated.**		

Unit 4A: Operations on Polynomial Functions			
A2.APR.A: Perform operations on polynomials and rational expressions			
Level: Honors Algebra II			
Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**		**Sample Tasks** ● Binomial Theorem
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Score 3.0	**The student will:** ● Divide polynomial using long division ● Divide polynomial using synthetic division ● Multiplying binomial to a power greater than 3. **The student exhibits no major conceptual or computational errors or omissions.**		● Ex: $(2x-1)^3$
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content	
Score 2.0	**There are no major errors or omissions regarding the simpler details and processes as the student:** ● Adds, subtracts and multiplies a polynomial expressions ● Divides a polynomial by a monomial **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**		● **Division of polynomial by a monomial**
	1.5	Partial knowledge of the 2.0 content but major errors or omissions regarding the 3.0 content	
Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**		
	0.5	With help, a partial understanding of the 2.0 content but not the 3.0 content	
Score 0.0	**Even with help, no understanding or skill demonstrated.**		

<table>
<tr><th colspan="4">Unit 4B: Solving Polynomial Functions</th></tr>
<tr><td colspan="4">A2.REI.A: Solve equations and inequalities.</td></tr>
<tr><td colspan="4">Level: Honors Algebra II</td></tr>
<tr><td rowspan="2">Score 4.0</td><td colspan="2" rowspan="2">In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.</td><td>Sample Tasks</td></tr>
<tr><td>x ^ 6 - y ^ 6</td></tr>
<tr><td></td><td>3.5</td><td>In addition to score 3.0 performance, in-depth inferences and applications with partial success.</td><td></td></tr>
<tr><td>Score 3.0</td><td colspan="2">The student will:
Solve polynomials of degree 3 or higher by rational root theorem
Solve polynomials by factoring
Difference of two squares (degree 4 or higher)
Sum/Difference of cubes
trinomial factoring in quadratic form
grouping (include 2 x 2 and 3 x 1)
U-substitution
Solve by square rooting .
The student exhibits no major conceptual or computational errors or omissions.</td><td>Ex: $x^3 - 8 = 0$</td></tr>
<tr><td></td><td>2.5</td><td>No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content</td><td></td></tr>
<tr><td>Score 2.0</td><td colspan="2">There are no major errors or omissions regarding the simpler details and processes as the student:
Solving quadratics by factoring
Difference of two squares (degree of 2)
by finding the GCF
trinomials with a degree of 2
However, the student exhibits major errors or omissions regarding the more complex ideas and processes.</td><td>Ex: $x^2 - 9 = 0$</td></tr>
<tr><td></td><td>1.5</td><td>Partial knowledge of the 2.0 content but major errors or omissions regarding the 3.0 content</td><td rowspan="4"></td></tr>
<tr><td>Score 1.0</td><td colspan="2">With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.</td></tr>
<tr><td></td><td>0.5</td><td>With help, a partial understanding of the 2.0 content but not the 3.0 content</td></tr>
<tr><td>Score 0.0</td><td colspan="2">Even with help, no understanding or skill demonstrated.</td></tr>
</table>

<table>
<tr><td colspan="4">Unit 4C: Polynomial Functions: Graphing</td></tr>
<tr><td colspan="4">A2.IF.A: Use and interpret functions.
A2.BF.A: Create new functions from existing functions.</td></tr>
<tr><td colspan="4">Level: Honors Algebra II</td></tr>
<tr><td>Score 4.0</td><td colspan="2">In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.</td><td>Sample Tasks</td></tr>
<tr><td></td><td>3.5</td><td>In addition to score 3.0 performance, in-depth inferences and applications with partial success.</td><td></td></tr>
<tr><td>Score 3.0</td><td colspan="2">The student will:
● Graph a quadratic using the focus and directrix
● Graph a polynomial function
o using intercept form
o using vertex form
● Graph a polynomial function in standard form using a graphing calculator.
● Identify and interpret key characteristics of a polynomial function including:
o domain & range
o end behavior
o x- and y- intercepts
o local max and min values
o intervals of increasing and decreasing
The student exhibits no major conceptual or computational errors or omissions.</td><td>●</td></tr>
<tr><td></td><td>2.5</td><td>No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content</td><td></td></tr>
<tr><td>Score 2.0</td><td colspan="2">There are no major errors or omissions regarding the simpler details and processes as the student:
● Classify polynomial functions
● Given the zeros, graph a polynomial function.
● Identify and interpret key characteristics
However, the student exhibits major errors or omissions regarding the more complex ideas and processes.</td><td>● Identify end behavior, degree, and leading coefficient.</td></tr>
<tr><td></td><td>1.5</td><td>Partial knowledge of the 2.0 content but major errors or omissions regarding the 3.0 content</td><td rowspan="4"></td></tr>
<tr><td>Score 1.0</td><td colspan="2">With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.</td></tr>
<tr><td></td><td>0.5</td><td>With help, a partial understanding of the 2.0 content but not the 3.0 content</td></tr>
<tr><td>Score 0.0</td><td colspan="2">Even with help, no understanding or skill demonstrated.</td></tr>
</table>

Unit 4D: Polynomial Functions Writing			
1. A2.BF.A: Create new functions from existing functions.			
Level: Honors Algebra II			
Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**		**Sample Tasks**
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Score 3.0	**The student will:** • Write an equation in factored form with integer coefficients given complex roots or irrational roots. • Write an equation in vertex form given graph of a polynomial function. • Write a quadratic equation with the focus and directrix **The student exhibits no major conceptual or computational errors or omissions.**		• Given the roots 3 + i and 4 + sq rt 3, write a polynomial equation in factored form with integer coefficients
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content	
Score 2.0	**There are no major errors or omissions regarding the simpler details and processes as the student:** • Write an equation in factored form with integer coefficients given rational roots. **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**		•
	1.5	Partial knowledge of the 2.0 content but major errors or omissions regarding the 3.0 content	
Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**		
	0.5	With help, a partial understanding of the 2.0 content but not the 3.0 content	
Score 0.0	**Even with help, no understanding or skill demonstrated.**		

Unit 5A-C: Operations with Radical Expressions			
A2.NQ.A: Extend and use the relationship between rational exponents and radicals.			
Level: Honors Algebra II			
Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**		**Sample Tasks**
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Score 3.0	**The student will:** ● Add and subtract radical expressions ● Multiply radical expressions ● Rationalize a radical expression ● Evaluate radical expressions using the properties of rational exponents. **The student exhibits no major conceptual or computational errors or omissions.**		●
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content	
Score 2.0	**There are no major errors or omissions regarding the simpler details and processes as the student:** ● Converts between rational exponents & radical functions ● Simplifies rational exponents **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**		●
	1.5	Partial knowledge of the 2.0 content but major errors or omissions regarding the 3.0 content	
Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**		
	0.5	With help, a partial understanding of the 2.0 content but not the 3.0 content	
Score 0.0	**Even with help, no understanding or skill demonstrated.**		

Unit 5D: Radical Functions Solving			
A2.NQ.A: Extend and use the relationship between rational exponents and radicals.			
Level: Honors Algebra II			
Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**		**Sample Tasks**
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Score 3.0	**The student will:** • Solve a multi-step radical equation including those with extraneous solutions. • Solve a multi-step equation with rational exponents including those with extraneous solutions. • Solve a radical inequality. **The student exhibits no major conceptual or computational errors or omissions.**		• (x+2) ½ = (x)½ - 7
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content	
Score 2.0	**There are no major errors or omissions regarding the simpler details and processes as the student:** • Solves a radical equation in which the radical is isolated. • Solves a simple rational exponent equation. **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**		•
	1.5	Partial knowledge of the 2.0 content but major errors or omissions regarding the 3.0 content	
Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**		
	0.5	With help, a partial understanding of the 2.0 content but not the 3.0 content	
Score 0.0	**Even with help, no understanding or skill demonstrated.**		

<table>
<tr><th colspan="4">Unit 5E: Graphing Radical Functions</th></tr>
<tr><td colspan="4">A2.IF.A: Use and interpret functions.
A2.BF.A: Create new functions from existing functions.</td></tr>
<tr><td colspan="4">Level: Honors Algebra II</td></tr>
<tr><td>Score 4.0</td><td colspan="2">In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.</td><td>Sample Tasks</td></tr>
<tr><td></td><td>3.5</td><td>In addition to score 3.0 performance, in-depth inferences and applications with partial success.</td><td></td></tr>
<tr><td>Score 3.0</td><td colspan="2">The student will:
● Graph a square root function
● Graph a cube root function
● Graph a square root inequality
● Identify transformations of a square root function.
● Identify domain, range, x-intercept, y-intercept
● Graph a function and its inverse on the same coordinate plane

The student exhibits no major conceptual or computational errors or omissions.</td><td>●</td></tr>
<tr><td></td><td>2.5</td><td>No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content</td><td></td></tr>
<tr><td>Score 2.0</td><td colspan="2">There are no major errors or omissions regarding the simpler details and processes as the student:

● Graphs a square root function with minor mistakes
● Graphs a cube root function with minor mistakes
● Identifies domain and range of square root and cube root functions
However, the student exhibits major errors or omissions regarding the more complex ideas and processes.</td><td>●</td></tr>
<tr><td></td><td>1.5</td><td>Partial knowledge of the 2.0 content but major errors or omissions regarding the 3.0 content</td><td rowspan="4"></td></tr>
<tr><td>Score 1.0</td><td colspan="2">With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.</td></tr>
<tr><td></td><td>0.5</td><td>With help, a partial understanding of the 2.0 content but not the 3.0 content</td></tr>
<tr><td>Score 0.0</td><td colspan="2">Even with help, no understanding or skill demonstrated.</td></tr>
</table>

Unit 5F: Writing Radical Functions			
A2.BF.A: Create new functions from existing functions.			
Level: Honors Algebra II			
Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**		**Sample Tasks**
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Score 3.0	**The student will:** ● Use composition of functions to verify that two non-linear equations are inverses. ● Create new functions by adding, subtracting, multiplying, and dividing two functions. ● Identify the domain of a function algebraically. ● Write the inverse of a non-linear equation. **The student exhibits no major conceptual or computational errors or omissions.**		●
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content	
Score 2.0	**There are no major errors or omissions regarding the simpler details and processes as the student:** ● Use composition of functions to verify that two linear equations are inverses. ● Writes the inverse of a linear equation. ● Graphs a linear function and its inverse on the same coordinate plane. **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**		●
	1.5	Partial knowledge of the 2.0 content but major errors or omissions regarding the 3.0 content	
Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**		
	0.5	With help, a partial understanding of the 2.0 content but not the 3.0 content	
Score 0.0	**Even with help, no understanding or skill demonstrated.**		

Unit 6A & 6C: Properties of Exponential and Logarithmic Functions			
A2.SSE.A: Define and use logarithms.			
Level: Honors Algebra II			
Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**		**Sample Tasks**
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Score 3.0	**The student will:** ● Use the properties of logarithms to condense and expand. ● Develop the definition of a log based on the properties of exponents (convert between log & exponential form) **The student exhibits no major conceptual or computational errors or omissions.**		● Condense $log\ 6\ - log\ 2 + 3log\ x$ into a single logarithm
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content	
Score 2.0	**There are no major errors or omissions regarding the simpler details and processes as the student:** ● Apply the change of base formula to evaluate logs. ● Evaluate a logarithm without a calculator. ● Rewrite expressions in logarithmic or exponential forms. **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**		● Evaluate 6 using common logarithms
Using	**1.5**	Partial knowledge of the 2.0 content but major errors or omissions regarding the 3.0 content	
Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**		
	0.5	With help, a partial understanding of the 2.0 content but not the 3.0 content	
Score 0.0	**Even with help, no understanding or skill demonstrated.**		

Unit 6B & 6D & 6F: Solving Exponential and Logarithmic Functions

A2.SSE.A: Define and use logarithms.
A2.REI.A: Solve equations and inequalities

Level: Honors Algebra II

Score			Sample Tasks
Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**		
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Score 3.0	**The student will:** • Solve exponential & logarithmic equations using the inverse relationship • Solve exponential equation in quadratic form. • Solve equations using properties of logarithms. • Solve an exponential equation by rewriting the equation with the same base. **The student exhibits no major conceptual or computational errors or omissions.**		• Solve $x = \frac{3}{2}$ • Solve e^2x - 3e^x - 4 =0
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content	
Score 2.0	**There are no major errors or omissions regarding the simpler details and processes as the student:** • Solve simple exponential equations that do no require logarithms **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**		• **Solve** $2^x = 8$
	1.5	Partial knowledge of the 2.0 content but major errors or omissions regarding the 3.0 content	
Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**		
	0.5	With help, a partial understanding of the 2.0 content but not the 3.0 content	
Score 0.0	**Even with help, no understanding or skill demonstrated.**		

<table>
<tr><td colspan="4">Unit 6G: Graph Exponential and Logarithmic Functions</td></tr>
<tr><td colspan="4">A2.IF.A: Use and interpret functions.
A2.BF.A: Create new functions from existing functions.</td></tr>
<tr><td colspan="4">Level: Honors Algebra II</td></tr>
<tr><td>Score 4.0</td><td colspan="2">In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.</td><td>Sample Tasks</td></tr>
<tr><td></td><td>3.5</td><td>In addition to score 3.0 performance, in-depth inferences and applications with partial success.</td><td></td></tr>
<tr><td>Score 3.0</td><td colspan="2">The student will:
● Graph a logarithmic function using vertex form.
● Graph an exponential function using vertex form.
● Graph a logarithmic function that requires expanding the logarithm.
● Identify key characteristics of an exponential and logarithmic function including:
o Domain and range
o Horizontal and vertical asymptotes
o Growth vs. decay
The student exhibits no major conceptual or computational errors or omissions.</td><td>● Log 2 (8x) = y *Expand first, then graph
● Log (-x) = y</td></tr>
<tr><td></td><td>2.5</td><td>No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content</td><td></td></tr>
<tr><td>Score 2.0</td><td colspan="2">There are no major errors or omissions regarding the simpler details and processes as the student:
● Graph a logarithmic function using vertex form with minor mistakes
● Graph an exponential function using vertex form with minor mistakes.
However, the student exhibits major errors or omissions regarding the more complex ideas and processes.</td><td>●</td></tr>
<tr><td></td><td>1.5</td><td>Partial knowledge of the 2.0 content but major errors or omissions regarding the 3.0 content</td><td></td></tr>
<tr><td>Score 1.0</td><td colspan="2">With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.</td><td></td></tr>
<tr><td></td><td>0.5</td><td>With help, a partial understanding of the 2.0 content but not the 3.0 content</td><td></td></tr>
<tr><td>Score 0.0</td><td colspan="2">Even with help, no understanding or skill demonstrated.</td><td></td></tr>
</table>

<table>
<tr><td colspan="4">Unit 6 E: Applying Exponential and Logarithmic Functions</td></tr>
<tr><td colspan="4">A2.SSE.A: Define and use logarithms.
A2.REI.A: Solve equations and inequalities.</td></tr>
<tr><td colspan="4">Level: Honors Algebra II</td></tr>
<tr><td>Score 4.0</td><td colspan="2">In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.</td><td>Sample Tasks</td></tr>
<tr><td></td><td>3.5</td><td>In addition to score 3.0 performance, in-depth inferences and applications with partial success.</td><td></td></tr>
<tr><td>Score 3.0</td><td colspan="2">The student will:
Solve an application problem involving growth & decay by finding missing information, given the ending amount
Write an exponential function, given data.
Compare quantities and solve application problems involving logarithms.
The student exhibits no major conceptual or computational errors or omissions.</td><td>pH scale, earthquake intensity, light intensity and sound intensity</td></tr>
<tr><td></td><td>2.5</td><td>No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content</td><td></td></tr>
<tr><td>Score 2.0</td><td colspan="2">There are no major errors or omissions regarding the simpler details and processes as the student:
Solves an application problem involving growth & decay using the growth and decay models
However, the student exhibits major errors or omissions regarding the more complex ideas and processes.</td><td>Compound interest, half-life</td></tr>
<tr><td></td><td>1.5</td><td>Partial knowledge of the 2.0 content but major errors or omissions regarding the 3.0 content</td><td></td></tr>
<tr><td>Score 1.0</td><td colspan="2">With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.</td><td></td></tr>
<tr><td></td><td>0.5</td><td>With help, a partial understanding of the 2.0 content but not the 3.0 content</td><td></td></tr>
<tr><td>Score 0.0</td><td colspan="2">Even with help, no understanding or skill demonstrated.</td><td></td></tr>
</table>

Unit 7A: Operations on Rational Functions

A2.APR.A: Perform operations on polynomials and rational expressions.

Level: Honors Algebra II

Score		Description	Sample Tasks
Score 4.0		**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**	
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Score 3.0		**The student will:** • Add, subtract, multiply, and divide rational expressions. **The student exhibits no major conceptual or computational errors or omissions.**	• $\dfrac{\left(1-\dfrac{1}{x+1}\right)}{\left(\dfrac{1}{x-1}+1\right)}$
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content	
Score 2.0		**There are no major errors or omissions regarding the simpler details and processes as the student:** • Add or subtract simple rational expressions. • Multiply and/or divide monomial expressions **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**	• $\dfrac{2x+3}{x+3}+\dfrac{x}{x-2}$ • $\dfrac{36x}{9x^2}\cdot\dfrac{12x^7}{2x}\cdot\dfrac{5}{x^2}$
	1.5	Partial knowledge of the 2.0 content but major errors or omissions regarding the 3.0 content	
Score 1.0		**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**	
	0.5	With help, a partial understanding of the 2.0 content but not the 3.0 content	
Score 0.0		**Even with help, no understanding or skill demonstrated.**	

Unit 7B: Solve Rational Functions			
A2.REI.A: Solve equations and inequalities.			
Level: Honors Algebra II			
Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**		**Sample Tasks**
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Score 3.0	**The student will:** • Solve a rational equation where numerators and denominators are polynomials, and where extraneous solutions may result. **The student exhibits no major conceptual or computational errors or omissions.**		• $\frac{2x}{x+5} - \frac{x^2-x-10}{x^2+8x+15} = \frac{3}{x+3}$
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content	
Score 2.0	**There are no major errors or omissions regarding the simpler details and processes as the student:** • Solve a rational equation that can be solved as a proportion. **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**		$\frac{x+2}{x} + 4 = \frac{x+4}{x-2}$ •
	1.5	Partial knowledge of the 2.0 content but major errors or omissions regarding the 3.0 content	
Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**		
	0.5	With help, a partial understanding of the 2.0 content but not the 3.0 content	
Score 0.0	**Even with help, no understanding or skill demonstrated.**		

Unit 7C: Graph Rational Functions			
A2.IF.A: Use and interpret functions.			
Level: Honors Algebra II			
Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**		**Sample Tasks**
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Score 3.0	**The student will:** • Convert a rational function to vertex form then graph the rational function using vertex form. • Identify key characteristics including: o domain and range o vertical, horizontal, oblique and no asymptote o holes **The student exhibits no major conceptual or computational errors or omissions.**		• Graph $f(x) = \frac{x-1}{x^2-4x+3}$ • Graph $f(x) = \frac{x^2-3x-4}{x-2}$
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content	
Score 2.0	**There are no major errors or omissions regarding the simpler details and processes as the student:** • Graph a rational function that is written in vertex form. **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**		• **Graph** $f(x) = \frac{1}{x+2}$
	1.5	Partial knowledge of the 2.0 content but major errors or omissions regarding the 3.0 content	
Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**		
	0.5	With help, a partial understanding of the 2.0 content but not the 3.0 content	
Score 0.0	**Even with help, no understanding or skill demonstrated.**		

Integrated Math I Course Overview	
Grade level(s): 11-12	**Credits earned: .5**
Course Rationale	**Course Description**
This course is designed to build upon and improve students basic algebra 2 skills, and to prepare them for passing a college algebra class. Technology will be used to support students in performing computations rather than getting bogged down in them, in an effort to form more, and deeper connections between Algebraic concepts.	Integrated Math 1 is a one semester course in which students will build upon their Geometry and Algebra experience, and will introduce Trigonometry beyond that learned in a Geometry class. This class is designed to enhance students' mathematical skills in college and career readiness.
Transfer Goals/Big Ideas	
Students will be able to independently use their learning to… We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have: 1) Mathematical literacy. 2) A complete mathematical skill set. 3) An understanding of the real life applications of mathematics.	
Priority Missouri Learning Standards	
A2.FM.A Use functions to model real-world problems. A2.IF.A: Use and interpret functions. G.SRT.C Define trigonometric ratios, and solve problems involving right triangles. G.MG.A Apply geometric concepts in modeling situations. A2.APR.A Perform operations on polynomials and rational expressions.	

Unit 1: Measurement and Geometry
Desired Results

<table>
<tr><th>Standards</th><th colspan="2">Transfer Goal(s) /Big Ideas</th></tr>
<tr><td rowspan="3">A2.NQ.A.1
A2.NQ.B.5
A2.NQ.A.3
A2.REI.A
A2. REI.B
A2.APR.A
A2.IF.A.1
G.CO.C.9
G.SRT.C.5
G.SRT.C.7
A2.FM.A
G.C.A</td><td colspan="2">We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have:
1) Mathematical literacy.
2) A complete mathematical skill set.
3) An understanding of the real life applications of mathematics</td></tr>
<tr><th>Enduring Understandings</th><th>Essential Questions</th></tr>
<tr><td>Students will understand that…
● 45-45-90 triangles are formed from squares and 30-60-90 triangles are formed from Equilateral triangles
● Pythagorean Theorem can only be used on right triangles when 2 sides are given
● Properties of circles can be used to solve a variety of real- world applications.</td><td>Students will consider…
● How do special right triangles help solve real-world problems.
● How do squares relate to triangles? How do triangles relate to circles?
● How do properties of theorems help solve real-word problems.</td></tr>
</table>

Learning Targets
Students will… ● Students will use properties of circle to solve circles. Students will use the equation of a circle to graph a circle. (2 days) ● Students will use the Pythagorean Theorem to solve triangles. Students will use the properties of Special Right Triangles to solve triangles. (1 day) ● Students will apply the properties of circles and special right triangles to solve real-world problems. Students will apply the equation of a circle and Pythagorean Theorem to solve real-life applications. Students will solve complex figures using the equations of a circle, special right triangles, and the Pythagorean Theorem. (3 days 1 day as project day)
Unit Duration:
7 days

Unit 2: Trigonometric Functions
Desired Results

<table>
<tr><th>Standards</th><th colspan="2">Transfer Goal(s) /Big Ideas</th></tr>
<tr><td rowspan="3">G.SRT.C
A2.FM.A</td><td colspan="2">We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have:
1) Mathematical literacy.
2) A complete mathematical skill set.
3) An understanding of the real life applications of mathematics</td></tr>
<tr><th>Enduring Understandings</th><th>Essential Questions</th></tr>
<tr><td>Students will understand that…
● Angles of Elevation and Depression are congruent.For acute angles in a right triangle
● the ratios of the sides define the trigonometric ratios and their inverses.
● The sine of an acute angle is equivalent to the cosine of its complement.
● Trigonometric ratios can be used to find side lengths and angles of right triangles.
● Trigonometric functions of triangles can be used to solve real world problems</td><td>Students will consider…
● Why are the sine and cosine of complementary angles equivalent?
● How can trig ratios be used to solve real-world problems.</td></tr>
</table>

Learning Targets
Students will… ● Students will use Right Triangle Trig and Angles of Elevation and Depression to solve triangles. Students will solve Oblique Triangles using Law of Sines and Law of Cosines (1 day) ● Students will apply right triangle trig and laws of trig to solve real-world problems. Students will use angles of elevation and depression to solve real-life applications (2day)
Unit Duration:
5 days

Unit 3: Applications of Functions
Desired Results

<table>
<tr><th>Standards</th><th colspan="2">Transfer Goal(s) /Big Ideas</th></tr>
<tr><td rowspan="3">G.GMD.A.1
G.GMD.A.2
A2.FM.A</td><td colspan="2">Students will be able to independently use their learning to…
We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have:
1) Mathematical literacy.
2) A complete mathematical skill set.
3) An understanding of the real life applications of mathematics.</td></tr>
<tr><th>Enduring Understandings</th><th>Essential Questions</th></tr>
<tr><td>Students will understand that…
● Literal equations can be rearranged to help solve real-world situations.
● Formulas can be used together to find measurements of complex figures.</td><td>Students will consider…
● How does rearranging a literal equation help solve real-world situations?
● What rules should be followed to rearrange literal equations?
● How can you identify which equation/formula to use?</td></tr>
</table>

Learning Targets
Students will… ● Students will discover multiple Literal Equations and formulas and use them to solve problems.(1 day) ● Students will apply literal equations and formulas to solve real-world problems. Students will understand how and when to apply certain formulas to real-life application. (2 day)
Unit Duration:
4 days

Unit 4: The Mathematics of Finance
Desired Results

<table>
<tr><th>Standards</th><th colspan="2">Transfer Goal(s) /Big Ideas</th></tr>
<tr><td rowspan="3">A2.FM.A
9-12.PF.V.1.B
9-12.PF.V.2.B</td><td colspan="2">Students will be able to independently use their learning to…
We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have:
1) Mathematical literacy.
2) A complete mathematical skill set.
3) An understanding of the real life applications of mathematics.</td></tr>
<tr><th>Enduring Understandings</th><th>Essential Questions</th></tr>
<tr><td>Students will understand that…
● Financial understanding is essential to a successful life.
● There are differences in loans and interests, and it is important to think about which to use in certain circumstances.</td><td>Students will consider…
● How can financial education help you become a financially responsible person?</td></tr>
</table>

Learning Targets
Students will… ● Students will use interest formulas to solve problems. Students will understand the difference in different interest and loans. Students will discover equations for loans, home ownership, and car leasing. (2 days) ● Students will apply equations to solve loan, home ownership and car leasing problems. (2 days)
Unit Duration:
5 days

Unit 5: Applications of Quadratics and Polynomials
Desired Results

<table>
<tr><th>Standards</th><th colspan="2">Transfer Goal(s) /Big Ideas</th></tr>
<tr><td rowspan="3">A506
A507
A508
A509
F506

A2.REI.A.2
A2.APR.A
A2.FM.A</td><td colspan="2">Students will be able to independently use their learning to…
We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have:
1) Mathematical literacy.
2) A complete mathematical skill set.
3) An understanding of the real life applications of mathematics.</td></tr>
<tr><th>Enduring Understandings</th><th>Essential Questions</th></tr>
<tr><td>Students will understand that…
● Quadratics can be used to solve real-world problems.
● There is more than one way to solve a quadratic Equation
● Polynomial operations can be used to solve real world problems.</td><td>Students will consider…
● How can quadratics be used to solve real-world situations?
● How can a polynomial be created from a real-life problem.</td></tr>
</table>

Learning Targets
Students will… ● Students will use polynomials to solve composite functions. Students will prove inverse operations using composite functions. (1 day) ● Students will graph quadratics and polynomials. Students will write the equations of quadratics and polynomials. (2 day) ● Students will solve quadratics using factoring. Students will apply factoring to simplify rational expressions and solve rational equations. Students will solve quadratic equations using the quadratic formula and discover different solutions through the discriminant. (2 day w/ quiz) ● Students will use technology to solve quadratic application problems. Students will apply quadratics to solve vertical motion, Pythagorean Theorem, area, and volume problems. Students will solve real-world problems using quadratics. Students will use application skills to turn standard form into vertex form. (2 day)
Unit Duration:
9 days

Unit 6: Advanced Algebra
Desired Results

<table>
<tr><th rowspan="1">Standards</th><th colspan="2">Transfer Goal(s) /Big Ideas</th></tr>
<tr><td rowspan="3">A2.NQ.B.5
A2.NQ.B.6
A2.REI.B.3
A2.BF.A.2
A2.FM.A</td><td colspan="2">We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have:
1) Mathematical literacy.
2) A complete mathematical skill set.</td></tr>
<tr><th>Enduring Understandings</th><th>Essential Questions</th></tr>
<tr><td>Students will understand that…
● Solving systems can be done in multiple ways
● There are more than real numbers involved in math.
● Inverses cancel each other</td><td>Students will consider…
● How can a system of equations be used to solve a real-world situation?
● Why would I need to know how to find an inverse in real-life?</td></tr>
</table>

Learning Targets
Students will… ● Students will solve systems of equations with three variables. Students will solve non-linear systems of equations. Students will use technology to solve non-line systems of equations (2 day) ● Students will discover patterns in complex numbers. Students will apply patterns to perform operations with complex numbers. (2 day/quiz) ● Students will discover inverse functions. Students will find inverse functions. Students will apply inverse functions to cancel original functions. (1 day)
Unit Duration:
5 days

Unit 6: ACT skills
Desired Results

<table>
<tr><th>Standards</th><th colspan="2">Transfer Goal(s) /Big Ideas</th></tr>
<tr><td rowspan="3">G.CP.A.3
G.CP.A.5
G.CP.A.8
A2.SSE.A.1
A2.SSE.A.2
A2.SSE.A.3
A2.FM.A
A2.DS.A4
A2.DS.B</td><td colspan="2">Students will be able to independently use their learning to…
We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have:
1) Mathematical literacy.
2) A complete mathematical skill set.
3) An understanding of the real life applications of mathematics.</td></tr>
<tr><th>Enduring Understandings</th><th>Essential Questions</th></tr>
<tr><td>Students will understand that…
● Matrices can be used in a variety of solving problems.
● Trig ratios have reciprocals that can be used to solve real-world problems.
● Trig can be used to convert degrees to radians so you can relate a linear measure and an angle measure.
● exponential and logarithmic functions are inverse operations
● statistic strategies can be used to solve real-world applications.
● Reading, understanding, interpreting, and communicating data are critical in modeling</td><td>Students will consider…
● How can diagrams or pictorial representations be used to evaluate?
● How can we prove exponential and logarithmic as inverse functions?
● How can matrices be used to solve real-life applications?
● How can our prior knowledge in trigonometry be expanded by the reciprocal ratios?</td></tr>
</table>

Learning Targets
Students will… ● Students will solve systems of equations using matrices. Students will apply matrices properties to solve real-world problems. Students will find inverses of matrices. (9.1,3,4) ● Students will discover secant, cosecant, and cotangent. Students will graph trigonometric functions. Students will discover the exchange of radians and degrees. Students will discover trigonometric identities. Students will apply identity properties to prove basic identities. ● Students will use Exponential Equations 10.5 and Logarithmic Equations 10.6 properties to solve problems. Students will graph Exponential Equations 10.5 and Logarithmic Equations 10.6. Students will apply log functions to solve financial problems. ● Students will use multiple statistic properties to solve problems, find patterns, etc. Students will apply properties of mean, median, and mode to solve real-life situations. Students will identify different data sets used in statistics to discover patterns, solve problems, etc. Students will use probability, odds, and counting methods to discover patterns, solve problems, etc.
Unit Duration:
7 days (Fridays through the semester)

<table>
<tr><th colspan="4">Strand 1: Measurement and Geometry</th></tr>
<tr><th colspan="4">Topic: Measurement and Geometry</th></tr>
<tr><th colspan="4">Grade: 11-12</th></tr>
<tr><td rowspan="2">Score 4.0</td><td colspan="2" rowspan="2">In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.</td><td>Sample Activities</td></tr>
<tr><td></td></tr>
<tr><td></td><td>3.5</td><td>In addition to score 3.0 performance, in-depth inferences and applications with partial success.</td><td></td></tr>
<tr><td>Score 3.0</td><td colspan="2">The student:
● Students will use properties of circle to solve circles. Students will use the equation of a circle to graph a circle.
● Students will use the Pythagorean Theorem to solve triangles. Students will use the properties of Special Right Triangles to solve triangles.
● Students will apply the properties of circles and special right triangles to solve real-world problems. Students will apply the equation of a circle and Pythagorean Theorem to solve real-life applications. Students will solve complex figures using the equations of a circle, special right triangles, and the Pythagorean Theorem.
The student exhibits no major errors or omissions.</td><td></td></tr>
<tr><td></td><td>2.5</td><td>No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content.</td><td></td></tr>
<tr><td>Score 2.0</td><td colspan="2">There are no major errors or omissions regarding the simpler details and processes as the student:
● Students will use properties of circle to solve circles.
● Students will use the Pythagorean Theorem to solve triangles.
● Students will apply the equation of a circle and Pythagorean Theorem to solve real-life applications.

However, the student exhibits major errors or omissions regarding the more complex ideas and processes.</td><td></td></tr>
<tr><td></td><td>1.5</td><td>Partial knowledge of the 2.0 content, but major errors or omissions regarding the 3.0 content.</td><td rowspan="4"></td></tr>
<tr><td>Score 1.0</td><td colspan="2">With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.</td></tr>
<tr><td></td><td>0.5</td><td>With help, a partial understanding of the 2.0 content, but not the 3.0 content.</td></tr>
<tr><td>Score 0.0</td><td colspan="2">Even with help, no understanding or skill demonstrated.</td></tr>
</table>

Strand 2: Trigonometry			
Topic:Trig			
Grade: 11-12			
Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**		**Sample Activities**
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Score 3.0	**The student:** ● Students will use Right Triangle Trig and Angles of Elevation and Depression to solve triangles. Students will solve Oblique Triangles using Law of Sines and Law of Cosines ● Students will apply right triangle trig and laws of trig to solve real-world problems. Students will use angles of elevation and depression to solve real-life applications. **The student exhibits no major errors or omissions.**		
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content.	
Score 2.0	**There are no major errors or omissions regarding the simpler details and processes as the student:** ● Students will use Right Triangle Trig and Angles of Elevation and Depression to solve triangles. ● Students will use angles of elevation and depression to solve real-life applications. **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**		
	1.5	Partial knowledge of the 2.0 content, but major errors or omissions regarding the 3.0 content.	
Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**		
	0.5	With help, a partial understanding of the 2.0 content, but not the 3.0 content.	
Score 0.0	**Even with help, no understanding or skill demonstrated.**		

<table>
<tr><th colspan="4">Strand 3: Applications of Equations</th></tr>
<tr><th colspan="4">Topic: Applications</th></tr>
<tr><th colspan="4">Grade: 11-12</th></tr>
<tr><td>Score 4.0</td><td colspan="2">In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.</td><td>Sample Activities</td></tr>
<tr><td></td><td>3.5</td><td>In addition to score 3.0 performance, in-depth inferences and applications with partial success.</td><td></td></tr>
<tr><td>Score 3.0</td><td colspan="2">The student:
● Students will discover multiple Literal Equations and formulas and use them to solve problems.
● Students will apply literal equations and formulas to solve real-world problems. Students will understand how and when to apply certain formulas to real-life application.
The student exhibits no major errors or omissions.</td><td></td></tr>
<tr><td></td><td>2.5</td><td>No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content.</td><td></td></tr>
<tr><td>Score 2.0</td><td colspan="2">There are no major errors or omissions regarding the simpler details and processes as the student:
● Students will discover multiple Literal Equations and formulas and use them to solve problems.

However, the student exhibits major errors or omissions regarding the more complex ideas and processes.</td><td></td></tr>
<tr><td></td><td>1.5</td><td>Partial knowledge of the 2.0 content, but major errors or omissions regarding the 3.0 content.</td><td></td></tr>
<tr><td>Score 1.0</td><td colspan="2">With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.</td><td></td></tr>
<tr><td></td><td>0.5</td><td>With help, a partial understanding of the 2.0 content, but not the 3.0 content.</td><td></td></tr>
<tr><td>Score 0.0</td><td colspan="2">Even with help, no understanding or skill demonstrated.</td><td></td></tr>
</table>

Strand 4: Mathematics of Finance			
Topic: Finance			
Grade: 11-12			
Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**		**Sample Activities**
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Score 3.0	**The student:** ● Students will use interest formulas to solve problems. Students will understand the difference in different interest and loans. Students will discover equations for loans, home ownership, and car leasing. ● Students will apply equations to solve loan, home ownership and car leasing problems. **The student exhibits no major errors or omissions.**		
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content.	
Score 2.0	**There are no major errors or omissions regarding the simpler details and processes as the student:** ● Students will use interest formulas to solve problems. Students will understand the difference in different interest and loans. Students will discover equations for loans, home ownership, and car leasing. **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**		
	1.5	Partial knowledge of the 2.0 content, but major errors or omissions regarding the 3.0 content.	
Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**		
	0.5	With help, a partial understanding of the 2.0 content, but not the 3.0 content.	
Score 0.0	**Even with help, no understanding or skill demonstrated.**		

<table>
<tr><th colspan="4">Strand 5: Polynomials and Quadratics</th></tr>
<tr><th colspan="4">Topic: Polynomials and Quadratics</th></tr>
<tr><th colspan="4">Grade: 11-12</th></tr>
<tr><td>Score 4.0</td><td colspan="2">In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.</td><td>Sample Activities</td></tr>
<tr><td></td><td>3.5</td><td>In addition to score 3.0 performance, in-depth inferences and applications with partial success.</td><td></td></tr>
<tr><td>Score 3.0</td><td colspan="2">The student:
● Students will use polynomials to solve composite functions. Students will prove inverse operations using composite functions.
● Students will graph quadratics and polynomials. Students will write the equations of quadratics and polynomials.
● Students will solve quadratics using factoring. Students will apply factoring to simplify rational expressions and solve rational equations. Students will solve quadratic equations using the quadratic formula and discover different solutions through the discriminant.
● Students will use technology to solve quadratic application problems. Students will apply quadratics to solve vertical motion, Pythagorean Theorem, area, and volume problems. Students will solve real-world problems using quadratics. Students will use application skills to turn standard form into vertex form.
The student exhibits no major errors or omissions.</td><td></td></tr>
<tr><td></td><td>2.5</td><td>No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content.</td><td></td></tr>
<tr><td>Score 2.0</td><td colspan="2">There are no major errors or omissions regarding the simpler details and processes as the student:
● Students will use polynomials to solve composite functions. Students will prove inverse operations using composite functions.
● Students will graph quadratics and polynomials. Students will write the equations of quadratics and polynomials.
● Students will solve quadratics using factoring. Students will solve quadratic equations using the quadratic formula and discover different solutions through the discriminant.
However, the student exhibits major errors or omissions regarding the more complex ideas and processes.</td><td></td></tr>
<tr><td></td><td>1.5</td><td>Partial knowledge of the 2.0 content, but major errors or omissions regarding the 3.0 content.</td><td></td></tr>
<tr><td>Score 1.0</td><td colspan="2">With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.</td><td></td></tr>
<tr><td></td><td>0.5</td><td>With help, a partial understanding of the 2.0 content, but not the 3.0 content.</td><td></td></tr>
<tr><td>Score 0.0</td><td colspan="2">Even with help, no understanding or skill demonstrated.</td><td></td></tr>
</table>

<table>
<tr><th colspan="4">Strand 5: Advanced Algebra</th></tr>
<tr><th colspan="4">Topic: Algebra</th></tr>
<tr><th colspan="4">Grade: 11-12</th></tr>
<tr><td>Score 4.0</td><td colspan="2">In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.</td><td>Sample Activities</td></tr>
<tr><td></td><td>3.5</td><td>In addition to score 3.0 performance, in-depth inferences and applications with partial success.</td><td></td></tr>
<tr><td>Score 3.0</td><td colspan="2">The student:
● Students will solve systems of equations with three variables. Students will solve non-linear systems of equations. Students will use technology to solve non-line systems of equations
● Students will discover patterns in complex numbers. Students will apply patterns to perform operations with complex numbers.
● Students will discover inverse functions. Students will find inverse functions. Students will apply inverse functions to cancel original functions.
The student exhibits no major errors or omissions.</td><td></td></tr>
<tr><td></td><td>2.5</td><td>No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content.</td><td></td></tr>
<tr><td>Score 2.0</td><td colspan="2">There are no major errors or omissions regarding the simpler details and processes as the student:
● Students will solve systems of equations with three variables. Students will use technology to solve non-line systems of equations
● Students will discover patterns in complex numbers.
● Students will discover inverse functions. Students will find inverse functions.
However, the student exhibits major errors or omissions regarding the more complex ideas and processes.</td><td></td></tr>
<tr><td></td><td>1.5</td><td>Partial knowledge of the 2.0 content, but major errors or omissions regarding the 3.0 content.</td><td rowspan="4"></td></tr>
<tr><td>Score 1.0</td><td colspan="2">With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.</td></tr>
<tr><td></td><td>0.5</td><td>With help, a partial understanding of the 2.0 content, but not the 3.0 content.</td></tr>
<tr><td>Score 0.0</td><td colspan="2">Even with help, no understanding or skill demonstrated.</td></tr>
</table>

Strand 1: ACT Skills			
Topic:ACT			
Grade: 11-12			
Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**		**Sample Activities**
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Score 3.0	**The student:** ● Students will solve systems of equations using matrices. Students will apply matrices properties to solve real-world problems. Students will find inverses of matrices. ● Students will discover secant, cosecant, and cotangent. Students will graph trigonometric functions. Students will discover the exchange of radians and degrees. Students will discover trigonometric identities. Students will apply identity properties to prove basic identities. ● Students will use Exponential Equations and Logarithmic Equations properties to solve problems. Students will graph Exponential Equations and Logarithmic Equations. Students will apply log functions to solve financial problems. ● Students will use multiple statistic properties to solve problems, find patterns, etc. Students will apply properties of mean, median, and mode to solve real-life situations. Students will identify different data sets used in statistics to discover patterns, solve problems, etc. Students will use probability, odds, and counting methods to discover patterns, solve problems, etc. **The student exhibits no major errors or omissions.**		
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content.	
Score 2.0	**There are no major errors or omissions regarding the simpler details and processes as the student:** ● Students will solve systems of equations using matrices. ● Students will discover secant, cosecant, and cotangent. Students will graph trigonometric functions. ● Students will use multiple statistic properties to solve problems, find patterns, etc. Students will apply properties of mean, median, and mode to solve real-life situations. Students will identify different data sets used in statistics to discover patterns, solve problems, etc. Students will use probability, odds, and counting methods to discover patterns, solve problems, etc. **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**		
	1.5	Partial knowledge of the 2.0 content, but major errors or omissions regarding the 3.0 content.	
Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**		
	0.5	With help, a partial understanding of the 2.0 content, but not the 3.0 content.	
Score 0.0	**Even with help, no understanding or skill demonstrated.**		

Integrated Math 2 Course Overview	
Grade level(s):	**Credits earned: [delete if not a high school course]**
Course Rationale	**Course Description**
The rationale for this course is to promote provide students a firm problem-solving foundation. The course allows students to develop specific problem solving techniques; communications skills, both written and oral; cooperation skills; and perseverance needed for later courses and for the work place.	Integrated Math 2 is a one semester course in which students will learn multiple Problem Solving and Critical thinking techniques. The focus will be on strategies that are not Algebra based, but are centered around thinking creatively. Cooperative learning, presentations and projects will be heavily utilized to think through problems. This class is designed to enhance students' skills in college and career readiness.
Transfer Goals/Big Ideas	
Students will use critical thinking, perseverance, collaboration, problem-solving, and communication to: 1) Communicate ideas, and solutions effectively 2) Solve real-world problems	
Priority Missouri Learning Standards/National Standards	
NCTM standards 1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively 3. Construct viable arguments and critique the reasoning of others 4. Model with mathematics 5. Use Appropriate Tools Strategically 6. Attend to Precision	

Unit 1: Problem Solving Strategies
Desired Results

<table>
<tr><th>Standards</th><th colspan="2">Transfer Goal(s) /Big Ideas</th></tr>
<tr><td rowspan="3">Show Me Standards:
M1
CA6

NCTM Standards:
1
2
3
4
5
6</td><td colspan="2">Students will use critical thinking, perseverance, collaboration, problem-solving, and communication to:
● Communicate ideas, and solutions effectively
● Solve real-world problems using problem solving strategies.</td></tr>
<tr><th>Enduring Understandings</th><th>Essential Questions</th></tr>
<tr><td>Students will understand that…

There is usually more than one strategy that can be used to solve a problem.</td><td>Students will consider…

How do you decide what strategy to use to solve a problem?</td></tr>
<tr><th colspan="3">Learning Targets</th></tr>
<tr><td colspan="3">Students will…
● Solve Problems by Making a systematic List
● Solve Problems by Eliminating Possibilities
● Solve Problems using Guess and Check
● Solve Problems using Subproblems
● Solve Problems using an Easier Related Problem
● Solve Problems by working Backwards</td></tr>
<tr><th colspan="3">Unit Duration:</th></tr>
<tr><td colspan="3">16 days</td></tr>
</table>

Unit 2: Patterns
Desired Results

Standards

Show Me Standards:
M1
CA6

NCTM Standards:
1
2
3
4
5
6

Transfer Goal(s) /Big Ideas

Students will use critical thinking, perseverance, collaboration, problem-solving, and communication to:

- Communicate ideas, and solutions effectively
- Solve real-world problems using patterns

Enduring Understandings	Essential Questions
Students will understand that… • Patterns can be used to solve many real-world problems • Patterns can be represented in a variety of ways, including algebraic, and geometric.	Students will consider… • What do you look for when trying to determine a pattern? • How can patterns be represented, and used in solving problems?

Learning Targets

Students will…

- Describe patterns.
- Interpret patterns to find solutions to problems. (pair with above)
- Find patterns in shapes (1 day)
- Interpret patterns to find equations (1day)
- Find Geometric, Arithmetic patterns (1 day, +rev and test)
- Apply Sequences and Series
- Use written and verbal communication to present solutions.

Unit Duration:

6 days

Unit 3: Unit Analysis
Desired Results

<table>
<tr><th>Standards</th><th colspan="2">Transfer Goal(s) /Big Ideas</th></tr>
<tr><td rowspan="3">ACT Standard
G203

Show Me Standards:
M1
M6
CA6

NCTM Standards:
1
2
3
4
5
6</td><td colspan="2">Students will use critical thinking, perseverance, collaboration, problem-solving, and communication to:
● Communicate ideas, and solutions effectively
● Solve real-world problems related to measurement by applying unit analysis conversions</td></tr>
<tr><th>Enduring Understandings</th><th>Essential Questions</th></tr>
<tr><td>Students will understand that…
The accuracy of the solutions to real world problems relies on the accurate conversions of the units involved.

Unit conversions are very specific, and there is only one correct final answer unit conversion.

When performing unit conversions, there is a <u>best</u> way to organize your work, to guarantee successful calculations, however there are multiple ways of thinking about the conversions.</td><td>Students will consider…
How would you perform a calculation that takes a measurement from miles to inches?

How would you perform a calculation from seconds to weeks?

Which is easier to convert, Metric or US standard measurements?</td></tr>
</table>

Learning Targets
Students will… ● Recognize the different units of measure presented in a problem. Multiply by the correct form of "one" using fractions with equivalent numerators and denominators. ● Analyze units and cancel unwanted units. ● Identify correct units that answer the question posed in the problem. ● Convert units with English and Metric systems from one system to another. ● Use written and verbal communication to present solutions.
Unit Duration:
4 days

<table>
<tr><th colspan="3">Unit 4: Diagrams, Physical Representations, and Sets
Desired Results</th></tr>
<tr><th>Standards</th><th colspan="2">Transfer Goal(s) /Big Ideas</th></tr>
<tr><td rowspan="3">Show Me Standards:
M1
M2
CA6

NCTM Standards:
1
2
3
4
5
6</td><td colspan="2">Students will use critical thinking, perseverance, collaboration, problem-solving, and communication to:
Communicate ideas, and solutions effectively
Solve real-world problems using diagrams, physical representations, or sets</td></tr>
<tr><th>Enduring Understandings</th><th>Essential Questions</th></tr>
<tr><td>Students will understand that… Physical representations are helpful in organizing the information presented in a problem. There are multiple physical representations that can be used. There is usually more than one way to solve a problem.</td><td>Students will consider… How do you decide which physical representation is best for the situation? If a set is identified as A = {x|s is a number close to 20}, what numbers should be allowed in the set?</td></tr>
</table>

Learning Targets
Students will… ● Create diagrams that represent real-world problems ● Analyze diagrams to solve real-world problems ● Use Venn Diagrams ● Students work in groups to solve problems. ● Act out a problem to find the solution. ● Develop and use manipulatives to represent data given in a problem, and use these manipulatives to solve the problem. ● Use written and verbal communication to present solutions. ● Use basic properties of sets (½ DAY AFTER TEST 1) ● Find complements, and subsets ● Apply set theory to solve problems ● Establish a one-to-one correspondence between sets ● Verify infinite sets ● Establish the Cardinality of a set of numbers ● Apply Cantor's Theorem
Unit Duration:
8 days - break up into 2 tests 1)diagram and Ph. rep(3.5)   2) Sets (application of part 1) (4.5 days)

Unit 5: Logic
Desired Results

<table>
<tr><th>Standards</th><th colspan="2">Transfer Goal(s) /Big Ideas</th></tr>
<tr><td rowspan="3">Show Me Standards:
M1
M6
CA6

NCTM Standards:
1
2
3
4
5
6</td><td colspan="2">Students will use critical thinking, perseverance, collaboration, problem-solving, and communication to:
● Communicate ideas, and solutions effectively
● Solve real-world problems by applying logic</td></tr>
<tr><th>Enduring Understandings</th><th>Essential Questions</th></tr>
<tr><td>Students will understand that…
• Logic is a life-skill that is used to construct valid arguments
• Logic is used to make decisions
• How to determine the truth value of a statement
• Analyze conditional and biconditional statements</td><td>Students will consider…
• How do you know when a person's argument is wrong?
• How can you use logic to help your friend, who is on trial?</td></tr>
</table>

Learning Targets
Students will… ● Analyze information and the relationship between statements (conditional, converse, inverse, contrapositive, biconditional, counterexamples) 2days ● Determine the validity of arguments (Euler diagrams) (1day, review, then test)- (3) ● Organize data into a matrix or chart. ● Analyze data to eliminate possibilities in a matrix. *** Matrix charts will be done on a puzzle day (1o r 2 days) ● Recognize logical connections and negations presented in problems. ● Use written and verbal communication to present solutions. ● Create their own logic puzzle with solution for other students to do.
Unit Duration:
7 days

<table>
<tr><th colspan="4">Strand 1: Problem Solving Strategies</th></tr>
<tr><th colspan="4">Topic: Problem Solving</th></tr>
<tr><th colspan="4">Grade: 11-12</th></tr>
<tr><td>Score 4.0</td><td colspan="2">In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.</td><td>Sample Activities</td></tr>
<tr><td></td><td>3.5</td><td>In addition to score 3.0 performance, in-depth inferences and applications with partial success.</td><td></td></tr>
<tr><td>Score 3.0</td><td colspan="2">The student:
The student will be able to show understanding of the problem, devise a plan, carry out the plan, and review the solution.
Will solve problems by creating a solutions list and Eliminating Possibilities
Will solve problems using the Guess and Check strategy, and Working Backwards
Will solve complex problems by breaking them into sub-problems or a simpler relatable problem.
The student exhibits no major errors or omissions.</td><td></td></tr>
<tr><td></td><td>2.5</td><td>No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content.</td><td></td></tr>
<tr><td>Score 2.0</td><td colspan="2">There are no major errors or omissions regarding the simpler details and processes as the student:
The student will perform basic calculations
The student will effectively check the reasonableness of their solution
Will apply number sense while solving real-world problems
However, the student exhibits major errors or omissions regarding the more complex ideas and processes.</td><td></td></tr>
<tr><td></td><td>1.5</td><td>Partial knowledge of the 2.0 content, but major errors or omissions regarding the 3.0 content.</td><td rowspan="4"></td></tr>
<tr><td>Score 1.0</td><td colspan="2">With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.</td></tr>
<tr><td></td><td>0.5</td><td>With help, a partial understanding of the 2.0 content, but not the 3.0 content.</td></tr>
<tr><td>Score 0.0</td><td colspan="2">Even with help, no understanding or skill demonstrated.</td></tr>
</table>

Strand 2: Patterns			
Topic: Patterns			
Grade: 11-12			
Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**		**Sample Activities**
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Score 3.0	**The student:** ● Students will find and interpret and geometric and arithmetic sequences to complete problems. ● Students will interpret patterns in tables, word problems and sequences to create equations ● Students will use written and verbal communication to present solutions involving patterns **The student exhibits no major errors or omissions.**		● Polygonal numbers excursion ● Find a pattern in Pascal's triangle that is not triangular. ● Fibonacci Sums: Make a conjecture for each of the following sums, where $F_n$represents the nth Fibonacci number: $F_1 + F_2 + F_3 + \cdots + F_n = ?$
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content.	
Score 2.0	**There are no major errors or omissions regarding the simpler details and processes as the student:** ● Students will find basic patterns in shapes, numbers sequences and tables ● Students will describe basic patterns in shapes, number sequences and tables. **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**		Find the next term in the sequence 1, 9, 17, 25, Describe the pattern: 1, 4, 9, 16, 25, 36, 49, and find the next two numbers.
	1.5	Partial knowledge of the 2.0 content, but major errors or omissions regarding the 3.0 content.	
Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**		
	0.5	With help, a partial understanding of the 2.0 content, but not the 3.0 content.	
Score 0.0	**Even with help, no understanding or skill demonstrated.**		

Strand 3: Unit Analysis			
Topic: Measurment			
Grade: 11-12			
Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**		**Sample Activities**
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Score 3.0	**The student:** ● **Students will be able to recognize the different units of measure presented in a problem, and relate to each other.** ● **Students will convert between standard US units in using multiplication of fractions** ● **Students will convert between US and Metric units using multiplication of fractions** ● **Students will convert between metric measurements using** **The student exhibits no major errors or omissions.**		Jane traveled 25 miles in 40 minutes. What was Jane's average speed?
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content.	
Score 2.0	**There are no major errors or omissions regarding the simpler details and processes as the student:** ● Students will use correct, and appropriate units when writing a solution to a problem. **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**		● Find the area of a square ● Find the distance traveled by the car ● Find the speed of the airplane.
	1.5	Partial knowledge of the 2.0 content, but major errors or omissions regarding the 3.0 content.	
Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**		
	0.5	With help, a partial understanding of the 2.0 content, but not the 3.0 content.	
Score 0.0	**Even with help, no understanding or skill demonstrated.**		

<table>
<tr><th colspan="4">Strand 4: Organizing information</th></tr>
<tr><th colspan="4">Topic: Sets/Diagrams/Physical Represention of information</th></tr>
<tr><th colspan="4">Grade: 11-12</th></tr>
<tr><td>Score 4.0</td><td colspan="2">In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.</td><td>Sample Activities</td></tr>
<tr><td></td><td>3.5</td><td>In addition to score 3.0 performance, in-depth inferences and applications with partial success.</td><td></td></tr>
<tr><td>Score 3.0</td><td colspan="2">The student:
Students will create different types of diagrams that represent real-world problems
Students will analyze different types of diagrams to solve real-world problems
Students will develop and use manipulatives to represent data/information from real-world problems, to solve those problems
Students will use written and verbal communication to present solutions
Students will use basic properties of sets to find complements and subsets
Students will verigy infinite sets and establish the cardinality of a set of numbers
Students will apply Cantor’s Theorem.
The student exhibits no major errors or omissions.</td><td>Crossing a river problem.

Who is taller?

Determine whether B is a Proper Subset of A.

Union and Intersection of Fuzzy Sets Excursion.</td></tr>
<tr><td></td><td>2.5</td><td>No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content.</td><td></td></tr>
<tr><td>Score 2.0</td><td colspan="2">There are no major errors or omissions regarding the simpler details and processes as the student:
Can interpret and create a venn diagram of up to 2 categories
Can understand and create simple diagrams relating no more than 2 pieces of information.
However, the student exhibits major errors or omissions regarding the more complex ideas and processes.</td><td>Show the intersection of Sets A and B using a Venn Diagram</td></tr>
<tr><td></td><td>1.5</td><td>Partial knowledge of the 2.0 content, but major errors or omissions regarding the 3.0 content.</td><td rowspan="4"></td></tr>
<tr><td>Score 1.0</td><td colspan="2">With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.</td></tr>
<tr><td></td><td>0.5</td><td>With help, a partial understanding of the 2.0 content, but not the 3.0 content.</td></tr>
<tr><td>Score 0.0</td><td colspan="2">Even with help, no understanding or skill demonstrated.</td></tr>
</table>

Strand 5: Logic			
Topic: Logic			
Grade: 11-12			
Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**		**Sample Activities**
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Score 3.0	**The student:** ● Students will analyze information and the relationship between statements and determine the validity of a statement ● Students will organize and analyze data into a matrix, or a chart ● students will recognize logical connections and negations presented in problems ● Students will use written and verbal communication to present solutions **The student exhibits no major errors or omissions.**		Fallacies excursion Create a Euler diagram to determine the validity of the arguement
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content.	
Score 2.0	**There are no major errors or omissions regarding the simpler details and processes as the student:** ● Students will be able to write a statement in if-then form, and it's converse ● Students will understand the vocabulary and symbols for: conditional, biconditional, negation, counterexample, converse, contrapositive **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**		Find the converse of the statement Translate the sentence into a conditional statement.
	1.5	Partial knowledge of the 2.0 content, but major errors or omissions regarding the 3.0 content.	
Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**		
	0.5	With help, a partial understanding of the 2.0 content, but not the 3.0 content.	
Score 0.0	**Even with help, no understanding or skill demonstrated.**		

Pre-Calculus
Course Overview

Grade level(s): 11, 12	Credits earned: 1 credit
Course Rationale	**Course Description**
Precalculus is a course that includes algebra and trigonometry at a level which prepares students for the study of calculus.	Precalculus is an advanced course emphasizing a wide variety of functions including polynomials, exponential, logarithmic, rational, inverse, and trigonometric. Other topics include matrices, conic sections, complex and polar coordinates, sequences, and combinatorics. The intent of this course is to prepare students for Calculus and mathematics study at the college level. A graphing calculator is required.

Transfer Goals/Big Ideas

We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have:
1) Mathematical literacy.
2) A complete mathematical skill set.
3) An understanding of the real life applications of mathematics.

Priority Missouri Learning Standards/National Standards

From Missouri Higher Education Precalculus Algebra Standards:

1. Foundations of Functions
2. Analysis of Functions
3. Algebraic Reasoning

Unit 1: Functions and Graphs
Desired Results

<table>
<tr><th>Standards</th><th colspan="2">Transfer Goal(s) /Big Ideas</th></tr>
<tr><td rowspan="3">From Missouri Higher Education Precalculus Algebra Standards:

1. Foundations of Functions
● Use multiple representations of functions to interpret and describe how two quantities change together.
● Measure, compute, describe and interpret rates of change of quantities embedded in multiple representations
● Use appropriate tools and representations to investigate the patterns and relationships present in multiple function types.

2. Analysis of Functions
● Construct, use and describe transformations, operations, compositions and inverses of functions.

3. Algebraic Reasoning
● Use algebraic techniques to simplify expressions and locate roots.</td><td colspan="2">We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have:
1) Mathematical literacy.
2) A complete mathematical skill set.
3) An understanding of the real life applications of mathematics.</td></tr>
<tr><th>Enduring Understandings</th><th>Essential Questions</th></tr>
<tr><td>Students will understand that…
● A function is a relation in which every input has exactly one output and passes the vertical line test.
● The domain of a function is the set of all input values and the range is the set of all output values.
● Restrictions to a domain result when an equation has a root or a variable in the denominator.
● Piecewise functions use two or more functions for different intervals of the domain.
● The x-intercepts are where the graph of a function crosses the x-axis and are the zeros for the function.
● The y-intercepts are where the graph of a function crosses the y-axis and are found by making the independent variable zero in the equation.
● The end behavior of a graph describes how a function behaves at either end of the graph.
● On a given interval, a function can increase, decrease, or remain constant.
● Extrema are critical points where a relations</td><td>Students will consider…
● When is a relation a function?
● How does one determine the domain and range of a relation from an equation and graph?
● When does a relation have restrictions to its domain?
● How does one find the x- and y-intercepts from the graph and equation of a relation?
● When is a function even or odd?
● How does one determine the end behavior of a function?
● How can one determine if a function is increasing, decreasing, or constant on a given interval.
● How can one determine the extrema of a function?
● How can one determine the average rate of change for a nonlinear function?
● How can one transform a parent function?
● How does one determine the domain of a composition of functions?
● How does one determine if a function is one-to-one?</td></tr>
</table>

	changes from increasing to decreasing, and for a set of real-world quantities, indicates optimal values. ● For nonlinear functions, the average rate of change is calculated by finding the slope of the secant line. ● Parent functions are the simplest function in a family of functions and can be transformed using translations, reflections, rotations, and dilations to obtain other functions in the family. ● Operations between functions as well as compositions of functions are possible. ● The inverse of a function is obtained by exchanging the independent and dependent variables and is a reflection of the function across the line y = x. ● A function is one-to-one if its inverse is also a function, thus passing the horizontal line test.	

Learning Targets
Students will… ● Identify and evaluate functions and state the domain. ● Analyze the graph of a function by finding the domain, range, y-intercept, zeros and use it to evaluate values of functions. ● Explore symmetries of graphs and identify odd and even functions. ● Determine intervals on which functions are increasing, constant, decreasing, and determine maxima and minima of functions. ● Determine the average rate of change of a function. ● Identify, graph, and describe parent functions. ● Identify transformations of parent functions ● Perform operations with functions and find the composition of functions. ● Use the horizontal line test to verify functions are inverses. ● Find the inverse of a function algebraically and graphically.
Unit Duration:
15 days

Unit 2: Power, Polynomial, and Rational Functions

Desired Results

<table>
<tr><th>Standards</th><th colspan="2">Transfer Goal(s) /Big Ideas</th></tr>
<tr><td rowspan="3">From Missouri Higher Education Precalculus Algebra Standards:
2. Analysis of Functions
● Create, use and interpret polynomial, power and rational functions.

3. Algebraic Reasoning
● Use algebraic techniques to simplify expressions and locate roots.
● Use algebraic reasoning to simplify a variety of expressions and find roots of equations involving multiple function types.</td><td colspan="2">We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have:
1) Mathematical literacy.
2) A complete mathematical skill set.
3) An understanding of the real life applications of mathematics.</td></tr>
<tr><th>Enduring Understandings</th><th>Essential Questions</th></tr>
<tr><td>Students will understand that…
● A power function is any function in the form $f(x) = ax^n$, where a and n are nonzero constant real numbers.
● A set of data is well matched to given type of function when the correlation coefficient is close to 1 or -1.
● The leading coefficient and the degree of a polynomial and be used to determine its end behavior.
● A polynomial of degree n will have exactly n complex zeros, including repeated zeros.
● When the zero of a polynomial has even multiplicity, the graph is tangent to the x-axis, but when the zero has odd multiplicity, the graph crosses the x-axis.
● Long and synthetic division can be used to divide polynomials to find its zeros.
● The quotient of the factors of the leading term and constant of a polynomial can be used to determine a list of possible zeros for the polynomial.
● When a polynomial equation in one variable with real</td><td>Students will consider…
● What are the similarities and difference between power, radical, polynomial, and rational functions?
● How does the degree and sign of the leading coefficient of a polynomial determine the end behavior?
● How can the number of zeros of a polynomial be determined?
● How can the zeros of a polynomial be determined?
● How can the vertical asymptotes, horizontal asymptotes, and holes be determined for a rational function?</td></tr>
</table>

	coefficients has a root of the form a + bi, where b ≠ 0, then its complex conjugate is also a root ● For rational functions, the vertical asymptotes are the zeros of the denominator, the horizontal asymptote can be determined using the degrees of the numerator and denominator, and holes occur when the numerator and denominator have a common factor.	

Learning Targets
Students will… ● Graph and analyze power, radical, polynomial, and rational functions. ● Apply the leading term test to describe the end behavior of a graph. ● Model real world data with polynomial functions. ● Divide polynomials using long and synthetic division. ● Use the Remainder and Factor theorems. ● Find the real and complex zeros of a polynomial function. ● Solve polynomial and rational equations and inequalities.
Unit Duration:
12 days

Unit 3: Exponential and Logarithmic Functions
Desired Results

<table>
<tr><th>Standards</th><th colspan="2">Transfer Goal(s) /Big Ideas</th></tr>
<tr><td rowspan="3">From Missouri Higher Education Precalculus Algebra Standards:
1. Foundation of Functions
● Use appropriate tools and representations to investigate the patterns and relationships present in multiple function types.
2. Analysis of Functions
● Create, use and interpret exponential and logarithmic equations and convert between forms as appropriate.

3. Algebraic Reasoning
● Use algebraic reasoning to simplify a variety of expressions and find roots of equations involving multiple function types.</td><td colspan="2">We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have:
1) Mathematical literacy.
2) A complete mathematical skill set.
3) An understanding of the real life applications of mathematics.</td></tr>
<tr><th>Enduring Understandings</th><th>Essential Questions</th></tr>
<tr><td>Students will understand that…
● Exponential and logarithmic functions are inverses of one another.
● Exponential models can be used to solve real-world problems.
● The one-to-one property can be used to solve exponential and logarithmic equations.
● A logarithm with base e is called a natural logarithm and follows the same properties of logarithms.</td><td>Students will consider…
● How are exponential functions and logarithmic functions related?
● What is the relationship between the algebraic and graphical representations of an exponential function?
● What is the relationship between the algebraic and graphical representations of a logarithmic function?
● How are exponential functions and logarithmic functions used to model real-world problems and their solutions?</td></tr>
</table>

Learning Targets
Students will… ● Evaluate, analyze, and graph exponential and logarithmic functions. ● Evaluate expressions involving logarithms. ● Apply the properties of logarithms and the change of base formula. ● Solve exponential and logarithmic equations. ● Use exponential functions to solve problems involving compound interest and exponential growth and decay in mathematics and real-world contexts
Unit Duration: 10 days

Unit 4: Trigonometric Functions
Desired Results

Standards	Transfer Goal(s) /Big Ideas
From Missouri Department of Education Learning Standards (Specifically recommended topics additional to Algebra 2): ● *Using a unit circle, create the functions f(t) = sin(t) and g(t) = cos(t) to define the position of a point on the circle, at time t. Graph these functions in the Cartesian coordinate plane, and define and explore amplitude, period and midline.* ● *Use parameter changes to amplitude, period, midline and phase shift to model real-world contexts. Use the form f(t) = A sin(B(t+h)) + k and explain how to determine each of the parameters A, B, h and k.* ● *Solve problems using Law of Sines and Law of Cosines.*	We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have: 1) Mathematical literacy. 2) A complete mathematical skill set. 3) An understanding of the real life applications of mathematics.

Enduring Understandings	Essential Questions
Students will understand that… ● *Trigonometric functions can be used to solve right and oblique triangles.* ● *Values of trigonometric functions can be found for any angles and converted between units of angle measure.* ● *Trigonometric functions and their inverses are graphable and transformable.*	*Students will consider…* ● *How can a situation be modeled and represented using fundamental trigonometric properties?* ● *Why is it necessary to have more than one method of angle measurement and when is it appropriate to use one versus the other?* ● *What is the benefit of graphically representing trigonometric functions?* ● *Why do the graphs of trigonometric functions adhere so well to so many fundamental scientific concepts?*

Learning Targets
Students will… ● Find values of trigonometric functions for acute angles of right triangles. ● Solve right triangles. ● Convert degree measures of angles to radian measures and vice versa. ● Use angle measures and technology to solve real world problems. ● Find values of trigonometric functions for any angle. ● Find values of trigonometric functions using the unit circle. ● Graph transformations of the Sine and Cosine functions by hand and using technology. ● Use sinusoidal functions and technology to solve theoretical and real world problems. ● Graph tangent and reciprocal trigonometric functions. ● Evaluate and graph inverse trigonometric functions. ● Find compositions of trigonometric functions. ● Solve oblique triangles by using the Law of Sines and the Law of Cosines. ● Find area of oblique triangles.
Unit Duration:
15 days

Unit 5: Trigonometric Identities, Equations, and Applications
Desired Results

<table>
<tr><th>Standards</th><th colspan="2">Transfer Goal(s) /Big Ideas</th></tr>
<tr><td rowspan="3">From Missouri Department of Education Learning Standards (Specifically recommended topics additional to Algebra 2):
● Solve equations involving trigonometric functions
● Solve problems using trigonometric identities.
● Graph using polar coordinates</td><td colspan="2">We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have:
1) Mathematical literacy.
2) A complete mathematical skill set.
3) An understanding of the real life applications of mathematics.</td></tr>
<tr><th>Enduring Understandings</th><th>Essential Questions</th></tr>
<tr><td>Students will understand that…
● Trigonometric identities can be used to simplify complex problems and verify meaningful results.
● Trigonometric equations can be solved using multiple strategies, including technology.
● Sum and difference identities can be used to evaluate trigonometric expressions and solve equations.
● Equations can be modeled beyond just the cartesian (rectangular) system in a polar system defined by trigonometric associations.
● Several techniques can be employed to convert between rectangular and polar systems.</td><td>Students will consider…
● What is the appropriate identity to use in a given situation?
● What strategies can be employed to arrive at equations which are solvable?
● How are real world scenarios able to be modelled and subsequently solved using trigonometric identities?
● Why do certain characteristics of polar graphs produce certain results and how can these understandings be used to model real world situations?
● What is the value in converting between a rectangular and polar system? How does this enhance one’s understanding of math?</td></tr>
</table>

Learning Targets
Students will… ● *Identify and use basic trigonometric identities to find trigonometric values.* ● *Use basic trigonometric identities to simplify and rewrite trigonometric expressions.* ● *Verify trigonometric identities.* ● *Determine whether equations are identities.* ● *Solve trigonometric equations using algebraic techniques and basic identities.* ● *Use sum and difference identities to evaluate trigonometric functions.* ● *Use sum and difference identities to solve trigonometric equations.* ● *Use double-angle, power-reducing, and half-angle identities to evaluate trigonometric expressions and solve trigonometric equations.* ● *Use product to sum identities to evaluate trigonometric expressions and solve trigonometric equations.* ● *Graph polar coordinates and equations.* ● *Convert between polar and rectangular coordinates and equations.* ● *Identify polar equations of conic sections.* ● *Convert complex numbers between polar and rectangular forms.*
Unit Duration:
10 days

Unit 6: Systems of Equations and Matrices
Desired Results

<table>
<tr><th>Standards</th><th colspan="2">Transfer Goal(s) /Big Ideas</th></tr>
<tr><td rowspan="3">From Missouri Higher Education Precalculus Algebra Standards:
3. Algebraic Reasoning
● Solve and apply systems of equations and inequalities.</td><td colspan="2">We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have:
1) Mathematical literacy.
2) A complete mathematical skill set.
3) An understanding of the real life applications of mathematics.</td></tr>
<tr><th>Enduring Understandings</th><th>Essential Questions</th></tr>
<tr><td>Students will understand that…
● Systems of equations can be created and solved using matrices, by hand and through the use of technology.
● The characteristics of linear inequalities and their graphical representations are useful in solving real-world problems.</td><td>Students will consider…
● Why is it helpful to have multiple methods for solving a system of equations?
● What does the solution to a system of equations represent graphically?
● How can systems of equations and inequalities be used to represent situations and solve real-world problems?
● In what ways is optimization useful to the real world?</td></tr>
</table>

Learning Targets
Students will… ● Solve systems of linear equations using matrices and Gaussian elimination. ● Solve systems of linear equations using matrices and Gauss-Jordan elimination. ● Multiply matrices. ● Find the determinants and inverses of a 2x2 and a 3x3 matrices ● Solve a linear system of equations using inverses. ● Solve a linear system of equations using Cramer's Rule. ● Write partial fraction decomposition of rational expressions with linear factors in the denominator. ● Use Linear Programming to solve real-world applications. ● Recognize situations where there is no solution or more than one solution of a linear programming application.
Unit Duration: 10 days

Unit 7: Conic Sections
Desired Results

Standards	Transfer Goal(s) /Big Ideas	
From Missouri Higher Education Precalculus Algebra Standards: 2. Analysis of Functions *Create, use and interpret polynomial, power and rational functions.* 3. Algebraic Reasoning *Use rational exponents to express and simplify a variety of expressions and solve equations.*	*We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have:* *1) Mathematical literacy.* *2) A complete mathematical skill set.* *3) An understanding of the real life applications of mathematics.*	
	Enduring Understandings	**Essential Questions**
	Students will understand that… *Students will understand that…* ● Conic sections are used in a variety of construction and scientific applications such as bridge design, planetary and satellite orbits, mirrors, navigation and arches. ● The angle or direction you cut through a cone determines the type of conic you will get.	*Students will consider…* ● How can conic sections be developed? ● What are the applications of each conic section? ● What are the similarities and differences between the four types of conic sections?

Learning Targets
Students will… ● *Be able to identify the four conic sections (circle, ellipse, hyperbola, and parabola)* ● *Be able to write the equations of a circle, ellipse, hyperbola, and parabola in standard form.* ● *Be able to graph a circle, ellipse, hyperbola, and parabola.* ● *Be able to use the properties of circles, ellipses, hyperbolas, and parabolas to solve real-life problems.*
Unit Duration:
8-10 days

Unit 8: Sequences and Series
Desired Results

<table>
<tr><th>Standards</th><th colspan="2">Transfer Goal(s) /Big Ideas</th></tr>
<tr><td rowspan="3">From DESE Missouri Learning Standards
A.LQE.B
G.CP.A</td><td colspan="2">We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have:
1) Mathematical literacy.
2) A complete mathematical skill set.
3) An understanding of the real life applications of mathematics.</td></tr>
<tr><th>Enduring Understandings</th><th>Essential Questions</th></tr>
<tr><td>Students will understand that…
Students will understand that…
Once the pattern of a sequence is identified, it can be used to extend the sequence.
Some sequences can be modeled with an explicit formula that can be used to find any term of the sequence.
In an arithmetic sequence, the difference of any term to its preceding term is a constant.
In a geometric sequence, the ratio of any term to its preceding term is a constant.
Sequences and series can be used to model real-life situations.
Mathematical patterns can help simplify complex situations.
Permutations and combinations can be used in conjunction with other probability methods to calculate probabilities of compound events and solve problems</td><td>Students will consider…
Why is a sequence a function?
How can you tell the difference between an arithmetic and geometric sequence?
How can you use sequences and series to solve real life problems?
What are the advantages and disadvantages of a recursive rule compared to an explicit rule?
How can different calculations with an arithmetic or geometric sequence be used in the real world?
Why would we need to find the sum of an infinite series?
How is mathematical induction used to prove statements and rules true?
What are similarities and differences between using Pascal’s triangle versus Binomial theorem?
What is the difference between combinations and permutations?</td></tr>
</table>

Learning Targets
Students will… Identify and create arithmetic and geometric sequences and series. Write and use a recursive rule for both arithmetic and geometric sequences. Write and use an explicit rule for both arithmetic and geometric sequences. Find the sum of arithmetic and geometric series. Use factorial notation and summation notation. Use arithmetic and geometric sequences to model and solve real-life problems. Use mathematical induction to prove statements. Use the Binomial Theorem and Pascal's Triangle to find binomial coefficients. Use binomial coefficients to write binomial expansions. Use the Fundamental Counting Principle. Use the permutations and combinations formulas. Find the probability of events.
Unit Duration:
8-10 days

Strand 1:			
Topic: Pre-Calculus			
Grade:			
Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**		**Sample Activities**
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Score 3.0	**The student:** **The student exhibits no major errors or omissions.**		
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content.	
Score 2.0	**There are no major errors or omissions regarding the simpler details and processes as the student:** **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**		
	1.5	Partial knowledge of the 2.0 content, but major errors or omissions regarding the 3.0 content.	
Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**		
	0.5	With help, a partial understanding of the 2.0 content, but not the 3.0 content.	
Score 0.0	**Even with help, no understanding or skill demonstrated.**		

Calculus Course Overview	
Grade level(s):12	**Credits earned:** 1
Course Rationale	**Course Description**
The rationale for Calculus is to allow students to investigate rates and changes of varying quantities and provides the background for further studies in mathematics, engineering, and sciences. Focus is on conceptual understanding, quantitative reasoning, and problem solving skills. This course provides insight into the demands of both college curriculum and work related experiences.	This is an intensive full year course in the calculus of a single variable. This course provides an introduction to differential and integral calculus. Topics will include an introduction to limits, continuity, derivatives, related rates, Newton's Method, the Mean-Value Theorem, Max-Min problems, the integral, the Fundamental Theorem of Integral Calculus, exponential and logarithmic functions, curve sketching, areas, volumes, and average values. Graphing calculators will be utilized throughout the course. A student may earn college credit for the successful completion of this course or by attaining the required score on the advanced placement test.

Transfer Goals/Big Ideas

Students will be able to independently use their learning to…
We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have:
1) Mathematical literacy.
2) A complete mathematical skill set.
3) An understanding of the real life applications of mathematics

Priority Missouri Learning Standards/National Standards *See Addendum

MPAC 1: Reasoning with definitions and theorems
MPAC 2: Connecting concepts
MPAC 3: Implementing algebraic/computational processes
MPAC 4: Connecting multiple representations
MPAC 5: Building notational fluency
MPAC 6: Communicating

Unit 1: Limits and Continuity

Desired Results

<table>
<tr><th>Standards</th><th colspan="2">Transfer Goal(s) /Big Ideas</th></tr>
<tr><td rowspan="3"></td><td colspan="2">Many calculus concepts are developed by first considering a discrete model and then the consequences of a limiting case. Therefore, the idea of limits is essential for discovering and developing important ideas, definitions, formulas, and theorems in calculus. Students must have a solid, intuitive understanding of limits and be able to compute various limits, including one-sided limits, limits at infinity, the limit of a sequence, and infinite limits. They should be able to work with tables and graphs in order to estimate the limit of a function at a point. Students should know the algebraic properties of limits and techniques for finding limits of indeterminate forms, and they should be able to apply limits to understand the behavior of a function near a point. Students must also understand how limits are used to determine continuity, a fundamental property of functions.</td></tr>
<tr><th>Enduring Understandings</th><th>Essential Questions</th></tr>
<tr><td>Students will understand that…
EU 1.1: The concept of a limit can be used to understand the behavior of functions.

EU 1.2: Continuity is a key property of functions that is defined using limits.</td><td>Students will consider…

1. What is the idea of a limit?
2. What is the connection of the limit to Calculus?
3. Does every function have to have a limit?
4. What makes a function continuous?
5. What are the ways where a limit will be used?
6. Where can the concepts of limit and continuity be used in real life?
7. What are one-sided limits and infinite limits</td></tr>
</table>

Learning Targets
Students will… ***: Given a function , the limit of as approaches is a real number if can be made arbitrarily close to by taking sufficiently close to (but not equal to).*** ***If the limit exists and is a real number, then the common notation is $\lim_{x \to c}$ f(x) = R and the epsilon-delta definition of a limit.*** ***EK 1.1A2: The concept of a limit can be extended to include one-sided limits, limits at infinity, and infinite limits.*** ***EK 1.1A3: A limit might not exist for some functions at particular values of . Some ways that the limit might not exist are if the function is unbounded, if the function is oscillating near this value, or if the limit from the left does not equal the limit from the right.*** ***EK 1.1B1: Numerical and graphical information can be used to estimate limits.*** ***EK 1.1C1: Limits of sums, differences, products, quotients, and composite functions can be found using the basic theorems of limits and algebraic rules.*** ***EK 1.1C2: The limit of a function may be found by using algebraic manipulation, alternate forms of trigonometric functions, or the squeeze theorem.*** ***EK 1.1C3: Limits of the indeterminate forms and may be evaluated using L'Hospital's Rule.*** ***EK 1.1D1: Asymptotic and unbounded behavior of functions can be explained and described using limits.*** ***EK 1.1D2: Relative magnitudes of functions and their rates of change can be compared using limits.*** ***EK 1.2A1: A function f is continuous at x=c provided that f(c) exists, $\lim_{x \to c}$f(x) exists, and $\lim_{x \to c}$f(x)= f(c).*** ***EK 1.2A2: Polynomial, rational, power, exponential, logarithmic, and trigonometric functions are continuous at all points in their domains.*** ***EK 1.2A3: Types of discontinuities include removable discontinuities, jump discontinuities, and discontinuities due to vertical asymptotes.*** ***EK 1.2B1: Continuity is an essential condition for theorems such as the Intermediate Value Theorem, the Extreme Value Theorem, and the Mean Value Theorem.***
Unit Duration: 4 weeks

Unit 2: Derivatives
Desired Results

Standards	Transfer Goal(s) /Big Ideas	
	Using derivatives to describe the rate of change of one variable with respect to another variable allows students to understand change in a variety of contexts. In Calculus, students build the derivative using the concept of limits and use the derivative primarily to compute the instantaneous rate of change of a function. Applications of the derivative include finding the slope of a tangent line to a graph at a point, analyzing the graph of a function (for example, determining whether a function is increasing or decreasing and finding concavity and extreme values), and solving problems involving rectilinear motion. Students should be able to use different definitions of the derivative, estimate derivatives from tables and graphs, and apply various derivative rules and properties. In addition, students should be able to solve separable differential equations, understand and be able to apply the Mean Value Theorem, and be familiar with a variety of real-world applications, including related rates, optimization, and growth and decay models.	
	Enduring Understandings	**Essential Questions**
	Students will understand that… ***EU 2.1: The derivative of a function is defined as the limit of a difference quotient and can be determined using a variety of strategies.*** ***EU 2.2: A function's derivative, which is itself a function, can be used to understand the behavior of the function.*** ***EU 2.3: The derivative has multiple***	*Students will consider…* 1. ***What is a derivative of a function and how will it be found?*** 2. ***How are the function and its first and second derivatives connected?*** 3. ***How will derivatives be used to solve real life problems?*** 4. ***What is the relationship between differentiability and continuity?*** 5. ***How does the formal definition of derivative apply to what we know about tangent lines?***

	interpretations and applications including those that involve instantaneous rates of change. ***EU 2.4: The Mean Value Theorem connects the behavior of a differentiable function over an interval to the behavior of the derivative of that function at a particular point in the interval.***	***6. What is the relationship between the graph of a function and its derivative?*** ***7. What is the difference between the average rate of change and the instantaneous rate of change?*** ***8. When is it beneficial/necessary to use the chain rule?*** ***9. What are extrema and critical points and what do they tell us about a function?***

Learning Targets

Students will…

EK 2.1A1: The difference quotients $\frac{f(a+h)-f(a)}{a-h}$ ***and*** $\frac{f(x)-f(a)}{x-a}$ ***express the average rate of change of a function over an interval.***

EK 2.1A2: The instantaneous rate of change of a function at a point can be expressed by $\lim_{h\to 0}\frac{f(a+h)-f(a)}{h}$ ***or*** $\lim_{x\to a}\frac{f(x)-f(a)}{x-a}$***, provided that the limit exists. These are common forms of the definition of the derivative and are denoted f'(a).***

EK 2.1A3: The derivative of f is the function whose value at x is $\lim_{h\to 0}\frac{f(x+h)-f(x)}{h}$***,provided this limit exists.***

EK 2.1A4: For y = f(x) , notations for the derivative include $\frac{\square\square}{dx}$***, f'(x), and y'.***

EK 2.1A5: The derivative can be represented graphically, numerically, analytically, and verbally.

EK 2.1B1: The derivative at a point can be estimated from information given in tables or graphs.

EK 2.1C1: Direct application of the definition of the derivative can be used to find the derivative for selected functions, including polynomial, power, sine, cosine, exponential, and logarithmic functions.

EK 2.1D1: Differentiating f' produces the second derivative f", provided the derivative of f' exists; repeating this process produces higher order derivatives of f .

EK 2.1D2: Higher order derivatives are represented with a variety of notations. For y = f(x) , notations for the second derivative include $\frac{d^2y}{dx^2}$ ***, f", and y". Higher order derivatives can be denoted by*** $\frac{d^ny}{dx^n}$ ***or*** $y^{(n)}(x)$.

EK 2.2A1: First and second derivatives of a function can provide information about the function and its graph including intervals of increase or decrease, local (relative) and global (absolute) extrema, intervals of upward or downward concavity, and points of inflection.

EK 2.2A2: Key features of functions and their derivatives can be identified and related to their graphical, numerical, and analytical representations.

EK 2.2A3: Key features of the graphs of f, f', and f" and are related to one another.

EK 2.2B1: A continuous function may fail to be differentiable at a point in its domain.

EK 2.2B2: If a function is differentiable at a point, then it is continuous at that point.

EK 2.3A1: The unit for f'(x) is the unit for f divided by the unit for x.

EK 2.3A2: The derivative of a function can be interpreted as the instantaneous rate of change with respect to its independent variable.

EK 2.3B1: The derivative at a point is the slope of the line tangent to a graph at that point on the graph.

EK 2.3B2: The tangent line is the graph of a locally linear approximation of the function near the point of tangency.

EK 2.3C1: The derivative can be used to solve rectilinear motion problems involving position, speed, velocity, and acceleration. ***EK 2.3C2: The derivative can be used to solve related rates problems, that is, finding a rate at which one quantity is changing by relating it to other quantities whose rates of change are known.*** ***EK 2.3C3: The derivative can be used to solve optimization problems, that is, finding a maximum or minimum value of a function over a given interval.*** ***EK 2.3D1: The derivative can be used to express information about rates of change in applied contexts.*** ***EK 2.3E1: Solutions to differential equations are functions or families of functions.*** ***EK 2.3E2: Derivatives can be used to verify that a function is a solution to a given differential equation.*** ***EK 2.3F1: Slope fields provide visual clues to the behavior of solutions to first order differential equations.*** ***EK 2.4A1: If a function is continuous over the interval [a,b] and differentiable over the interval (a,b) , the Mean Value Theorem guarantees a point within that open interval where the instantaneous rate of change equals the average rate of change over the interval.***
Unit Duration: 14 weeks

Unit 3: Integrals and the Fundamental Theorem of Calculus
Desired Results

Standards	**Transfer Goal(s) /Big Ideas**
	Integrals are used in a wide variety of practical and theoretical applications. Calculus students should understand the definition of a definite integral involving a Riemann sum, be able to approximate a definite integral using different methods, and be able to compute definite integrals using geometry. They should be familiar with basic techniques of integration and properties of integrals. The interpretation of a definite integral is an important skill, and students should be familiar with area, volume, and motion applications, as well as with the use of the definite integral as an accumulation function. It is critical that students grasp the relationship between integration and differentiation as expressed in the Fundamental Theorem of Calculus. Students should be able to work with and analyze functions defined by an integral.

Enduring Understandings	**Essential Questions**
Students will understand that… ***EU 3.1: Antidifferentiation is the inverse process of differentiation.*** ***EU 3.2: The definite integral of a function over an interval is the limit of a Riemann sum can be calculated using a variety of strategies.*** ***EU 3.3: The Fundamental Theorem of Calculus, which has two distinct formulations, connects differentiation and integration.*** ***EU 3.4: The definite integral of a function over***	*Students will consider…* ***1. What is the relationship between the limit and integration?*** ***2. What is the correlation between differentiation and integration?*** ***3. What do integrals tell us about a function?*** ***4. Which method for determining definite integrals is most accurate?*** ***5. How can we use a slope field to gain information about a function?*** ***6. How can you find the area under a curve***

	an interval is a mathematical tool with many interpretations and applications involving accumulation. ***EU 3.5: Antidifferentiation is an underlying concept involved in solving separable differential equations. Solving separable differential equations involves determining a function or relation given its rate of change.***	***using integration?*** ***7. How is the concept of integration used in real life?*** ***8. What is a differential equation and how is it related to integration?*** ***9. How will solving a differential equation be applied in real life?*** ***10. Which method for determining the volume of revolution around a line is most appropriate?***

Learning Targets

Students will…

EK 3.1A1: An antiderivative of a function f is a function g whose derivative is f.

EK 3.1A2: Differentiation rules provide the foundation for finding antiderivatives.

EK 3.2A1: A Riemann sum, which requires a partition of an interval (I), is the sum of products, each of which is the value of the function at a point in a subinterval multiplied by the length of that subinterval of the partition.

EK 3.2A2: The definite integral of a continuous function f over the interval [a,b], denoted by $\int_a^b f(x)\,dx$***, is the limit of the Riemann sums as the widths of the subintervals approach 0. That is,*** $\int_a^b f(x)\,dx = \lim_{max\,\Delta x_i \to 0} \sum_{i=1}^{n} f\left(x_i\right) \cdot \Delta x_i,\ where\ \Delta x_i$***, where*** $\Delta x_i^{\cdot}$ ***is a value in the ith subinterval,*** Δx_i ***is the width of the ith subinterval, n is the number of subintervals, and*** $max\,\Delta x_i$ ***is the width of the largest subinterval. Another form of the definition is*** $\int_a^b f(x)\,dx = \lim_{n \to \infty} \sum_{i=1}^{n} f\left(x_i^{\cdot}\right) \Delta x_i$ ***where*** $\Delta x_i = \frac{b-a}{n}\ and\ x_i$ ***is the value in the ith subinterval.***

EK 3.2A3: The information in a definite integral can be translated into the limit of a related Riemann sum, and the limit of a Riemann sum can be written as a definite integral.

EK 3.2B1: Definite integrals can be approximated for functions that are represented graphically, numerically,algebraically, and verbally.

EK 3.2B2: Definite integrals can be approximated using a left Riemann sum, a right Riemann sum, a midpoint Riemann sum, or a trapezoidal sum; approximations can be computed, using either uniform or nonuniform partitions.

EK 3.2C1: In some cases, a definite integral can be evaluated by using geometry and the connection between the definite integral and area.
EK 3.2C2: Properties of definite integrals include the integral of a constant times a function, the integral of the sum of two functions, reversal of limits of integration, and the integral of a function over adjacent intervals.
EK 3.2C3: The definition of the definite integral may be extended to functions with removable or jump discontinuities.
EK 3.3A1: The definite integral can be used to define new functions; for example, $f(x)=\int_0^x e^{-t^2}\mathrm{d}t.$
EK 3.3A2: If is a continuous function on the interval , then $\frac{d}{dx}\left(\int_a^x f(t)\,\mathrm{d}t\right)=f(x),$ ***where x is between a and b.***
EK 3.3A3: Graphical, numerical, analytical, and verbal representations of a function provide information about the function g defined as $g(x)=\int_a^x f(t)\,\mathrm{d}t.$
EK 3.3B1: The function defined by $F(x)=\int_a^x f(t)\,\mathrm{d}t$ ***is the antiderivative of f.***
EK 3.3B2: If is continuous on the interval [a,b] and is an antiderivative of , then $F(x)=\int_a^b f(x)\,\mathrm{d}x=F(b)-F(a).$
EK 3.3B3: The notation $\int f(x)\,\mathrm{d}x=F(x)+C$ ***means that F'(x) = f(x), and*** $\int f(x)\,\mathrm{d}x$ ***is called the indefinite integral of the function f.***
EK 3.3B4: Many functions do not have closed form antiderivatives.
EK 3.3B5: Techniques for finding antiderivatives include algebraic manipulation such as long division, completing the square, and substitution of variables.
EK 3.4A1: A function defined as an integral represents an accumulation of a rate of change.
EK 3.4A2: The definite integral of the rate of change of a quantity over an interval gives the net change of that quantity over that interval.
EK 3.4A3: The limit of an approximating Riemann sum can be interpreted as a definite integral.
EK 3.4B1: The average value of a function over an interval [a,b] is $\frac{1}{b-a}\int_a^b f(x)\,\mathrm{d}x.$
EK 3.4C1: For a particle in rectilinear motion over an interval of time, the definite integral of velocity represents the particle's displacement over the interval of time, and the definite integral of speed represents the particle's total distance traveled over the interval of time.
EK 3.4D1: Areas of certain regions in the plane can be calculated with definite integrals.
EK 3.4D2: Volumes of solids with known cross sections, including discs and washers, can be calculated with definite integrals.
EK 3.4D3: The length of a planar curve defined by a function or by a parametrically defined curve can be calculated using a definite integral.
EK 3.4E1: The definite integral can be used to express information about accumulation and net change in many applied contexts.
EK 3.5A1: Antidifferentiation can be used to find specific solutions to differential equations with given initial conditions, including applications to motion

along a line, exponential growth and decay.

EK 3.5A2: Some differential equations can be solved by separation of variables.

EK 3.5A3: Solutions to differential equations may be subject to domain restrictions.

EK 3.5A4: The function F defined by $F(x) = c + \int_a^x f(t)\,dt$ ***is a general solution to the differential equation*** $\frac{dy}{dx} = f(x)$, *and* $F(x) = y_0 + \int_a^x f(t)\,dt$ ***is the particular solution to the differential equation*** $\frac{dy}{dx} = f(x)$ ***satisfying*** $F(a) = y_0$.

EK 3.5B1: The model for exponential growth and decay that arises from the statement "The rate of change of a quantity is proportional to the size of the quantity is $\frac{dy}{dt} = ky$.

Unit Duration: 18 weeks

Strand 1: Limits and Continuity

Standard 1: Find Limits Numerically, Graphically, and Analytically

Level: Calculus

			Sample Tasks
Score 4.0		**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**	
	3.5	**In addition to score 3.0 performance, in-depth inferences and applications with partial success.**	
Score 3.0		**The student will:** • **Estimate a limit using a numerical or graphical approach.** • **Learn different ways that a limit can fail to exist.** • **Study and use the formal definition of a limit.** • **Determine limits at infinity.** • **Evaluate a limit using properties of limits.** • **Develop and use a strategy for finding limits.** • **Evaluate a limit using dividing out (factoring) and rationalizing techniques.** • **Evaluate a limit using the Squeeze Theorem.** • **Limits of the indeterminate forms and may be evaluated using L'Hospital's Rule.** • **Evaluate a limit using properties of limits.** • **Develop and use a strategy for finding limits.** • **Evaluate a limit using dividing out (factoring) and rationalizing techniques.** • **Evaluate a limit using the Squeeze Theorem.** **The student exhibits no major errors or omissions.**	Find the $\lim\limits_{x\to -5}\dfrac{\sqrt{4-x}-3}{x+5}$ **numerically**. Explain three ways in which a limit would fail to exist. Illustrate each type with a graph of a function.
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content	
Score 2.0		**There are no major errors or omissions regarding the simpler details and processes as the student completes the concepts in level 3.0. There are no major errors or omissions regarding the simpler details and processes as the student completes the concepts in level 3.0.**	
	1.5	**Partial knowledge of the 2.0 content but major errors or omissions regarding the 3.0 content**	
Score 1.0		**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**	
	0.5	**With help, a partial understanding of the 2.0 content but not the 3.0 content**	
Score 0.0		**Even with help, no understanding or skill demonstrated.**	

Strand 1: Limits and Continuity

Standard 2: Determine Continuity

Level: Calculus

Score 4.0	In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.		**Sample Tasks**
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Score 3.0	**The student will:** • Determine continuity at a point and continuity on an open interval. • Determine one-sided limits and continuity on a closed interval. • Understand the concept of continuity and use properties of continuity. • Understand and use the Intermediate Value Theorem. • Determine infinite limits from the left and from the right sides. • Find and sketch the vertical asymptotes. • Continuity is an essential condition for theorems such as the Intermediate Value Theorem, the Extreme Value Theorem, and the Mean Value Theorem. • Determine continuity at a point and continuity on an open interval. • Determine one-sided limits and continuity on a closed interval. • Understand the concept of continuity and use properties of continuity. • Understand and use the Intermediate Value Theorem. • Determine infinite limits from the left and from the right sides. • Find and sketch the vertical asymptotes. **The student exhibits no major errors or omissions.**		Find $\lim_{x\to -2^+} \frac{\lvert x+2\rvert}{x+2}$. Discuss the continuity for $f(x)=\frac{x^2-4}{x^2-3x-10}$. State whether there are any removable or nonremovable discontinuities and describe them.
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content	
Score 2.0	There are no major errors or omissions regarding the simpler details and processes as the student completes the concepts in level 3.0. There are no major errors or omissions regarding the simpler details and processes as the student completes the concepts in level 3.0.		
	1.5	Partial knowledge of the 2.0 content but major errors or omissions regarding the 3.0 content	
Score 1.0	With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.		
	0.5	With help, a partial understanding of the 2.0 content but not the 3.0 content	
Score 0.0	Even with help, no understanding or skill demonstrated.		

AP Statistics Course Overview	
Grade level(s): 11,12	**Credits earned:** 1 credit
Course Rationale	**Course Description**
The purpose of the AP course in statistics is to introduce students to the major concepts and tools for collecting, analyzing and drawing conclusions from data.	The AP Statistics course is a non-calculus-based college-level course in statistics. The course introduces students to the major concepts and tools for collecting, analyzing, and drawing conclusions from data. There are four themes in the AP Statistics course: exploring data, sampling and experimentation, anticipating patterns, and statistical inference. Students use technology, investigations, problem solving, and writing as they build conceptual understanding.
Transfer Goals/Big Ideas	
Students will be able to independently use their learning to… *We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have:* *1) Mathematical literacy.* *2) A complete mathematical skill set.* *3) An understanding of the real life applications of mathematics.*	

Priority Missouri Learning Standards/National Standards
Strand I: Exploring Data: Describing patterns and departures from patterns 1. Constructing and interpreting graphical displays of distributions of univariate data (dotplot, stemplot, histogram, cumulative frequency plot) 2. Summarizing distributions of univariate data 3. Comparing distributions of univariate data (dotplots, back-to-back stemplots, parallel boxplots) 4. Exploring bivariate data 5. Exploring categorical data **Strand II: Sampling and Experimentation: Planning and conducting a study** 6. Overview of methods of data collection 7. Planning and conducting surveys 8. Planning and conducting experiments 9. Generalizability of results and types of conclusions that can be drawn from observational studies, experiments and surveys **Strand III: Anticipating Patterns: Exploring random phenomena using probability and simulation** 10. Probability 11. Combining independent random variables 12. The normal distribution 13. Sampling distributions **Strand IV: Statistical Inference: Estimating population parameters and testing hypotheses** 14. Estimation (point estimators and confidence intervals) 15. Tests of significance

Unit 1: Exploring Univariate Data
Desired Results

Standards

1. Constructing and interpreting graphical displays of distributions of univariate data (dotplot, stemplot, histogram, cumulative frequency plot)
2. Summarizing distributions of univariate data

Transfer Goal(s) /Big Ideas

We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have:
1) Mathematical literacy.
2) A complete mathematical skill set.
3) An understanding of the real life applications of mathematics.

Enduring Understandings

Students will understand that:

1. The who, what, where, why of the data are important information that must be depicted in each given data set.
2. The shape, center, and spread should be described for every distribution.

Essential Questions

Students will consider…

1. What is data?
2. How do we understand and communicate data?
3. What assumptions can be made from data?
4. How can graphical displays be manipulated to present misleading information?

Learning Targets

Students will…

- Center and Spread
    - Make a dotplot or stemplot to display small sets of data, make a histogram with a reasonable choice of classes, make a boxplot
    - Describe the overall pattern (shape, center, spread) of a distribution and identify any major departures from the pattern (like outliers).
- Clusters and gaps
    - Describe the overall pattern (shape, center, spread) of a distribution and identify any major departures from the pattern (like outliers).
- Outliers and unusual features
    - Identify outliers using the 1.5 x IQR rule.

- Describe the overall pattern (shape, center, spread) of a distribution and identify any major departures from the pattern (like outliers)
- Shape
    - Identify the shape of a distribution from a dotplot, stemplot, or histogram as roughly symmetric or skewed. Identify the number of modes.
- Measuring Center: Mean and Median
    - Calculate and interpret measures of center (mean, median)
    - Approximately locate the median (equal-areas point) and the mean (balance point) on a density curve.
- Measuring spread: range, interquartile range, standard deviation
    - Calculate and interpret measures of spread (standard deviation)
    - Calculate and interpret measures of spread (IQR)
- Measuring position: quartiles, percentiles, standardized scores (z-scores)
    - Use percentiles to locate individual values within distributions of data.
    - Find the standardized value (z-score) of an observation. Interpret z-scores in context.
    - Interpret a cumulative relative frequency graph.
- The effect of changing units on summary measures
    - Describe the effect of adding, subtracting, multiplying by, or dividing by a constant on the shape, center, and spread of a distribution of data.
- Comparing center and spread
    - Select appropriate measures of center and spread.
    - Use appropriate graphs and numerical summaries to compare distributions of quantitative variables.
- Comparing clusters and gaps
    - Describe the overall pattern (shape, center, spread) of a distribution and identify any major departures from the pattern (like outliers).
- Comparing shape
    - Identify the shape of a distribution from a dotplot, stemplot, or histogram as roughly symmetric or skewed. Identify the number of modes.
- Frequency tables and bar charts
    - Make a bar graph of the distribution of a categorical variable or, in general, to compare related quantities.
    - Recognize when a pie chart can and cannot be used.
    - Identify what makes some graphs deceptive.
- Marginal and joint frequencies for two-way tables
    - From a two-way table of counts, answer questions involving marginal and conditional distributions.
    - Describe the relationship between two categorical variables by computing appropriate conditional distributions.
- Conditional relative frequencies and association

- Find the probability that an event occurs using a two-way table. • Comparing distributions using bar charts - Construct bar graphs to display the relationship between two categorical variables.
Unit Duration:
8 Days

AP Statistics Course Overview	
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Transfer Goals/Big Ideas

Students will be able to independently use their learning to…

We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have:

1) Mathematical literacy.

2) A complete mathematical skill set.

3) An understanding of the real life applications of mathematics.

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Unit 2:
Desired Results

<table>
<tr><th>Standards</th><th colspan="2">Transfer Goal(s) /Big Ideas</th></tr>
<tr><td rowspan="3">2. Summarizing distributions of univariate data
3. Comparing distributions of univariate data (dotplots, back-to-back stemplots, parallel boxplots)
4. Exploring bivariate data</td><td colspan="2">We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have:
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3) An understanding of the real life applications of mathematics.</td></tr>
<tr><th>Enduring Understandings</th><th>Essential Questions</th></tr>
<tr><td>Students will understand that:
1. Correlations do not imply causation
2. A linear model can be used to represent relationships between bivariate data.</td><td>Students will consider…
● What is association?
● What is correlation?
● How are they connected?
● Does association imply causation?
● How can modeling data help us to understand patterns?
● When is it appropriate to use extrapolation to predict the future?
● How do outliers affect distribution?</td></tr>
</table>

Learning Targets

Students will…

Analyzing patterns in scatterplots

- Describe why it is important to investigate relationships between variables.
- Identify explanatory and response variables in situations where one variable helps to explain or influences the other.
- Make a scatter plot to display the relationship between two quantitative variables.
- Describe the direction, form, and strength of the overall pattern of a scatter plot.
- Recognize outliers in a scatterplot.

Correlation and linearity

- Know the basic properties of correlation.
- Calculate and interpret correlation.
- Explain how the correlation r is influenced by extreme observations.

Least squares regression line

- Interpret the slope and y intercept of a least-squares regression line.
- Use the least-squares regression line to predict y for a given x.
- Explain the dangers of extrapolation.
- Explain the concept of least squares.
- Use technology to find a least-squares regression line.
- Find the slope and intercept of the least-squares regression line from the means and standard deviations of x and y and their correlation.

Residual plots

- Calculate and interpret residuals.
- Construct and interpret residual plots to assess if a linear model is appropriate.

Coefficients of Determination and Standard Deviation of the Residuals

- Use the standard deviation of the residuals to assess how well the line fits the data.
- Use r2 to assess how well the line fits the data.

Outliers and influential points

- Recognize how the slope, y intercept, standard deviation of the residuals, and r2 are influenced by extreme observations.

Confidence interval for the slope

- Construct and interpret a confidence interval for the slope of the population regression line.

Test for the slope of a least squares regression line

- Check conditions for performing inference about the slope of the population regression line.
- Perform a significance test about the slope of a population regression line.

Transformations to achieve linearity

- Use transformations involving powers and roots to achieve linearity for a relationship between two variables.
- Make predictions from a least-squares regression line involving transformed data.

Logarithmic and Power transformations

- Use transformations involving logarithms to achieve linearity for a relationship between two variables.
- Make predictions from a least-squares regression line involving transformed data.
- Determine which of several transformations does a better job of producing a linear relationship.

Unit Duration:
7 days

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Unit 3: Sampling and Experimentation
Desired Results

Standards	Transfer Goal(s) /Big Ideas	
6. Overview of methods of data collection 7. Planning and conducting surveys 8. Planning and conducting experiments 9. Generalizability of results and types of conclusions that can be drawn from observational studies, experiments and surveys	*We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have:* *1) Mathematical literacy.* *2) A complete mathematical skill set.* *3) An understanding of the real life applications of mathematics.*	
	Enduring Understandings	**Essential Questions**
	Students will understand that: 1. Careful planning is essential to obtaining valid data and clarifying the question leads to the appropriate methodology. 2. An analysis is only as good as the data. 3. Well-designed experiments can allow us to reach appropriate cause-and-effect conclusions.	*Students will consider…* 1. How do we obtain data and why is it important? 2. How can bias be identified and prevented? 3. To what extent does data collection methodology affect results?

Learning Targets

Students will…

- Methods of Data Collection
  - Analyzing a variety of methods of data collection through studies and experiments, including census, sample survey, experiment and observational study.
- Populations, samples, and random selection
  - Identify the population and sample in a sample survey.
  - Identify voluntary response samples and convenience samples. Explain how these bad sampling methods can lead to bias.
  - Describe how to use Table D to select a simple random sample

- Sources of bias in sampling and surveys
    - Explain how undercoverage, nonresponse, and question wording can lead to bias in a sample survey.
- Sampling methods, including simple random sample, stratified sampling, and cluster sampling
    - Distinguish a simple random sample from a stratified random sample or cluster sample. Give advantages and disadvantages of each sampling method.
- Treatments, control groups, experimental units, random assignments, and replication
    - Distinguish between an observational study and an experiment.
    - Explain how a lurking variable in an observational study can lead to confounding.
    - Identify the experimental units or subjects, explanatory variables (factors), treatments, and response variables in an experiment.
    - Explain why random assignment is an important experimental design principle.
- Sources of bias and confounding, including placebo effect and blinding
    - Describe how to avoid the placebo effect in an experiment.
    - Explain the meaning and the purpose of blinding in an experiment.
    - Explain in context what "statistically significant" means.
- Completely randomized design
    - Describe a completely randomized design for an experiment.
    - Explain why random assignment is an important experimental design principle.
- Randomized block design, including matched pairs design
    - Distinguish between a completely randomized design and a randomized block design.
    - Know when a matched pairs experimental design is appropriate and how to implement such a design.
- Experiments, observational studies, and surveys
    - Determine the scope of inference for a statistical study.

Unit Duration:
8 days

AP Statistics
Course Overview

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Unit 4: Probability
Desired Results

Standards	**Transfer Goal(s) /Big Ideas**	
10. Probability	*Students will be able to independently use their learning to…* *We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have:* *1) Mathematical literacy.* *2) A complete mathematical skill set.* *3) An understanding of the real life applications of mathematics.*	
	Enduring Understandings	**Essential Questions**
	Students will understand that: 1. Probability models are useful tools for making decisions and predictions. 2. Probability is the basis of statistical inference. 3. The notion and behavior of a random variable is foundational to understanding probability distributions. 4. The Law of Large Numbers is an important concept when simulating probability experiments.	*Students will consider…* 1. How can we base decisions on chance? 2. How can probability be used to simulate events and to predict future happenings? 3. What are the benefits of simulating events as opposed to gathering real data? 4. How can modeling predict the future?

Learning Targets

Students will…
● Interpret probability, including long-run relative frequency interpretation
● “Law of Large Numbers” concept
    ○ apply the "Law of Large Numbers" concept
● Addition rule, multiplication rule, conditional probability and independence
    ○ Apply addition rule, multiplication rule, conditional probability and independence

Unit Duration:
6 Days

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Unit 5: Random Variables

Desired Results

<table>
<tr><th>Standards</th><th colspan="2">Transfer Goal(s) /Big Ideas</th></tr>
<tr><td rowspan="3">2. Summarizing distributions of univariate data
3. Comparing distributions of univariate data (dotplots, back-to-back stemplots, parallel boxplots)
10. Probability
11. Combining independent random variables
12. The normal distribution</td><td colspan="2">We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have:
1) Mathematical literacy.
2) A complete mathematical skill set.
3) An understanding of the real life applications of mathematics.</td></tr>
<tr><th>Enduring Understandings</th><th>Essential Questions</th></tr>
<tr><td>Students will understand that:
1. The normal distribution is used to model the spread of data.
2. The notion and behavior of a random variable is foundational to understanding probability distributions.
3. Probability models are useful tools for making decisions and predictions.
4. Probability is the basis of statistical inference.</td><td>Students will consider…
1. How does the normal distribution apply to the real world?
2. How can probability be used to simulate events and to predict future happenings?
3. How can modeling predict the future?
4. Why is the normal distribution essential to the study of statistics?</td></tr>
</table>

Learning Targets
Students will… Mean or Expected value of a discrete random variable ● Use a probability distribution to answer questions about possible values of a random variable. ● Calculate the mean of a discrete random variable. ● Interpret the mean of a random variable. Standard Deviation of a discrete random variable ● Calculate the standard deviation of a discrete random variable. ● Interpret the standard deviation of a random variable. Linear Transformations of Random Variables ● Describe the effects of transforming a random variable by adding or subtracting a constant and multiplying or dividing by a constant. Mean and standard deviation for sums and differences of independent random variables ● Find the mean and standard deviation of the sum or difference of independent random variables. ● Determine whether two random variables are independent. ● Find probabilities involving the sum or difference of independent Normal random variables. Find probabilities involving geometric random variables. Probability ● Determine whether the conditions for a binomial random variable are met. ● Compute and interpret probabilities involving binomial distributions. Mean and Standard Deviation ● Calculate the mean and standard deviation of a binomial random variable. Interpret these values in context. Properties of the Normal distribution
Unit Duration:
10 days

AP Statistics
Course Overview

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Unit 6: Sampling Distributions
Desired Results

Standards	Transfer Goal(s) /Big Ideas	
13. Sampling distributions	*We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have:* *1) Mathematical literacy.* *2) A complete mathematical skill set.* *3) An understanding of the real life applications of mathematics.*	
	Enduring Understandings	**Essential Questions**
	Students will understand that: 1. The normal distribution and central limit theorem are essential to analyzing samples of data 2. Variation can be expected in the results of random samples and is affected by the design of the sample or experiment.	*Students will consider…* 1. What is the difference between a parameter and a statistic? Why is this field of study called "Statistics"? 2. What does "sampling variability" mean and why is it an issue? 3. How is the size of a sample related to its variability? 4. How is the mean of a sampling distribution related to the population mean or proportion? 5. Why is the Central Limit Theorem so important to statisticians?

Learning Targets

Students will…

- Simulation of sampling distributions
  - Distinguish between a parameter and a statistic.
  - Understand the definition of a sampling distribution.
  - Distinguish between population distribution, sampling distribution, and the distribution of sample data.
- Unbiased estimators
  - Determine whether a statistic is an unbiased estimator of a population parameter.
- Sample size and variability
  - Understand the relationship between sample size and the variability of an estimator.
- Central Limit Theorem
  - Explain how the shape of the sampling distribution of is related to the shape of the population distribution.
  - Use the central limit theorem to help find probabilities involving a sample mean .
- Sampling distribution of a sample mean
  - Find the mean and standard deviation of the sampling distribution of a sample mean from an SRS of size n.
  - Calculate probabilities involving a sample mean when the population distribution is Normal.
- Sampling distribution of a difference between two independent sample means
  - Describe the characteristics of the sampling distribution of two independent sample means
  - Calculate probabilities using the sampling distribution of two independent sample means
- Sampling distribution of a sample proportion
  - Find the mean and standard deviation of the sampling distribution of a sample proportion for an SRS of size n from a population having proportion p of successes.
  - Check whether the 10% and Normal conditions are met in a given setting.
  - Use Normal approximation to calculate probabilities involving .
  - Use the sampling distribution of to evaluate a claim about a population proportion.
- Sampling distribution of a difference between two independent sample proportions
  - Describe the characteristics of the sampling distribution of two independent sample proportions
  - Calculate probabilities using the sampling distribution of two independent sample proportions

Unit Duration:
10 days

AP Statistics
Course Overview

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Priority Missouri Learning Standards/National Standards

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4. Exploring bivariate data
5. Exploring categorical data

Strand II: Sampling and Experimentation: Planning and conducting a study (10%–15%)

6. Overview of methods of data collection
7. Planning and conducting surveys
8. Planning and conducting experiments
9. Generalizability of results and types of conclusions that can be drawn from observational studies, experiments and surveys

Strand III: Anticipating Patterns: Exploring random phenomena using probability and simulation (20%–30%)

10. Probability
11. Combining independent random variables
12. The normal distribution
13. Sampling distributions

Strand IV: Statistical Inference: Estimating population parameters and testing hypotheses

14. Estimation (point estimators and confidence intervals)
15. Tests of significance

Unit 7: Estimation (means and proportions)
Desired Results

<table>
<tr><th rowspan="4">Standards</th><th colspan="2">Transfer Goal(s) /Big Ideas</th></tr>
<tr><td colspan="2">We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have:
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<tr><th>Enduring Understandings</th><th>Essential Questions</th></tr>
<tr><td>Students will understand that:
1. Variation can be expected in the results of random samples and is affected by the design of the sample or experiment.
2. Tests of significance and confidence intervals drive decision making in our world.
3. Error analysis is a critical component of significance testing.
4. Confidence intervals are effective tools for estimating the proportion of a population.
5. Confidence intervals are effective tools for estimating the proportion or the mean of a population.</td><td>Students will consider…
1. How can modeling predict the future?
2. How much evidence do you need before you are able to make a reasonable conjecture?
3. How is statistical inference used to draw conclusions from data?
4. How is probability used to express the strength of our conclusions?
5. How do you determine if there is a statistically significant difference between two claims?</td></tr>
</table>

14. Estimation (point estimators and confidence intervals)

Learning Targets
Students will… ● Estimate population parameters and margins of error ● Properties of point estimators, including unbiasedness and variability ○ Understand properties of point estimators, including unbiasedness and variability ● Logic of confidence intervals, meaning of confidence level and confidence intervals, and properties of confidence intervals ○ Apply Logic of confidence intervals, meaning of confidence level and confidence intervals, and properties of confidence intervals ● Large sample confidence interval for a proportion ○ Understand large sample confidence interval for a proportion ● Large sample confidence interval for a difference between two proportions ○ Understand large sample confidence interval for a difference between two proportions ● Confidence interval for a mean ○ Calculate and interpret Confidence interval for a mean ● Confidence interval for a difference between two means (unpaired and paired) ○ Calculate and interpret Confidence interval for a difference between two means (unpaired and paired) ● Confidence interval for the slope of a least-squares regression line ○ Calculate and interpret Confidence interval for the slope of a least-squares regression line
Unit Duration:
7 days

AP Statistics
Course Overview

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Unit 8: Tests of significance (means and proportions)

Desired Results

Standards	Transfer Goal(s) /Big Ideas
15. Tests of significance	*We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have:* *1) Mathematical literacy.* *2) A complete mathematical skill set.* *3) An understanding of the real life applications of mathematics.*

Enduring Understandings	Essential Questions
Students will understand that: 1. Significance tests determine the likelihood of a sample. 2. Confidence intervals are effective tools for estimating the proportion or the mean of a population. 3. Inference is a tool for validating a claim about a population parameter. 4. Inference is a tool for estimating an unknown population parameter. 5. Significance tests can also determine whether two variables are independent. 6. Tests of significance and confidence intervals drive decision making in our world. 7. Error analysis is a critical component of significance testing.	*Students will consider…* 1. What does it mean to make an inference? 2. How can we verify that two variables are independent? 3. How is statistical inference used to draw conclusions from data? 4. How can one account for errors in significance tests?

Learning Targets

Students will…

Null and alternative hypotheses

- State correct hypotheses for a significance test about a population

P-value

- Interpret P-values in context

One and two-sided tests

Type I and Type II Errors

- Interpret a Type I error and a Type II error in context, and give the consequences of each.

Power

- Understand the relationship between the significance level of a test, P(Type II error), and power.

Large sample test for a proportion

- Check conditions for carrying out a test about a population proportion.
- If conditions are met, conduct a significance test about a population proportion.
- Use a confidence interval to draw a conclusion for a two-sided test about a population proportion.

Test for a mean

- Check conditions for carrying out a test about a population mean.
- If conditions are met, conduct a one-sample t test about a population mean .
- Use a confidence interval to draw a conclusion for a two-sided test about a population mean.

Test for the difference between two means: Paired

- Recognize paired data and use one-sample t procedures to perform significance tests for such data.

Large sample test for a difference between two proportions

- Perform a significance test to compare two proportions.
- Interpret the results of inference procedures in a randomized experiment.

Test for the difference between two means: Independent

- Perform a significance test to compare two means.
- Check conditions for using two-sample t procedures in a randomized experiment.
- Interpret the results of inference procedures in a randomized experiment.

Unit Duration:
12 days

AP Statistics Course Overview	
Grade level(s): 11,12	**Credits earned:** 1 credit
Course Rationale	**Course Description**
The purpose of the AP course in statistics is to introduce students to the major concepts and tools for collecting, analyzing and drawing conclusions from data.	The AP Statistics course is a non-calculus-based college-level course in statistics. The course introduces students to the major concepts and tools for collecting, analyzing, and drawing conclusions from data. There are four themes in the AP Statistics course: exploring data, sampling and experimentation, anticipating patterns, and statistical inference. Students use technology, investigations, problem solving, and writing as they build conceptual understanding.
Transfer Goals/Big Ideas	
Students will be able to independently use their learning to… *We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have:* *1) Mathematical literacy.* *2) A complete mathematical skill set.* *3) An understanding of the real life applications of mathematics.*	

Priority Missouri Learning Standards/National Standards
Strand I: Exploring Data: Describing patterns and departures from patterns 1. Constructing and interpreting graphical displays of distributions of univariate data (dotplot, stemplot, histogram, cumulative frequency plot) 2. Summarizing distributions of univariate data 3. Comparing distributions of univariate data (dotplots, back-to-back stemplots, parallel boxplots) 4. Exploring bivariate data 5. Exploring categorical data **Strand II: Sampling and Experimentation: Planning and conducting a study (10%–15%)** 6. Overview of methods of data collection 7. Planning and conducting surveys 8. Planning and conducting experiments 9. Generalizability of results and types of conclusions that can be drawn from observational studies, experiments and surveys **Strand III: Anticipating Patterns: Exploring random phenomena using probability and simulation (20%–30%)** 10. Probability 11. Combining independent random variables 12. The normal distribution 13. Sampling distributions **Strand IV: Statistical Inference: Estimating population parameters and testing hypotheses** 14. Estimation (point estimators and confidence intervals) 15. Tests of significance

Unit 9: Chi-Squared Hypothesis Testing & Test for Slope of a Least Squares Regression Line
Desired Results

<table>
<tr><th>Standards</th><th colspan="2">Transfer Goal(s) /Big Ideas</th></tr>
<tr><td rowspan="3">15. Tests of significance</td><td colspan="2">We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have:
1) Mathematical literacy.
2) A complete mathematical skill set.
3) An understanding of the real life applications of mathematics.</td></tr>
<tr><th>Enduring Understandings</th><th>Essential Questions</th></tr>
<tr><td>Students will understand that:
1. Significance tests can determine the likelihood of a sample from a series of proportions.
2. Significance tests can determine whether two variables are independent.
3. Regression is an instrument used to generalize relationships for bivariate data</td><td>Students will consider…
1. How can we verify that two variables are independent?
2. How does one distinguish among the various tests of significance?
3. How do we make a declaration of independence statistically?
4. How do we use a model to make statistical inference?
5. What makes an argument statistically convincing?</td></tr>
</table>

Learning Targets
Students will… ● Basics of Chi-squared ○ Know how to compute expected counts, conditional distributions, and contributions to the chi-square statistic. ● Goodness of Fit Test ○ Check the Random, Large sample size, and Independent conditions before performing a chi-square test. ○ Use a chi-square goodness-of-fit test to determine whether sample data are consistent with a specified distribution of a categorical variable. ○ Examine individual components of the chi-square statistic as part of a follow-up analysis. ● Homogeneity Test ○ Check the Random, Large sample size, and Independent conditions before performing a chi-square test. ○ Use a chi-square test for homogeneity to determine whether the distribution of a categorical variable differs for several populations or treatments. ○ Interpret computer output for a chi-square test based on a two-way table. ○ Examine individual components of the chi-square statistic as part of a follow-up analysis. ○ Show that the two-sample z test for comparing two proportions and the chi-square test for a 2-by-2 two-way table give equivalent results. ● Association/Independence Test ○ Check the Random, Large sample size, and Independent conditions before performing a chi-square test. ○ Use a chi-square test of association/independence to determine whether there is convincing evidence of an association between two categorical variables. ○ Interpret computer output for a chi-square test based on a two-way table. ○ Examine individual components of the chi-square statistic as part of a follow-up analysis. ● Test for Slope of a Least - Squares Regression Line ○ Create and interpret tests for slope of LSRL.
Unit Duration:
5 days

<table>
<tr><td colspan="3"></td></tr>
<tr><td colspan="3">Topic: Exploring Univariate Data</td></tr>
<tr><td colspan="3">Grade: 12</td></tr>
<tr><td>Score 4.0</td><td colspan="2">In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.</td></tr>
<tr><td></td><td>3.5</td><td>In addition to score 3.0 performance, in-depth inferences and applications with partial success.</td></tr>
<tr><td>Score 3.0</td><td colspan="2">The student:
Will approximate the median and mean on a density curve
Will calculate and interpret measures of spread (standard deviation & IQR)
Will use percentiles to locate individual values within distributions of data.
Will interpret z-scores in context
Given a two-way table of counts:
Will answer questions involving marginal conditional distributions.
Will find probability that an event occurs
The student exhibits no major errors or omissions.</td></tr>
<tr><td></td><td>2.5</td><td>No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content.</td></tr>
<tr><td>Score 2.0</td><td colspan="2">There are no major errors or omissions regarding the simpler details and processes as the student:
Makes a dotplot, stemplot, histogram, or boxplot and identify its shape.
Describes the overall pattern of a distribution (inc outliers)
Identifies outliers using the 1.5 x IQR rule
Calculates mean and median.
Calculates a z-score of an observation.
Constructs bar graphs to display the relationship between two categorical variables.
However, the student exhibits major errors or omissions regarding the more complex ideas and processes.</td></tr>
<tr><td></td><td>1.5</td><td>Partial knowledge of the 2.0 content, but major errors or omissions regarding the 3.0 content.</td></tr>
<tr><td>Score 1.0</td><td colspan="2">With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.</td></tr>
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</table>

Sample Activities

Level 2 Sample Tasks

When asked for summary statistics, MINITAB produced the following output:

Variable	N	Mean	SE Mean	StDev	Minimum	Q1	Median	Q3	Maximum
Damage	50	22.39	3.60	25.45	0.00	2.23	12.66	41.63	88.60

Give the five-number summary, and explain why you can see from these five numbers that the distribution is strongly skewed to the right.

The histogram suggests that there may be outliers. Use the 1.5 x IQR rule of thumb to show that no values in this distribution meet this criterion for outliers.

Level 3 Sample Tasks

A small company estimating its photocopying expenses finds that the mean number of copies made per day for the past 12 months is 258 copies per day with a standard deviation of 24 copies per day. Which of the following is a correct interpretation of standard deviation?

(a) The number of copies made per day was always between 234 and 282.
(b) About 95% of the time, the number of copies made per day was between 234 and 282.
(c) The difference between the mean number of copies made per day and the median number of copies made per day was 24.
(d) On average, the number of copies made each day was about 24 copies per day away from the mean, 258.
(e) 1.5 times the interquartile range of copies made per day is 24.

<table>
<tr><td colspan="3"></td></tr>
<tr><td colspan="3">Topic: Exploring Bivariate Data</td></tr>
<tr><td colspan="3">Grade: 12</td></tr>
<tr><td>Score 4.0</td><td colspan="2">In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.</td></tr>
<tr><td></td><td>3.5</td><td>In addition to score 3.0 performance, in-depth inferences and applications with partial success.</td></tr>
<tr><td>Score 3.0</td><td colspan="2">The student:
● Will analyze patterns in scatterplots
● Will explain how the correlation r is influenced by extreme observations.
● Will explain the concept of least squares.
● Will find the slope and intercept of the least-squares regression line from the means and standard deviations of x and y and their correlation.
● Will construct and interpret residual plots to assess if a linear model is appropriate.
● Will use coefficient of determination and standard deviation of the residuals to assess how well the line fits the data.
● For the slope of a population regression line
    ○ Will construct a confidence interval
    ○ Will perform a significance test
● Use transformations to achieve linearity for a relationship between two variables
The student exhibits no major errors or omissions.</td></tr>
<tr><td></td><td>2.5</td><td>No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content.</td></tr>
<tr><td>Score 2.0</td><td colspan="2">There are no major errors or omissions regarding the simpler details and processes as the student:
● Knows the basic properties of correlation
● Calculates and interprets correlation.
● Interprets the slope and y intercept of a least-squares regression line.
● Uses the least-squares regression line to predict y for a given x.
● Calculates and interprets residuals.
However, the student exhibits major errors or omissions regarding the more complex ideas and processes.</td></tr>
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<tr><td>Score 1.0</td><td colspan="2">With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.</td></tr>
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Sample Activities

Level 2 Sample Tasks:

In a statistics course, a linear regression equation was computed to predict the final-exam score from the score on the first test. The equation was $\hat{y} = 10 + 0.9x$ where y is the final exam score and x is the score on the first test. Carla scored 95 on the first test. What is the predicted value of her score on the final exam?

A set of data describes the relationship between the size of annual salary raises and the performance ratings for employees of a certain company. The least squares regression equation is $= 1400 + 2000x$ where y is the raise amount (in dollars) and x is the performance rating. Which of the following statements *must* be true?

(a) For each one-point increase in performance rating, the raise will increase on average by \$1400.
(b) The actual relationship between salary raises and performance rating is linear.
(c) The residuals for half the observations in the dataset will be positive.
(d) The correlation between salary raise and performance rating is negative.
(e) If the mean performance rating is 1.2, then the mean raise is \$3800.

Level 3 Sample Tasks:

One weekend, a statistician notices that some of the cars in his neighborhood are very clean and others are quite dirty. He decides to explore this phenomenon, and asks 15 of his neighbors how many times they wash their cars each year and how much they paid in car repair costs last year. His results are in the table below:

	Mean	Standard deviation
x = number of car washes per year	6.4	3.78
y = repairs costs for last year	$955.30	$323.50

The correlation for these to two variables is $r = -0.71$, and a scatterplot reveals a roughly linear relationship.

(a) Find the equation of the least-squares regression line (with y as the response variable).

(b) What percentage of the variation in repair costs can be explained by the number of times per year a car is washed?

(c) Based on these data, can we conclude that washing your car frequently will reduce repair costs? Explain.

Topic: Sampling and Experimentation		
Grade: 12		
Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**	
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.
Score 3.0	**The student:** ● Will explain how undercoverage, nonresponse, and question wording can lead to bias in a sample survey. ● Will explain how a lurking variable in an observational study can lead to confounding. ● Will explain why random assignment is an important experimental design principle. ● Will explain sources of bias and confounding, including placebo effect and blinding ● Will explain why random assignment is an important experimental design principle. ● Knows when a matched pairs experimental design is appropriate and how to implement such a design. ● Will determine the scope of inference for a statistical study. **The student exhibits no major errors or omissions.**	
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content.
Score 2.0	**There are no major errors or omissions regarding the simpler details and processes as the student:** ● Identifies the population and sample in a sample survey. ● Identifies voluntary response samples and convenience samples and explains how these bad sampling methods can lead to bias. ● Distinguishes a simple random sample from a stratified random sample or cluster sample; gives advantages & disadvantages of each sampling method ● Identifies the experimental units or subjects, explanatory variables (factors), treatments, and response variables in an experiment. ● Distinguishes between a completely randomized design and a randomized block design. **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**	
	1.5	Partial knowledge of the 2.0 content, but major errors or omissions regarding the 3.0 content.
Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**	
	0.5	With help, a partial understanding of the 2.0 content, but not the 3.0 content.
Score 0.0	**Even with help, no understanding or skill demonstrated.**	

Sample Activities

Level 2 Sample Tasks:

A member of Congress wants to know what his constituents (people from their district) think of proposed legislation on health insurance. His staff reports that 228 letters have been received on the subject, of which 193 oppose the legislation. What is the population in this situation?

a) The constituents.
b) The 228 letters received.
c) The 193 opposing the legislation.
d) Congress.
e) None of the above.

Identical twins are separated at birth to study the affects of socio-economics and family stability has on behavioral development, this is an example of which of the following?

a) Block
b) Multi-stage
c) Clustering
d) Stratified
e) Matched Pair

Level 3 Sample Tasks:

Turkeys raised commercially for food are often fed the antibiotic salinomycin to prevent infections from spreading among the birds. However, salinomycin can damage the birds' internal organs, especially the pancreas. A researcher believes that a combination of effects of two different dosages of selenium (call them S1 and S2) in combination with any of three different dosages of vitamin E (call them E1, E2, and E3) added to the turkeys' diets. There are 48 turkeys available for the study. At the end of the study, the birds will be killed and the condition of their pancreas examined with a microscope.

34. Describe (in detail) an appropriate design for this experiment.

Topic: Probability		
Grade: 12		
Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**	
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.
Score 3.0	**The student:** ● Will use simulation to model chance behavior. ● Will use the addition rule to determine probability ● Will use the multiplication rule to determine probability ● Will compute conditional probabilities. ● Will find the probability that an event occurs using a two-way table. **The student exhibits no major errors or omissions.**	
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content.
Score 2.0	**There are no major errors or omissions regarding the simpler details and processes as the student:** ● Interprets probability as a long-run relative frequency. ● Determines whether two events are independent **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**	
	1.5	Partial knowledge of the 2.0 content, but major errors or omissions regarding the 3.0 content.
Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**	
	0.5	With help, a partial understanding of the 2.0 content, but not the 3.0 content.
Score 0.0	**Even with help, no understanding or skill demonstrated.**	

Sample Activities

Level 2 Sample Tasks:

If the probability of milking a cow in your life is .0043, what is the probability of not milking a cow in your life?

Decide whether the events are independent or dependent.

a) Selecting a King from a standard deck of cards (A), **not replacing it**, and then selecting a queen (B).

b) Selecting a King from a standard deck of cards (A), **replacing it**, and then selecting a queen (B).

c) Practicing the piano (A) and then becoming a concert pianist (B).

Level 3 Sample Tasks:

Three cable channels have quiz shows, comedies, and dramas. The number of each is shown here.

If a show is selected at random, find these probabilities.

a) The show is a quiz show or it is shown on channel 8.

b) The show is a drama or comedy.

c) The show is shown on channel 10, or it is a drama.

Type of show	Channel 6	Channel 8	Channel 10
Quiz show	5	2	1
Comedy	3	2	8
Drama	4	4	2

Topic: Random Variables		
Grade: 12		
Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**	
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.
Score 3.0	**The student:** ● Will calculate and interpret the mean of a discrete random variable. ● Will find the mean and standard deviation of the sum or difference of independent random variables. ● Will determine whether two random variables are independent. ● Will find probabilities involving the sum or difference of independent Normal random variables. ● Will calculate and interpret probabilities involving binomial distributions. ● Will calculate and interpret the mean and standard deviation of a binomial random variable. ● Using tables of the Normal distribution ○ will calculate the proportion of values in a specified interval. ○ will determine a z-score from a percentile. ○ will find the percentile of a value from any Normal distribution ● Will use the 68-95-99.7 rule to assess Normality of a data set. **The student exhibits no major errors or omissions.**	
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content.
Score 2.0	**There are no major errors or omissions regarding the simpler details and processes as the student:** ● Uses a probability distribution to answer questions about possible values of a random variable. ● Describes the effects of transforming a random variable by adding or subtracting a constant and multiplying or dividing by a constant. ● Determines whether the conditions for a binomial random variable are met. ● Makes an appropriate graph to determine if a distribution is bell-shaped. **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**	
	1.5	Partial knowledge of the 2.0 content, but major errors or omissions regarding the 3.0 content.
Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**	
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Score 0.0	**Even with help, no understanding or skill demonstrated.**	

Sample Activities

Level 2 Sample Tasks:

Which of the following random variables should be considered continuous?

(a) The time it takes for a randomly chosen woman to run 100 meters
(b) The number of brothers a randomly chosen person has
(c) The number of cars owned by a randomly chosen adult male
(d) The number of orders received by a mail-order company in a randomly chosen week

Level 3 Sample Tasks:

The number of calories in a one-ounce serving of a certain breakfast cereal is a random variable with mean 110. The number of calories in a full cup of whole milk is a random variable with mean 140. For breakfast you eat one ounce of the cereal with 1/2 cup of whole milk. Let Z be the random variable that represents the total number of calories in this breakfast.

Determine the mean of Z.

Suppose that a discrete random variable X has the following mean and variance . Define the new random variable, Y, where Y = 3X + 1. Find the mean and standard deviation of the new random variable Y. Show all of your work.

Costco notes that 30% of its customers who buy Tide detergent make use of the store coupon to receive a discount. If 9 people purchase Tide, answer the following questions:
(a) What is the probability that 4 people used a coupon?
(b) What is the probability that no more than 5 people used the coupon?
(c) What is the probability that at least 2 people used the coupon?
(d) Out of the 9 customers, how many would you expect to use a coupon?

<table>
<tr><td colspan="3"></td></tr>
<tr><td colspan="3">Topic: Sampling Distributions</td></tr>
<tr><td colspan="3">Grade: 12</td></tr>
<tr><td>Score 4.0</td><td colspan="2">In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.</td></tr>
<tr><td></td><td>3.5</td><td>In addition to score 3.0 performance, in-depth inferences and applications with partial success.</td></tr>
<tr><td>Score 3.0</td><td colspan="2">The student:
Will use the central limit theorem to help find probabilities involving a sample mean.
Will find the mean and standard deviation of the sampling distribution of a sample mean from an SRS of size n.
Will calculate probabilities
involving a sample mean when the population distribution is Normal.
using the sampling distribution of two independent sample means
using Normal approximation
using the sampling distribution of two independent sample proportions
Will find the mean and standard deviation of the sampling distribution of a sample proportion for an SRS of size n from a population having proportion p of successes.
The student exhibits no major errors or omissions.</td></tr>
<tr><td></td><td>2.5</td><td>No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content.</td></tr>
<tr><td>Score 2.0</td><td colspan="2">There are no major errors or omissions regarding the simpler details and processes as the student:
Distinguishes between a parameter and a statistic.
Understands the definition of a sampling distribution.
Distinguishes between population distribution, sampling distribution, and the distribution of sample data.
Understands the relationship between sample size and the variability of an estimator.
Describes the characteristics of the sampling distribution of two independent sample means or proportions
Uses the sampling distribution of to evaluate a claim about a population proportion.
However, the student exhibits major errors or omissions regarding the more complex ideas and processes.</td></tr>
<tr><td></td><td>1.5</td><td>Partial knowledge of the 2.0 content, but major errors or omissions regarding the 3.0 content.</td></tr>
<tr><td>Score 1.0</td><td colspan="2">With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.</td></tr>
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</table>

Sample Activities

Level 2 Sample Tasks:

A phone-in poll conducted by a newspaper reported that 73% of those who called in liked business tycoon Donald Trump. The unknown true percentage of American citizens that like Donald Trump is a

A. statistics B. sample C. parameter D. population E. size

Which best describes a sampling distribution of a statistic?

A. It is the probability that the sample statistic equals the parameter of interest.

B. It is the probability distribution of all the values that are contained in all possible samples of the same size.

C. It is the distribution of all of the statistics calculated from all possible samples of the same size from the same population.

D. It is the histogram of sample statistics from all possible samples of the same size.

E. It is none of these.

Level 3 Sample Tasks:

A sample of size 49 is drawn from a normal population with a mean of 63 and a standard deviation of 14. What are the mean and standard deviation of the sampling distribution of sample means?

A study of college freshmen's study habits found that the time (in hours) that college freshmen use to study each week follows a normal distribution with a mean of 7.2 hours and a standard deviation of 5.3 hours.

a.) What is the mean of the sampling distribution of , for the average number of hours an SRS of 40 college freshmen spent studying?

b.) What is the standard deviation of ? Be sure to explain why you can use the formula for the standard deviation for in this setting.

c.) Check that you can use the normal approximation for the distribution.

d.) What is the probability that the average time spent studying of an SRS of 40 college freshmen is less than 5 hours each week?

	Topic: Estimation (means & proportions)	
	Grade: 12	
Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**	
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.
Score 3.0	**The student:** ● Will carry out the steps in constructing a confidence interval for a population proportion: define the parameter; check conditions; perform calculations; interpret results in context. ● Will determine the sample size required to obtain a level C confidence interval for a population proportion with a specified margin of error. ● Understands how the margin of error of a confidence interval changes with the sample size and the level of confidence C. ● Understands why each of the three inference conditions--Random, Normal, and Independent--is important. ● Will construct and interpret a confidence interval for a population mean, to compare two proportions and for the slope of the population regression line. ● Will recognize paired data and uses one-sample t procedures to perform significance tests for paired data. ● Will use two-sample t procedures to compare two means **The student exhibits no major errors or omissions.**	
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content.
Score 2.0	**There are no major errors or omissions regarding the simpler details and processes as the student:** ● Interprets a confidence level. ● Understands that a confidence interval gives a range of plausible values for the parameter and that it changes with changes in the sample and confidence interval ● Determines sample sizes required to obtain a level C confidence interval ● Interprets computer output from a least-squares regression analysis. **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**	
	1.5	Partial knowledge of the 2.0 content, but major errors or omissions regarding the 3.0 content.
Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**	
	0.5	With help, a partial understanding of the 2.0 content, but not the 3.0 content.
Score 0.0	**Even with help, no understanding or skill demonstrated.**	

Sample Activities

Level 2 Sample Tasks:

What is the critical value z* for a confidence level of 94%?

The number of accidents per day at a large factory is noted for each of 30 days with $\bar{x} = 4.21$ and $s = 2.3$. With what degree of confidence can we assert that the mean number of accidents per day at the factory is between 3.497 and 4.923?

Level 3 Sample Tasks:

Many television viewers express doubts about the validity of certain commercials. In an attempt to answer their critics, the Timex Corporation wishes to estimate the proportion of consumers who believe what is shown in Timex television commercials. Let p represent the true proportion of consumers who believe what is shown in Timex television commercials. If Timex has no prior information regarding the true value of p, how many consumers should be included in their sample so that they will be 95% confident that their estimate is within 0.04 of the true value of p?

Experimenters injected a growth hormone gene into thousands of carp eggs. Of the 400 carp that grew from these eggs, 20 incorporated the gene into their DNA. Calculate a 95% confidence interval for the proportion of carp that would incorporate the gene into their DNA.

Topic: Tests of significance (means & proportions)		
Grade: 12		
Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**	
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.
Score 3.0	**The student:** ● Will conduct a significance test about a population proportion and use a confidence interval to draw a conclusion. ● Will conduct a one-sample t test about a population mean and use a confidence interval to draw a conclusion. ● Will perform a significance test to compare two proportions and interpret the results. ● Will perform a significance test to compare two means and interpret the results. **The student exhibits no major errors or omissions.**	
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content.
Score 2.0	**There are no major errors or omissions regarding the simpler details and processes as the student:** ● Checks conditions for carrying out a test about a population proportion. ● Checks conditions for carrying out a test about a population mean. ● Checks conditions for using two-sample t procedures in a randomized experiment. **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**	
	1.5	Partial knowledge of the 2.0 content, but major errors or omissions regarding the 3.0 content.
Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**	
	0.5	With help, a partial understanding of the 2.0 content, but not the 3.0 content.
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Sample Activities

Sample Tasks:

Suppose a basketball player claimed to be an 80% free-throw shooter. To test this claim, we have him attempt 50 free-throws. He makes 32 of them. His sample proportion of made shots is 32/50 = 0.64. What can we conclude about the claim based on this sample data?

- What hypotheses do you want to test, and at what significance level? Define any parameters you use. **(Level 2)**
- Choose the appropriate inference method. Check conditions. **(Level 2)**
- If the conditions are met, perform calculations. **(Level 3)**
    - Compute the test statistic.
    - Find the P-value.

Level 3 Sample Tasks:

A potato-chip producer has just received a truckload of potatoes from its main supplier. If the producer determines that more than 8% of the potatoes in the shipment have blemishes, the truck will be sent away to get another load from the supplier. A supervisor selects a random sample of 500 potatoes from the truck. An inspection reveals that 47 of the potatoes have blemishes. Carry out a significance test at the $\alpha = 0.10$ significance level. What should the producer conclude?

Topic: Chi-Squared Hypothesis Testing & Test for Slope of a Least Squares Regression Line		
Grade:		
Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**	
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.
Score 3.0	**The student:** ● Will know how to compute expected counts, conditional distributions, and contributions to the chi-square statistic. ● Will use a chi-square goodness-of-fit test to determine whether sample data are consistent with a specified distribution of a categorical variable ● Will use a chi-square test for homogeneity to determine whether the distribution of a categorical variable differs for several populations or treatments. ● Will show that the two-sample z test for comparing two proportions and the chi-square test for a 2-by-2 two-way table give equivalent results. ● Will use a chi-square test of association/independence to determine whether there is convincing evidence of an association between two categorical variables. ● Will examine individual components of the chi-squared tests as part of a follow-up analysis. **The student exhibits no major errors or omissions.**	
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content.
Score 2.0	**There are no major errors or omissions regarding the simpler details and processes as the student:** ● Checks the Random, Large sample size, and Independent conditions before performing a chi-square test. ● Interprets computer output for a chi-square test based on a two-way table. **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**	
	1.5	Partial knowledge of the 2.0 content, but major errors or omissions regarding the 3.0 content.
Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**	
	0.5	With help, a partial understanding of the 2.0 content, but not the 3.0 content.
Score 0.0	**Even with help, no understanding or skill demonstrated.**	

Sample Activities

Level 2 Sample Tasks:

Are all employees equally prone to having accidents? To investigate this hypothesis, a researcher looked at a light manufacturing plant and classified the accidents by type and by age of the employee.

	Accident Type		
Age	Sprain	Burn	Cut
Under 25	9	17	5
25 or over	61	13	12

A chi-square test gave a test statistic of 20.78. If we test at a = 0.05

(a) there appears to be no association between accident type and age.

(b) age seems to be independent of accident type.

(c) accident type does not seem to be independent of age.

(d) there appears to be a 20.78% correlation between accident type and age.

(e) the proportion of sprain, cuts, and burns seems to be similar for both age classes.

Level 3 Sample Tasks:

The M&M/Mars Company reports that their Peanut M&M's$\hat{\text{O}}$ Chocolate Candies are produced in the following distribution: 20% each of browns, yellows, reds and blues, and 10% each of greens and oranges. Sam bought a bag of Peanut M&M's and counted out the following distribution of colors: 12 brown, 7 yellow, 4 red, 8 blue, 13 green and 2 orange. Perform a test of the company's reported distribution and report your results. Do a complete analysis, including all of the important steps.

<table>
<tr><th colspan="2">COLLEGE ALGEBRA
Course Overview</th></tr>
<tr><td>Grade level(s): 11, 12</td><td>Credits earned: 3</td></tr>
<tr><td>Course Rationale</td><td>Course Description</td></tr>
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2) A complete mathematical skill set.
3) An understanding of the real life applications of mathematics.</td></tr>
<tr><td colspan="2">Priority Missouri Learning Standards/National Standards</td></tr>
<tr><td colspan="2">From Missouri Higher Education Precalculus Algebra Standards:
1. Foundations of Functions
2. Analysis of Functions
3. Algebraic Reasoning</td></tr>
</table>

Unit 1: Equations and Inequalities

Desired Results

<table>
<tr><th>Standards</th><th colspan="2">Transfer Goal(s) /Big Ideas</th></tr>
<tr><td rowspan="3">From Missouri Higher Education Precalculus Algebra Standards:
III. Algebraic Reasoning:
Students will identify and apply algebraic reasoning to write equivalent expressions, solve equations and interpret inequalities.</td><td colspan="2">We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have:
1) Mathematical literacy.
2) A complete mathematical skill set.
3) An understanding of the real life applications of mathematics.</td></tr>
<tr><th>Enduring Understandings</th><th>Essential Questions</th></tr>
<tr><td>Students will understand that…
Polynomial equations and inequalities may be used to model and solve real world mathematical problems.</td><td>Students will consider…
How can we create and solve multi-step polynomial equations and inequalities that represent real world situations?</td></tr>
</table>

Learning Targets
Students will… ● *Interpret information from a graph.* ● *Graph equations in the rectangular coordinate system.* ● *Solve rational equations and inequalities in one variable.* ● *Solve a formula for a variable.* ● *Add, subtract, multiply, and divide complex numbers.* ● *Create and solve real world problems involving polynomial equations and inequalities.* ● *Solve quadratic equations by factoring, square root method, completing the square, and the quadratic formula.* ● *Use the discriminant to determine the number and type of solutions.* ● *Solve polynomial equations by factoring.* ● *Solve radical equations and equation involving rational exponents.* ● *Solve absolute value equations and inequalities.*
Unit Duration:
10-14 days

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Transfer Goals/Big Ideas	
We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have: *1) Mathematical literacy.* *2) A complete mathematical skill set.* *3) An understanding of the real life applications of mathematics.*	
Priority Missouri Learning Standards/National Standards	
From Missouri Higher Education Precalculus Algebra Standards: 1. Foundations of Functions 2. Analysis of Functions 3. Algebraic Reasoning	

Unit 2: Functions and Graphs
Desired Results

<table>
<tr><th>Standards</th><th colspan="2">Transfer Goal(s) /Big Ideas</th></tr>
<tr><td rowspan="3">From Missouri Higher Education Precalculus Algebra Standards:
I. Foundation of Functions
Students will use multiple representation of different function types to investigate quantities and describe relationships between quantities.

II. Analysis of Functions
Students will describe characteristics of different function types and convert between different representations and algebraic forms to analyze and solve meaningful problems.</td><td colspan="2">We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have:
1) Mathematical literacy.
2) A complete mathematical skill set.
3) An understanding of the real life applications of mathematics.</td></tr>
<tr><th>Enduring Understandings</th><th>Essential Questions</th></tr>
<tr><td>Students will understand that…
● Functions can be represented graphically and their key features can represent real-world applications.</td><td>Students will consider…
● What are the benefits of graphing functions?
● What applications do quadratic functions represent?</td></tr>
</table>

Learning Targets

Students will…

- Determine whether an equation represents a function.
- Identify the domain and range of a function.
- Identify intervals of increasing and decreasing on a function.
- Write the equation of a line given two points.
- Find a function's average rate of change.
- Graph linear, absolute value, quadratic, cubic, square root, and cube root functions and graph circles using transformations.
- Form composition functions.
- Compute and graph inverse functions.

Unit Duration:

8-10 days

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Transfer Goals/Big Ideas	
We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have: *1) Mathematical literacy.* *2) A complete mathematical skill set.* *3) An understanding of the real life applications of mathematics.*	
Priority Missouri Learning Standards/National Standards	
From Missouri Higher Education Precalculus Algebra Standards: 1. Foundations of Functions 2. Analysis of Functions 3. Algebraic Reasoning	

Unit 3: Polynomial and Rational Functions
Desired Results

<table>
<tr><th>Standards</th><th colspan="2">Transfer Goal(s) /Big Ideas</th></tr>
<tr><td rowspan="3">From Missouri Higher Education Precalculus Algebra Standards:
II. Analysis of Functions
Students will describe characteristics of different function types and convert between different representations and algebraic forms to analyze and solve meaningful problems.

III. Algebraic Reasoning:
Students will identify and apply algebraic reasoning to write equivalent expressions, solve equations and interpret inequalities.</td><td colspan="2">We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have:
1) Mathematical literacy.
2) A complete mathematical skill set.
3) An understanding of the real life applications of mathematics.</td></tr>
<tr><th>Enduring Understandings</th><th>Essential Questions</th></tr>
<tr><td>Students will understand that…
● Knowing the zeros of a polynomial functions will help you graph the polynomial function.
● The degree of a polynomial tells you the basic shape of its graph and the number of roots the equation has.</td><td>Students will consider…
● What applications do polynomials have?
● Why is it important to know how to graph polynomial equations?
● How are the factors, zeros, and x-intercepts of a polynomials function related?
● What can the zeros of a polynomial functions represent in real-world applications?</td></tr>
</table>

Learning Targets
Students will… ● Graph parabolas. ● Solve problems involving a quadratic function's minimum or maximum value. ● Identify polynomial functions. ● Determine end behavior of a polynomial function. ● Graph polynomial functions by factoring. ● Use long division and synthetic division to divide polynomials. ● Apply the Remainder Theorem. ● Use the Rational Zero Theorem to find possible rational zeros. ● Find the zeros of a polynomial function. ● Solve polynomial equations. ● Graph rational functions.
Unit Duration:
9-11 days

COLLEGE ALGEBRA *Course Overview*	
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Transfer Goals/Big Ideas	
We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have: *1) Mathematical literacy.* *2) A complete mathematical skill set.* *3) An understanding of the real life applications of mathematics.*	
Priority Missouri Learning Standards/National Standards	
From Missouri Higher Education Precalculus Algebra Standards: 1. Foundations of Functions 2. Analysis of Functions 3. Algebraic Reasoning	

Unit 4: Exponential and Logarithmic Functions
Desired Results

<table>
<tr><th>Standards</th><th colspan="2">Transfer Goal(s) /Big Ideas</th></tr>
<tr><td rowspan="3">From Missouri Higher Education Precalculus Algebra Standards:

II. Analysis of Functions
Students will describe characteristics of different function types and convert between different representations and algebraic forms to analyze and solve meaningful problems.

III. Algebraic Reasoning:
Students will identify and apply algebraic reasoning to write equivalent expressions, solve equations and interpret inequalities.</td><td colspan="2">From Missouri Higher Education Precalculus Algebra Standards:
1. Foundations of Functions
2. Analysis of Functions
3. Algebraic Reasoning</td></tr>
<tr><th>Enduring Understandings</th><th>Essential Questions</th></tr>
<tr><td>Students will understand that…
● You can use logarithms to solve exponential equations and you can use exponents to solve logarithmic equations.
● The equations $y = b^x$ and $y = log_b x$ are inverse functions.</td><td>Students will consider…
● What applications to exponential and logarithmic equations have?
● How are exponential and logarithmic equations similar? What do they have in common? How are they related?</td></tr>
</table>

Learning Targets
Students will… ● Evaluate and graph exponential and logarithmic functions. ● Use compound interest formulas. ● Change from logarithmic to exponential form. ● Change from exponential to logarithmic form. ● Use basic logarithmic properties. ● Find the domain of a logarithmic function. ● Expand and condense logarithmic expressions. ● Use the change-of-base property. ● Solve exponential and logarithmic equations. ● Model exponential growth and decay.
Unit Duration:
6-8 days

COLLEGE ALGEBRA
Course Overview

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Transfer Goals/Big Ideas

We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have:

1) Mathematical literacy.

2) A complete mathematical skill set.

3) An understanding of the real life applications of mathematics.

Priority Missouri Learning Standards/National Standards

From Missouri Higher Education Precalculus Algebra Standards:

1. Foundations of Functions
2. Analysis of Functions
3. Algebraic Reasoning

Unit 5: Trigonometric Functions

Desired Results

Standards

From Missouri Department of Education Learning Standards (Specifically recommended topics additional to Algebra 2):

- *Using a unit circle, create the functions f(t) = sin(t) and g(t) = cos(t) to define the position of a point on the circle, at time t. Graph these functions in the Cartesian coordinate plane, and define and explore amplitude, period and midline.*
- *Use parameter changes to amplitude, period, midline and phase shift to model real-world contexts. Use the form f(t) = A sin(B(t+h)) + k and explain how to determine each of the parameters A, B, h and k.*

Transfer Goal(s) /Big Ideas

We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have:
1) Mathematical literacy.
2) A complete mathematical skill set.
3) An understanding of the real life applications of mathematics.

Enduring Understandings

Students will understand that…

- Trigonometric functions can be used to solve right triangles.
- Values of trigonometric functions can be found for any angles and converted between units of angle measure.
- Trigonometric functions and their inverses are graphable and transformable.

Essential Questions

Students will consider…

- How can a situation be modeled and represented using fundamental trigonometric properties?
- Why is it necessary to have more than one method of angle measurement and when is it appropriate to use one versus the other?
- What is the benefit of graphically representing trigonometric functions?
- Why do the graphs of trigonometric functions adhere so well to so many fundamental scientific concepts?

Learning Targets
Students will… ● Find values of trigonometric functions for acute angles of right triangles. ● Solve right triangles. ● Convert degree measures of angles to radian measures and vice versa. ● Use angle measures and technology to solve real world problems. ● Find values of trigonometric functions for any angle. ● Find values of trigonometric functions using the unit circle. ● Graph transformations of the Sine and Cosine functions by hand and using technology. ● Use sinusoidal functions and technology to solve theoretical and real world problems. ● Graph tangent and reciprocal trigonometric functions. ● Evaluate and graph inverse trigonometric functions. ● Find compositions of trigonometric functions.
Unit Duration: 8-10 days

COLLEGE ALGEBRA
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Transfer Goals/Big Ideas

We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have:

1) Mathematical literacy.

2) A complete mathematical skill set.

3) An understanding of the real life applications of mathematics.

Priority Missouri Learning Standards/National Standards

From Missouri Higher Education Precalculus Algebra Standards:

1. Foundations of Functions
2. Analysis of Functions
3. Algebraic Reasoning

Unit 6: Analytic Trigonometry

Desired Results

<table>
<tr><th rowspan="1">Standards</th><th colspan="2">Transfer Goal(s) /Big Ideas</th></tr>
<tr><td rowspan="4">From Missouri Department of Education Learning Standards (Specifically recommended topics additional to Algebra 2):
● Solve equations involving trigonometric functions
● Solve problems using trigonometric identities.</td><td colspan="2">We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have:
1) Mathematical literacy.
2) A complete mathematical skill set.
3) An understanding of the real life applications of mathematics.</td></tr>
<tr><th>Enduring Understandings</th><th>Essential Questions</th></tr>
<tr><td>Students will understand that…
● Trigonometric identities can be used to simplify complex problems and verify meaningful results.
● Trigonometric equations can be solved using multiple strategies, including technology.
● Sum and difference identities can be used to evaluate trigonometric expressions and solve equations.</td><td>Students will consider…
● What is the appropriate identity to use in a given situation?
● What strategies can be employed to arrive at equations which are solvable?
● How are real world scenarios able to be modelled and subsequently solved using trigonometric identities?</td></tr>
</table>

Learning Targets
Students will… ● *Identify and use basic trigonometric identities to find trigonometric values.* ● *Use basic trigonometric identities to simplify and rewrite trigonometric expressions.* ● *Verify trigonometric identities.* ● *Determine whether equations are identities.* ● *Solve trigonometric equations using algebraic techniques and basic identities.* ● *Use sum and difference identities to evaluate trigonometric functions.* ● *Use sum and difference identities to solve trigonometric equations.* ● *Use double-angle, power-reducing, and half-angle identities to evaluate trigonometric expressions and solve trigonometric equations.* ● *Use product to sum identities to evaluate trigonometric expressions and solve trigonometric equations.*
Unit Duration: 8-10 days

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Transfer Goals/Big Ideas	
We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have: *1) Mathematical literacy.* *2) A complete mathematical skill set.* *3) An understanding of the real life applications of mathematics.*	
Priority Missouri Learning Standards/National Standards	
From Missouri Higher Education Precalculus Algebra Standards: 1. Foundations of Functions 2. Analysis of Functions 3. Algebraic Reasoning	

Unit 7: Additional Topics in Trigonometry

Desired Results

Standards	**Transfer Goal(s) /Big Ideas**	
From Missouri Department of Education Learning Standards (GLE's) (Specifically recommended topics additional to Algebra 2): ● *Solve problems using Law of Sines and Law of Cosines.* ● *Graph using polar coordinates*	*We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have:* *1) Mathematical literacy.* *2) A complete mathematical skill set.* *3) An understanding of the real life applications of mathematics.*	
	Enduring Understandings	**Essential Questions**
	Students will understand that… ● Trigonometric functions can be used to solve obliques triangles. ● Equations can be modeled beyond just the cartesian (rectangular) system in a polar system defined by trigonometric associations. ● Several techniques can be employed to convert between rectangular and polar systems.	*Students will consider…* ● When is it necessary to use Law of Sines and Law of Cosines? ● How can the Law of Sines and the Law of Cosines be used along with technology to model and solve real world problems? ● Why do certain characteristics of polar graphs produce certain results and how can these understandings be used to model real world situations? ● What is the value in converting between a rectangular and polar system? How does this enhance one's understanding of math?

Learning Targets
Students will… ● Solve oblique triangles by using the Law of Sines and the Law of Cosines. ● Find area of oblique triangles. ● Graph polar coordinates and equations. ● Convert between polar and rectangular coordinates and equations. ● Identify polar equations of conic sections. ● Convert complex numbers between polar and rectangular forms.
Unit Duration: 8-10 days

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Transfer Goals/Big Ideas

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1) Mathematical literacy.

2) A complete mathematical skill set.

3) An understanding of the real life applications of mathematics.

Priority Missouri Learning Standards/National Standards

From Missouri Higher Education Precalculus Algebra Standards:

1. Foundations of Functions
2. Analysis of Functions
3. Algebraic Reasoning

Unit 8: Systems of Equations and Inequalities
Desired Results

<table>
<tr><th rowspan="4">Standards</th><th colspan="2">Transfer Goal(s) /Big Ideas</th></tr>
</table>

Standards	Transfer Goal(s) /Big Ideas	
From Missouri Higher Education Precalculus Algebra Standards: 3. Algebraic Reasoning • *Set up and solve systems of equations.* • *Graph systems of inequalities.*	*We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have:* *1) Mathematical literacy.* *2) A complete mathematical skill set.* *3) An understanding of the real life applications of mathematics.*	
	Enduring Understandings	**Essential Questions**
	Students will understand that… • *Systems of equations and inequalities may be solved by multiple methods with both single, infinite, and no solution outcomes.* • *Many real world situations fit conveniently into a system of equations and/or inequalities format, which makes it a useful means of solving relevant problems.* • *Similar to how fractions can be combined together they can also be decomposed, or separated into smaller components.* • *Linear Optimization provides a mathematically precise means for determining the most and least desirable outcome for many relevant scenarios.*	*Students will consider…* • *What are the strategies for defining a system or equations or inequalities?* • *What is the benefit of separating a rational function into the sum of several rational functions?* • *In what situations can you envision yourself utilizing optimization techniques?*

Learning Targets
Students will… ● Solve 2 and 3 variable linear systems by substitution and elimination. ● Identify systems that do not have exactly one solution. ● Solve real world problems involving systems in 2 and 3 variables and using technology. ● Decompose P(x)/Q(x) where Q(x) has distinct and repeated linear factors and where Q(x) has both repeated and non-repeated prime quadratic factors. ● Recognize and solve systems of nonlinear equations in two variables by addition and substitution. ● Graph linear and nonlinear inequalities in 2 variables. ● Use mathematical models involving linear inequalities. ● Graph systems of inequalities. ● Write objective functions describing a quantity that must be maximized or minimized. ● Use inequalities to describe limitations of a situation. ● Use linear programming in conjunction with technology to solve problems.
Unit Duration: 8-10 days

COLLEGE ALGEBRA
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Transfer Goals/Big Ideas

We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have:

1) Mathematical literacy.

2) A complete mathematical skill set.

3) An understanding of the real life applications of mathematics.

Priority Missouri Learning Standards/National Standards

From Missouri Higher Education Precalculus Algebra Standards:

1. Foundations of Functions
2. Analysis of Functions
3. Algebraic Reasoning

Unit 9: MATRICES & DETERMINANTS

Desired Results

Standards

From Missouri Higher Education Precalculus Algebra Standards:

3. Algebraic Reasoning

Use matrices to solve systems of linear equations.

Transfer Goal(s) /Big Ideas

We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have:
1) Mathematical literacy.
2) A complete mathematical skill set.
3) An understanding of the real life applications of mathematics.

Enduring Understandings

Students will understand that…

- There are various ways to use matrices to solve systems of equations, including Gaussian elimination, Gauss-Jordan elimination, inverses, and Cramer's Rule.
- If Gaussian or Gauss-Jordan elimination results in a row of zeros, the system has infinitely many solutions.
- If Gaussian or Gauss-Jordan elimination results in a row of zeros on the left of the vertical line and a nonzero number on the right, the system has no solution.
- Matrices can only be added and subtracted if they have the same dimensions.
- Matrices can only be multiplied when the first matrix has the same number of columns as the number of rows of the second matrix. The resulting matrix has the same number of rows as the first matrix and columns of the second matrix.
- Multiplication of matrices is not commutative.
- Only square matrices have multiplicative inverses, but not every square matrix is invertible.

Essential Questions

Students will consider…

When are two matrices equal?
When can matrices not be added, subtracted, or multiplied?
What can the determinant tell you about a matrix and its correlating system of equations?
How can you tell if two matrices are inverses of each other?

Learning Targets
Students will… ● Use Gaussian and Gauss-Jordan elimination to solve systems, including systems with infinitely many and no solutions. ● Perform operations with matrices. ● Find the determinants and inverses of a 2x2 and a 3x3 matrices ● Solve a linear system of equations using inverses matrices. ● Solve a linear system of equations using Cramer's Rule. ● Model applied situations with matrix operations.
Unit Duration:
8-10 days

COLLEGE ALGEBRA

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Transfer Goals/Big Ideas

We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have:

1) Mathematical literacy.

2) A complete mathematical skill set.

3) An understanding of the real life applications of mathematics.

Priority Missouri Learning Standards/National Standards

From Missouri Higher Education Precalculus Algebra Standards:

1. Foundations of Functions
2. Analysis of Functions
3. Algebraic Reasoning

Unit 10: Conic Sections & Analytic Geometry

Desired Results

Standards

From Missouri Higher Education Precalculus Algebra Standards:

2. Analysis of Functions
Create, use and interpret polynomial, power and rational functions.

3. Algebraic Reasoning
Use rational exponents to express and simplify a variety of expressions and solve equations.

Transfer Goal(s) /Big Ideas

We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have:
1) Mathematical literacy.
2) A complete mathematical skill set.
3) An understanding of the real life applications of mathematics.

Enduring Understandings

Students will understand that…

- Conic sections are used in a variety of construction and scientific applications such as bridge design, planetary and satellite orbits, mirrors, navigation and arches.
- The angle or direction you cut through a cone determines the type of conic you will get.

Essential Questions

Students will consider…

- How can conic sections be developed?
- What are the applications of each conic section?
- What are the similarities and differences between the four types of conic sections?

Learning Targets

Students will…
Analyze and graph ellipses, hyperbolas, parabolas, and circles on the rectangular.
Write equations of ellipses, hyperbolas, parabolas, and circles in standard form.
Solve applied problems involving ellipses, hyperbolas, parabolas, and circles.

Unit Duration:

8-10 days

<table>
<tr><th colspan="2">COLLEGE ALGEBRA
Course Overview</th></tr>
<tr><td>Grade level(s): 11, 12</td><td>Credits earned: 3</td></tr>
<tr><td>Course Rationale</td><td>Course Description</td></tr>
<tr><td>College Algebra is a course that includes algebra and trigonometry at a level which grants students the possibility to earn college credit.</td><td>College Algebra is a college-level course analyzing and solving polynomial, exponential, logarithmic, rational, piecewise and absolute value functions, including but not limited to transformations, operations, compositions, and inverses. Other topics consist of rates of change, systems of equations and inequalities, matrix operations, and applications of discussed topics.</td></tr>
<tr><td colspan="2">Transfer Goals/Big Ideas</td></tr>
<tr><td colspan="2">We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have:
1) Mathematical literacy.
2) A complete mathematical skill set.
3) An understanding of the real life applications of mathematics.</td></tr>
<tr><td colspan="2">Priority Missouri Learning Standards/National Standards</td></tr>
<tr><td colspan="2">From Missouri Higher Education Precalculus Algebra Standards:
1. Foundations of Functions
2. Analysis of Functions
3. Algebraic Reasoning</td></tr>
</table>

Unit 11: Sequences, Induction, and Probability

Desired Results

<table>
<tr><th>Standards</th><th colspan="2">Transfer Goal(s) /Big Ideas</th></tr>
<tr><td rowspan="3">From DESE Missouri Learning Standards
A.LQE.B
G.CP.A</td><td colspan="2">We will use critical thinking, perseverance, collaboration, problem-solving, and communication, to ensure that students have:
1) Mathematical literacy.
2) A complete mathematical skill set.
3) An understanding of the real life applications of mathematics.</td></tr>
<tr><th>Enduring Understandings</th><th>Essential Questions</th></tr>
<tr><td>Students will understand that…
Once the pattern of a sequence is identified, it can be used to extend the sequence.
Some sequences can be modeled with an explicit formula that can be used to find any term of the sequence.
In an arithmetic sequence, the difference of any term to its preceding term is a constant.
In a geometric sequence, the ratio of any term to its preceding term is a constant.
Sequences and series can be used to model real-life situations.
Mathematical patterns can help simplify complex situations.
Permutations and combinations can be used in conjunction with other probability methods to calculate probabilities of compound events and solve problems.</td><td>Students will consider…
Why is a sequence a function?
How can you tell the difference between an arithmetic and geometric sequence?
How can you use sequences and series to solve real life problems?
What are the advantages and disadvantages of a recursive rule compared to an explicit rule?
How can different calculations with an arithmetic or geometric sequence be used in the real world?
Why would we need to find the sum of an infinite series?
How is mathematical induction used to prove statements and rules true?
What are similarities and differences between using Pascal’s triangle versus Binomial theorem?
What is the difference between combinations and permutations?
When can the Fundamental Counting Principle be applied?</td></tr>
</table>

Learning Targets
Students will… Identify and create arithmetic and geometric sequences and series. Write and use a recursive rule for both arithmetic and geometric sequences. Write and use an explicit rule for both arithmetic and geometric sequences. Find the sum of arithmetic and geometric series. Use factorial notation and summation notation. Use arithmetic and geometric sequences to model and solve real-life problems. Use mathematical induction to prove statements. Use the Binomial Theorem and Pascal's Triangle to find binomial coefficients. Use binomial coefficients to write binomial expansions. Use the Fundamental Counting Principle. Use the permutations and combinations formulas. Find the probability of events.
Unit Duration:
8-10 days

STRAND 1: EQUATIONS & INEQUALITIES

Topic 1: Solving Equations and Inequalities

<table>
<tr><td colspan="4" align="center">Grade: 11-12</td></tr>
<tr><td>Score 4.0</td><td colspan="2" align="center">In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.</td><td align="center">Sample Activities</td></tr>
<tr><td></td><td>3.5</td><td>In addition to score 3.0 performance, in-depth inferences and applications with partial success.</td><td></td></tr>
<tr><td>Score 3.0</td><td colspan="2">The student:
Solve rational, radical, polynomial, and absolute value equations and inequalities in one variable.
Solve a formula for a variable.
Create and solve real world problems involving polynomial equations and inequalities.
Solve quadratic equations by factoring, square root method, completing the square, and the quadratic formula.
The student exhibits no major errors or omissions.</td><td></td></tr>
<tr><td></td><td>2.5</td><td>No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content.</td><td></td></tr>
<tr><td>Score 2.0</td><td colspan="2">There are no major errors or omissions regarding the simpler details and processes as the student completes the concepts in level 3.0.
However, the student exhibits major errors or omissions regarding the more complex ideas and processes.</td><td></td></tr>
<tr><td></td><td>1.5</td><td>Partial knowledge of the 2.0 content, but major errors or omissions regarding the 3.0 content.</td><td rowspan="4"></td></tr>
<tr><td>Score 1.0</td><td colspan="2">With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.</td></tr>
<tr><td></td><td>0.5</td><td>With help, a partial understanding of the 2.0 content, but not the 3.0 content.</td></tr>
<tr><td>Score 0.0</td><td colspan="2">Even with help, no understanding or skill demonstrated.</td></tr>
</table>

STRAND 1: EQUATIONS & INEQUALITIES			
Topic 2: Graphing Equations and Inequalities			
Grade: 11-12			
Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**		**Sample Activities**
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Score 3.0	**The student:** ● *Interpret information from a graph.* ● *Graph equations in the rectangular coordinate system.* **The student exhibits no major errors or omissions.**		
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content.	
Score 2.0	**There are no major errors or omissions regarding the simpler details and processes as the student completes the concepts in level 3.0.** **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**		
	1.5	Partial knowledge of the 2.0 content, but major errors or omissions regarding the 3.0 content.	
Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**		
	0.5	With help, a partial understanding of the 2.0 content, but not the 3.0 content.	
Score 0.0	**Even with help, no understanding or skill demonstrated.**		

STRAND 1: EQUATIONS & INEQUALITIES			
Topic 3: Writing Equations and Inequalities			
Grade: 11-12			
Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**		**Sample Activities**
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Score 3.0	**The student:** ● *Create and solve real world problems involving polynomial equations and inequalities.* **The student exhibits no major errors or omissions.**		
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content.	
Score 2.0	**There are no major errors or omissions regarding the simpler details and processes as the student:** **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**		
	1.5	Partial knowledge of the 2.0 content, but major errors or omissions regarding the 3.0 content.	
Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**		
	0.5	With help, a partial understanding of the 2.0 content, but not the 3.0 content.	
Score 0.0	**Even with help, no understanding or skill demonstrated.**		

STRAND 2: FUNCTIONS AND GRAPHS			
Topic 4: Functions			
Grade: 11-12			
Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**		**Sample Activities**
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Score 3.0	**The student:** • Determine whether an equation represents a function. • Identify the domain and range of a function. • Identify intervals of increasing and decreasing on a function. **The student exhibits no major errors or omissions.**		
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content.	
Score 2.0	**There are no major errors or omissions regarding the simpler details and processes as the student completes the concepts in level 3.0.** **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**		
	1.5	Partial knowledge of the 2.0 content, but major errors or omissions regarding the 3.0 content.	
Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**		
	0.5	With help, a partial understanding of the 2.0 content, but not the 3.0 content.	
Score 0.0	**Even with help, no understanding or skill demonstrated.**		

STRAND 2: FUNCTIONS AND GRAPHS			
Topic 5: Graphing Various Functions			
Grade: 11-12			
Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**		**Sample Activities**
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Score 3.0	**The student:** ● Graph linear, absolute value, quadratic, cubic, square root, and cube root functions and graph circles using transformations. ● Graph inverse functions. **The student exhibits no major errors or omissions.**		
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content.	
Score 2.0	**There are no major errors or omissions regarding the simpler details and processes as the student completes the concepts in level 3.0.** **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**		
	1.5	Partial knowledge of the 2.0 content, but major errors or omissions regarding the 3.0 content.	
Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**		
	0.5	With help, a partial understanding of the 2.0 content, but not the 3.0 content.	
Score 0.0	**Even with help, no understanding or skill demonstrated.**		

<table>
<tr><th colspan="4">STRAND 2: FUNCTIONS AND GRAPHS</th></tr>
<tr><td colspan="4">Topic 6: Writing Various Functions</td></tr>
<tr><td colspan="4">Grade: 11-12</td></tr>
<tr><td>Score 4.0</td><td colspan="2">In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.</td><td>Sample Activities</td></tr>
<tr><td></td><td>3.5</td><td>In addition to score 3.0 performance, in-depth inferences and applications with partial success.</td><td></td></tr>
<tr><td>Score 3.0</td><td colspan="2">The student:
● Write the equation of a line given two points.
● Find a function’s average rate of change.
● Form composition functions.
● Compute inverse functions.
The student exhibits no major errors or omissions.</td><td></td></tr>
<tr><td></td><td>2.5</td><td>No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content.</td><td></td></tr>
<tr><td>Score 2.0</td><td colspan="2">There are no major errors or omissions regarding the simpler details and processes as the student completes the concepts in level 3.0.
However, the student exhibits major errors or omissions regarding the more complex ideas and processes.</td><td></td></tr>
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<tr><td>Score 0.0</td><td colspan="2">Even with help, no understanding or skill demonstrated.</td><td></td></tr>
</table>

STRAND 3: POLYNOMIALS AND RATIONALS			
Topic 7: Solving Polynomial and Rational Functions			
Grade: 11-12			
Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**		**Sample Activities**
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Score 3.0	**The student:** ● Solve problems involving a quadratic function's minimum or maximum value. ● Use long division and synthetic division to divide polynomials. ● Apply the Remainder Theorem. ● Use the Rational Zero Theorem to find possible rational zeros. ● Find the zeros of a polynomial function. ● Solve polynomial equations. **The student exhibits no major errors or omissions.**		
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content.	
Score 2.0	**There are no major errors or omissions regarding the simpler details and processes as the student completes the concepts in level 3.0.** **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**		
	1.5	Partial knowledge of the 2.0 content, but major errors or omissions regarding the 3.0 content.	
Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**		
	0.5	With help, a partial understanding of the 2.0 content, but not the 3.0 content.	
Score 0.0	**Even with help, no understanding or skill demonstrated.**		

STRAND 3: POLYNOMIALS AND RATIONALS			
Topic 8: Graphing Polynomial and Rational Functions			
Grade: 11-12			
Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**		**Sample Activities**
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Score 3.0	**The student:** ● Graph quadratic functions. ● Graph polynomial functions by factoring. ● Graph rational functions. **The student exhibits no major errors or omissions.**		
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content.	
Score 2.0	**There are no major errors or omissions regarding the simpler details and processes as the student completes the concepts in level 3.0.** **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**		
	1.5	Partial knowledge of the 2.0 content, but major errors or omissions regarding the 3.0 content.	
Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**		
	0.5	With help, a partial understanding of the 2.0 content, but not the 3.0 content.	
Score 0.0	**Even with help, no understanding or skill demonstrated.**		

STRAND 4: LOGARITHMIC AND EXPONENTIAL FUNCTIONS

Topic 9: Properties of Logarithms and Exponentials

<table>
<tr><td colspan="4" align="center">Grade: 11-12</td></tr>
<tr><td>Score 4.0</td><td colspan="2">In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.</td><td>Sample Activities</td></tr>
<tr><td></td><td>3.5</td><td>In addition to score 3.0 performance, in-depth inferences and applications with partial success.</td><td></td></tr>
<tr><td>Score 3.0</td><td colspan="2">The student:
● Evaluate exponential and logarithmic expressions.
● Use basic logarithmic properties.
● Expand and condense logarithmic expressions.
● Use the change-of-base property.
The student exhibits no major errors or omissions.</td><td></td></tr>
<tr><td></td><td>2.5</td><td>No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content.</td><td></td></tr>
<tr><td>Score 2.0</td><td colspan="2">There are no major errors or omissions regarding the simpler details and processes as the student completes the concepts in level 3.0.
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<tr><td>Score 0.0</td><td colspan="2">Even with help, no understanding or skill demonstrated.</td></tr>
</table>

STRAND 4: LOGARITHMIC AND EXPONENTIAL FUNCTIONS			
Topic 10: Solving Logarithmic and Exponential Functions			
Grade: 11-12			
Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**		**Sample Activities**
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Score 3.0	**The student:** ● Solve exponential and logarithmic equations. ● Model exponential growth and decay. **The student exhibits no major errors or omissions.**		
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content.	
Score 2.0	**There are no major errors or omissions regarding the simpler details and processes as the student completes the concepts in level 3.0.** **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**		
	1.5	Partial knowledge of the 2.0 content, but major errors or omissions regarding the 3.0 content.	
Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**		
	0.5	With help, a partial understanding of the 2.0 content, but not the 3.0 content.	
Score 0.0	**Even with help, no understanding or skill demonstrated.**		

STRAND 4: LOGARITHMIC AND EXPONENTIAL FUNCTIONS			
Topic 11: Graphing Logarithmic and Exponential Functions			
Grade: 11-12			
Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**		**Sample Activities**
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Score 3.0	**The student:** ● Graph exponential and logarithmic functions. ● Find the domain and range of a logarithmic function. ● Model and interpret exponential growth and decay. **The student exhibits no major errors or omissions.**		
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content.	
Score 2.0	**There are no major errors or omissions regarding the simpler details and processes as the student completes the concepts in level 3.0.** **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**		
	1.5	Partial knowledge of the 2.0 content, but major errors or omissions regarding the 3.0 content.	
Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**		
	0.5	With help, a partial understanding of the 2.0 content, but not the 3.0 content.	
Score 0.0	**Even with help, no understanding or skill demonstrated.**		

STRAND 5: TRIGONOMETRIC FUNCTIONS

Topic 12: Trigonometric Functions

Level: College Algebra			
Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**		**Sample Activities**
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Score 3.0	**The student will:** ● Solve right triangles. ● Use angle measures and technology to solve real world problems. ● Find values of trigonometric functions for any angle, including angles on the unit circle. ● Find compositions of trigonometric functions. **The student exhibits no major errors or omissions.**		
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content.	
Score 2.0	**There are no major errors or omissions regarding the simpler details and processes as the student:** **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**		
	1.5	Partial knowledge of the 2.0 content, but major errors or omissions regarding the 3.0 content.	
Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**		
	0.5	With help, a partial understanding of the 2.0 content, but not the 3.0 content.	
Score 0.0	**Even with help, no understanding or skill demonstrated.**		

UNIT 5: TRIGONOMETRIC FUNCTIONS

Topic 13: Graphing Trigonometric Functions

<table>
<tr><th colspan="4">Level: College Algebra</th></tr>
<tr><td>Score 4.0</td><td colspan="2">In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.</td><td></td></tr>
<tr><td></td><td>3.5</td><td>In addition to score 3.0 performance, in-depth inferences and applications with partial success.</td><td></td></tr>
<tr><td>Score 3.0</td><td colspan="2">The student will:
● Graph transformations of the Sine and Cosine functions by hand and using technology.
● Use sinusoidal functions and technology to solve theoretical and real world problems.
● Graph tangent and reciprocal trigonometric functions.
● Evaluate and graph inverse trigonometric functions.
The student exhibits no major errors or omissions.</td><td></td></tr>
<tr><td></td><td>2.5</td><td>No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content.</td><td></td></tr>
<tr><td>Score 2.0</td><td colspan="2">There are no major errors or omissions regarding the simpler details and processes as the student:

However, the student exhibits major errors or omissions regarding the more complex ideas and processes.</td><td></td></tr>
<tr><td></td><td>1.5</td><td>Partial knowledge of the 2.0 content, but major errors or omissions regarding the 3.0 content.</td><td></td></tr>
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<tr><td>Score 0.0</td><td colspan="2">Even with help, no understanding or skill demonstrated.</td><td></td></tr>
</table>

STRAND 6: ANALYTIC TRIGONOMETRY			
Topic 14: Trigonometric Identities			
	Level: College Algebra		
Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**		
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Score 3.0	**The student will:** • *Use basic trigonometric identities to evaluate and simplify trigonometric expressions.* • *Verify trigonometric identities.* • *Use sum and difference, double-angle, power-reducing, half-angle, and product to sum identities to evaluate trigonometric expressions.* **The student exhibits no major errors or omissions.**		
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content.	
Score 2.0	**There are no major errors or omissions regarding the simpler details and processes as the student:** **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**		
	1.5	Partial knowledge of the 2.0 content, but major errors or omissions regarding the 3.0 content.	
Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**		
	0.5	With help, a partial understanding of the 2.0 content, but not the 3.0 content.	
Score 0.0	**Even with help, no understanding or skill demonstrated.**		

STRAND 6: ANALYTIC TRIGONOMETRY

Topic 15: Trigonometric Equations

Level: College Algebra			
Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**		
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Score 3.0	**The student will:** ● *Solve trigonometric equations using algebraic techniques and various trigonometric identities.* **The student exhibits no major errors or omissions.**		
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content.	
Score 2.0	**There are no major errors or omissions regarding the simpler details and processes as the student:** **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**		
	1.5	Partial knowledge of the 2.0 content, but major errors or omissions regarding the 3.0 content.	
Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**		
	0.5	With help, a partial understanding of the 2.0 content, but not the 3.0 content.	
Score 0.0	**Even with help, no understanding or skill demonstrated.**		

STRAND 7: ADDITIONAL TOPICS IN TRIGONOMETRY			
Topic 16: Oblique Triangles			
Grade: 11-12			
Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**		**Sample Activities**
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Score 3.0	**The student:** ● Solve oblique triangles by using the Law of Sines and the Law of Cosines. ● Find area of oblique triangles. **The student exhibits no major errors or omissions.**		
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content.	
Score 2.0	**There are no major errors or omissions regarding the simpler details and processes as the student completes the concepts in level 3.0.** **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**		
	1.5	Partial knowledge of the 2.0 content, but major errors or omissions regarding the 3.0 content.	
Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**		
	0.5	With help, a partial understanding of the 2.0 content, but not the 3.0 content.	
Score 0.0	**Even with help, no understanding or skill demonstrated.**		

STRAND 7: ADDITIONAL TOPICS IN TRIGONOMETRY

Topic 17: Polar Coordinates

Grade: 11-12			
Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**		**Sample Activities**
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Score 3.0	**The student:** ● Graph polar coordinates and equations. ● Convert between polar and rectangular coordinates and equations. ● Identify polar equations of conic sections. ● Convert complex numbers between polar and rectangular forms. **The student exhibits no major errors or omissions.**		
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content.	
Score 2.0	**There are no major errors or omissions regarding the simpler details and processes as the student completes the concepts in level 3.0.** **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**		
	1.5	Partial knowledge of the 2.0 content, but major errors or omissions regarding the 3.0 content.	
Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**		
	0.5	With help, a partial understanding of the 2.0 content, but not the 3.0 content.	
Score 0.0	**Even with help, no understanding or skill demonstrated.**		

STRAND 8: SYSTEMS OF EQUATIONS & INEQUALITIES

Topic 18: Solving Systems Of Equations & InequalitieS

	Grade: 11-12		
Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**		**Sample Activities**
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Score 3.0	**The student:** • Solve 2 and 3 variable linear systems by substitution and elimination. • Identify systems that do not have exactly one solution. • Solve real world problems involving systems in 2 and 3 variables and using technology. • Recognize and solve systems of nonlinear equations in two variables by addition and substitution. • Use mathematical models involving linear inequalities. • Use linear programming in conjunction with technology to solve problems. **The student exhibits no major errors or omissions.**		
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content.	
Score 2.0	**There are no major errors or omissions regarding the simpler details and processes as the student completes the concepts in level 3.0.** **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**		
	1.5	Partial knowledge of the 2.0 content, but major errors or omissions regarding the 3.0 content.	
Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**		
	0.5	With help, a partial understanding of the 2.0 content, but not the 3.0 content.	
Score 0.0	**Even with help, no understanding or skill demonstrated.**		

STRAND 8: SYSTEMS OF EQUATIONS & INEQUALITIES

Topic 19: Graphing Systems Of Equations & InequalitieS

Grade: 11-12			
Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**		**Sample Activities**
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Score 3.0	**The student:** ● Identify systems that do not have exactly one solution. ● Graph linear and nonlinear inequalities in 2 variables. ● Use mathematical models involving linear inequalities. ● Graph systems of inequalities. ● Use linear programming in conjunction with technology to solve problems. **The student exhibits no major errors or omissions.**		
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content.	
Score 2.0	**There are no major errors or omissions regarding the simpler details and processes as the student completes the concepts in level 3.0.** **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**		
	1.5	Partial knowledge of the 2.0 content, but major errors or omissions regarding the 3.0 content.	
Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**		
	0.5	With help, a partial understanding of the 2.0 content, but not the 3.0 content.	
Score 0.0	**Even with help, no understanding or skill demonstrated.**		

STRAND 8: SYSTEMS OF EQUATIONS & INEQUALITIES

Topic 20: Graphing Systems Of Equations & InequalitieS

Grade: 11-12			
Score 4.0	**In addition to Score 3.0, in-depth inferences and applications that go beyond what was taught.**		**Sample Activities**
	3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.	
Score 3.0	**The student:** ● Decompose P(x)/Q(x) where Q(x) has distinct and repeated linear factors and where Q(x) has both repeated and non-repeated prime quadratic factors. ● Use mathematical models involving linear inequalities. ● Write objective functions describing a quantity that must be maximized or minimized. ● Use inequalities to describe limitations of a situation. **The student exhibits no major errors or omissions.**		
	2.5	No major errors or omissions regarding 2.0 content and partial knowledge of the 3.0 content.	
Score 2.0	**There are no major errors or omissions regarding the simpler details and processes as the student completes the concepts in level 3.0.** **However, the student exhibits major errors or omissions regarding the more complex ideas and processes.**		
	1.5	Partial knowledge of the 2.0 content, but major errors or omissions regarding the 3.0 content.	
Score 1.0	**With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.**		
	0.5	With help, a partial understanding of the 2.0 content, but not the 3.0 content.	
Score 0.0	**Even with help, no understanding or skill demonstrated.**		

APPENDIX

Mathematical Practices for AP Calculus (MPACs)

The Mathematical Practices for AP Calculus (MPACs) capture important aspects of the work that mathematicians engage in, at the level of competence expected of AP Calculus students. They are drawn from the rich work in the National Council of Teachers of Mathematics (NCTM) Process Standards and the Association of American Colleges and Universities (AAC&U) Quantitative Literacy VALUE Rubric. Embedding these practices in the study of calculus enables students to establish mathematical lines of reasoning and use them to apply mathematical concepts and tools to solve problems. The Mathematical Practices for AP Calculus are not intended to be viewed as discrete items that can be checked off a list; rather, they are highly interrelated tools that should be utilized frequently and in diverse contexts.

The sample items included with this curriculum framework demonstrate various ways in which the learning objectives can be linked with the Mathematical Practices for AP Calculus.

The Mathematical Practices for AP Calculus are given below.

MPAC 1: Reasoning with definitions and theorems

Students can:

a. use definitions and theorems to build arguments, to justify conclusions or answers, and to prove results;

b. confirm that hypotheses have been satisfied in order to apply the conclusion of a theorem;

c. apply definitions and theorems in the process of solving a problem;

d. interpret quantifiers in definitions and theorems (e.g., "for all," "there exists");

e. develop conjectures based on exploration with technology; and

f. produce examples and counterexamples to clarify understanding of definitions, to investigate whether converses of theorems are true or false, or to test conjectures.

MPAC 2: Connecting concepts

Students can:

a. relate the concept of a limit to all aspects of calculus;

b. use the connection between concepts (e.g., rate of change and accumulation) or processes (e.g., differentiation and its inverse process, antidifferentiation) to solve problems;

c. connect concepts to their visual representations with and without technology; and

d. identify a common underlying structure in problems involving different contextual situations.

MPAC 3: Implementing algebraic/computational processes

Students can:

a. select appropriate mathematical strategies;

b. sequence algebraic/computational procedures logically;

c. complete algebraic/computational processes correctly;

d. apply technology strategically to solve problems;

e. attend to precision graphically, numerically, analytically, and verbally and specify units of measure; and

f. connect the results of algebraic/computational processes to the question asked.

MPAC 4: Connecting multiple representations

Students can:

a. associate tables, graphs, and symbolic representations of functions;

b. develop concepts using graphical, symbolical, verbal, or numerical representations with and without technology;

c. identify how mathematical characteristics of functions are related in different representations;

d. extract and interpret mathematical content from any presentation of a function (e.g., utilize information from a table of values);

e. construct one representational form from another (e.g., a table from a graph or a graph from given information); and

f. consider multiple representations (graphical, numerical, analytical, and verbal) of a function to select or construct a useful representation for solving a problem.

MPAC 5: Building notational fluency

Students can:

a. know and use a variety of notations (e.g., $f'(x), y', \frac{dy}{dx}$);

b. connect notation to definitions (e.g., relating the notation for the definite integral to that of the limit of a Riemann sum);

c. connect notation to different representations (graphical, numerical, analytical, and verbal); and

d. assign meaning to notation, accurately interpreting the notation in a given problem and across different contexts.

MPAC 6: Communicating

Students can:

a. clearly present methods, reasoning, justifications, and conclusions;

b. use accurate and precise language and notation;

c. explain the meaning of expressions, notation, and results in terms of a context (including units);

d. explain the connections among concepts;

e. critically interpret and accurately report information provided by technology; and

f. analyze, evaluate, and compare the reasoning of others.

TOPIC OUTLINE

Following is an outline of the major topics covered by the AP Statistics Exam. The ordering here is intended to define the scope of the course but not necessarily the sequence. The percentages in parentheses for each content area indicate the coverage for that content area in the exam.

I. Exploring Data: Describing patterns and departures from patterns (20%–30%)

   Exploratory analysis of data makes use of graphical and numerical techniques to study patterns and departures from patterns. Emphasis should be placed on interpreting information from graphical and numerical displays and summaries.

   A. Constructing and interpreting graphical displays of distributions of univariate data (dotplot, stemplot, histogram, cumulative frequency plot)
      1. Center and spread
      2. Clusters and gaps
      3. Outliers and other unusual features
      4. Shape
   B. Summarizing distributions of univariate data
      1. Measuring center: median, mean
      2. Measuring spread: range, interquartile range, standard deviation
      3. Measuring position: quartiles, percentiles, standardized scores (z-scores)
      4. Using boxplots
      5. The effect of changing units on summary measures

C. Comparing distributions of univariate data (dotplots, back-to-back stemplots, parallel boxplots)
   1. Comparing center and spread: within group, between group variation
   2. Comparing clusters and gaps
   3. Comparing outliers and other unusual features
   4. Comparing shapes
D. Exploring bivariate data
   1. Analyzing patterns in scatterplots
   2. Correlation and linearity
   3. Least-squares regression line
   4. Residual plots, outliers and influential points
   5. Transformations to achieve linearity: logarithmic and power transformations
E. Exploring categorical data
   1. Frequency tables and bar charts
   2. Marginal and joint frequencies for two-way tables
   3. Conditional relative frequencies and association
   4. Comparing distributions using bar charts

I. Sampling and Experimentation: Planning and conducting a study (10%–15%)

Data must be collected according to a well-developed plan if valid information on a conjecture is to be obtained. This plan includes clarifying the question and deciding upon a method of data collection and analysis.

A. Overview of methods of data collection
   1. Census
   2. Sample survey
   3. Experiment
   4. Observational study
B. Planning and conducting surveys
   1. Characteristics of a well-designed and well-conducted survey
   2. Populations, samples and random selection
   3. Sources of bias in sampling and surveys
   4. Sampling methods, including simple random sampling, stratified random sampling and cluster sampling
C. Planning and conducting experiments
   1. Characteristics of a well-designed and well-conducted experiment
   2. Treatments, control groups, experimental units, random assignments and replication
   3. Sources of bias and confounding, including placebo effect and blinding
   4. Completely randomized design
   5. Randomized block design, including matched pairs design
D. Generalizability of results and types of conclusions that can be drawn from observational studies, experiments and surveys

III. Anticipating Patterns: Exploring random phenomena using probability and simulation (20%–30%)

Probability is the tool used for anticipating what the distribution of data should look like under a given model.

A. Probability
   1. Interpreting probability, including long-run relative frequency interpretation
   2. "Law of Large Numbers" concept
   3. Addition rule, multiplication rule, conditional probability and independence
   4. Discrete random variables and their probability distributions, including binomial and geometric
   5. Simulation of random behavior and probability distributions
   6. Mean (expected value) and standard deviation of a random variable, and linear transformation of a random variable

B. Combining independent random variables
   1. Notion of independence versus dependence
   2. Mean and standard deviation for sums and differences of independent random variables

C. The normal distribution
   1. Properties of the normal distribution
   2. Using tables of the normal distribution
   3. The normal distribution as a model for measurements

D. Sampling distributions
   1. Sampling distribution of a sample proportion
   2. Sampling distribution of a sample mean
   3. Central Limit Theorem
   4. Sampling distribution of a difference between two independent sample proportions
   5. Sampling distribution of a difference between two independent sample means
   6. Simulation of sampling distributions
   7. t-distribution
   8. Chi-square distribution

IV. Statistical Inference: Estimating population parameters and testing hypotheses (30%–40%)

Statistical inference guides the selection of appropriate models.

A. Estimation (point estimators and confidence intervals)
   1. Estimating population parameters and margins of error
   2. Properties of point estimators, including unbiasedness and variability
   3. Logic of confidence intervals, meaning of confidence level and confidence intervals, and properties of confidence intervals
   4. Large sample confidence interval for a proportion
   5. Large sample confidence interval for a difference between two proportions

6. Confidence interval for a mean
7. Confidence interval for a difference between two means (unpaired and paired)
8. Confidence interval for the slope of a least-squares regression line

B. Tests of significance
1. Logic of significance testing, null and alternative hypotheses; p-values; one- and two-sided tests; concepts of Type I and Type II errors; concept of power
2. Large sample test for a proportion
3. Large sample test for a difference between two proportions
4. Test for a mean
5. Test for a difference between two means (unpaired and paired)
6. Chi-square test for goodness of fit, homogeneity of proportions, and independence (one- and two-way tables)
7. Test for the slope of a least-squares regression line

ACT College & Career Readiness Standards

MATHEMATICS

These Standards describe what students who score in specific score ranges on the mathematics section of the ACT® college readiness assessment are likely to know and be able to do.

For more information about the ACT College and Career Readiness Standards in Mathematics, go to www.act.org/standard/planact/math/mathnotes.html.

SCORE RANGE	Topics in the flow to **NUMBER AND QUANTITY (N)**
13–15	**N 201.** Perform one-operation computation with whole numbers and decimals **N 202.** Recognize equivalent fractions and fractions in lowest terms **N 203.** Locate positive rational numbers (expressed as whole numbers, fractions, decimals, and mixed numbers) on the number line
16–19	**N 301.** Recognize one-digit factors of a number **N 302.** Identify a digit's place value **N 303.** Locate rational numbers on the number line *Note: A matrix as a representation of data is treated here as a basic table.*
20–23	**N 401.** Exhibit knowledge of elementary number concepts such as rounding, the ordering of decimals, pattern identification, primes, and greatest common factor **N 402.** Write positive powers of 10 by using exponents **N 403.** Comprehend the concept of length on the number line, and find the distance between two points **N 404.** Understand absolute value in terms of distance **N 405.** Find the distance in the coordinate plane between two points with the same *x*-coordinate or *y*-coordinate **N 406.** Add two matrices that have whole number entries

Students who score in the 1–12 range are most likely beginning to develop the knowledge and skills assessed in the other ranges.

22

THE ACT COLLEGE READINESS BENCHMARK FOR MATHEMATICS IS 22. Students who achieve this score on the ACT Mathematics Test have a 50% likelihood of achieving a B or better in a first-year College Algebra course at a typical college. The knowledge and skills highly likely to be demonstrated by students who meet the Benchmark are shaded.

ACT College & Career Readiness Standards

MATHEMATICS

SCORE RANGE	Topics in the flow to **NUMBER AND QUANTITY (N)**
24–27	**N 501.** Order fractions **N 502.** Find and use the least common multiple **N 503.** Work with numerical factors **N 504.** Exhibit some knowledge of the complex numbers **N 505.** Add and subtract matrices that have integer entries
28–32	**N 601.** Apply number properties involving prime factorization **N 602.** Apply number properties involving even/odd numbers and factors/multiples **N 603.** Apply number properties involving positive/negative numbers **N 604.** Apply the facts that π is irrational and that the square root of an integer is rational only if that integer is a perfect square **N 605.** Apply properties of rational exponents **N 606.** Multiply two complex numbers **N 607.** Use relations involving addition, subtraction, and scalar multiplication of vectors and of matrices
33–36	**N 701.** Analyze and draw conclusions based on number concepts **N 702.** Apply properties of rational numbers and the rational number system **N 703.** Apply properties of real numbers and the real number system, including properties of irrational numbers **N 704.** Apply properties of complex numbers and the complex number system **N 705.** Multiply matrices **N 706.** Apply properties of matrices and properties of matrices as a number system

Students who achieve the 28–32 level are likely able to use variables fluently so that they can solve problems with variables in the same way that they can solve the problems with numbers, and they can use variables to represent general properties.

ACT College & Career Readiness Standards

MATHEMATICS

Because algebra and functions are closely connected, some Standards apply to both categories.

<table>
<tr><th>SCORE RANGE</th><th>Topics in the flow to
ALGEBRA (A)</th><th>Topics in the flow to
FUNCTIONS (F)</th></tr>
<tr><td rowspan="2">13–15</td><td colspan="2">AF 201. Solve problems in one or two steps using whole numbers and using decimals in the context of money</td></tr>
<tr><td>A 201. Exhibit knowledge of basic expressions (e.g., identify an expression for a total as $b + g$)

A 202. Solve equations in the form $x + a = b$, where a and b are whole numbers or decimals</td><td>F 201. Extend a given pattern by a few terms for patterns that have a constant increase or decrease between terms</td></tr>
<tr><td rowspan="2">16–19</td><td colspan="2">AF 301. Solve routine one-step arithmetic problems using positive rational numbers, such as single-step percent

AF 302. Solve some routine two-step arithmetic problems

AF 303. Relate a graph to a situation described qualitatively in terms of familiar properties such as before and after, increasing and decreasing, higher and lower

AF 304. Apply a definition of an operation for whole numbers (e.g., $a \square b = 3a - b$)</td></tr>
<tr><td>A 301. Substitute whole numbers for unknown quantities to evaluate expressions

A 302. Solve one-step equations to get integer or decimal answers

A 303. Combine like terms (e.g., $2x + 5x$)</td><td>F 301. Extend a given pattern by a few terms for patterns that have a constant factor between terms</td></tr>
</table>

Students who score in the 1–12 range are most likely beginning to develop the knowledge and skills assessed in the other ranges.

ACT College & Career Readiness Standards

MATHEMATICS

Because algebra and functions are closely connected, some Standards apply to both categories.

<table>
<tr><th>SCORE RANGE</th><th>Topics in the flow to
ALGEBRA (A)</th><th>Topics in the flow to
FUNCTIONS (F)</th></tr>
<tr><td rowspan="2">20–23</td><td colspan="2">AF 401. Solve routine two-step or three-step arithmetic problems involving concepts such as rate and proportion, tax added, percentage off, and estimating by using a given average value in place of actual values

AF 402. Perform straightforward word-to-symbol translations

AF 403. Relate a graph to a situation described in terms of a starting value and an additional amount per unit (e.g., unit cost, weekly growth)</td></tr>
<tr><td>A 401. Evaluate algebraic expressions by substituting integers for unknown quantities

A 402. Add and subtract simple algebraic expressions

A 403. Solve routine first-degree equations

A 404. Multiply two binomials

A 405. Match simple inequalities with their graphs on the number line (e.g., $x \geq -\frac{3}{5}$)

A 406. Exhibit knowledge of slope</td><td>F 401. Evaluate linear and quadratic functions, expressed in function notation, at integer values</td></tr>
</table>

22

The ACT College Readiness Benchmark for Mathematics is 22. Students who achieve this score on the ACT Mathematics Test have a 50% likelihood of achieving a B or better in a first-year College Algebra course at a typical college. The knowledge and skills highly likely to be demonstrated by students who meet the Benchmark are shaded.

ACT College & Career Readiness Standards

MATHEMATICS

Because algebra and functions are closely connected, some Standards apply to both categories.

SCORE RANGE	Topics in the flow to **ALGEBRA (A)**	Topics in the flow to **FUNCTIONS (F)**
24–27	**AF 501.** Solve multistep arithmetic problems that involve planning or converting common derived units of measure (e.g., feet per second to miles per hour) **AF 502.** Build functions and write expressions, equations, or inequalities with a single variable for common pre-algebra settings (e.g., rate and distance problems and problems that can be solved by using proportions) **AF 503.** Match linear equations with their graphs in the coordinate plane	
	A 501. Recognize that when numerical quantities are reported in real-world contexts, the numbers are often rounded **A 502.** Solve real-world problems by using first-degree equations **A 503.** Solve first-degree inequalities when the method does not involve reversing the inequality sign **A 504.** Match compound inequalities with their graphs on the number line (e.g., $-10.5 < x \le 20.3$) **A 505.** Add, subtract, and multiply polynomials **A 506.** Identify solutions to simple quadratic equations **A 507.** Solve quadratic equations in the form $(x + a)(x + b) = 0$, where a and b are numbers or variables **A 508.** Factor simple quadratics (e.g., the difference of squares and perfect square trinomials) **A 509.** Work with squares and square roots of numbers **A 510.** Work with cubes and cube roots of numbers **A 511.** Work with scientific notation **A 512.** Work problems involving positive integer exponents **A 513.** Determine when an expression is undefined **A 514.** Determine the slope of a line from an equation	**F 501.** Evaluate polynomial functions, expressed in function notation, at integer values **F 502.** Find the next term in a sequence described recursively **F 503.** Build functions and use quantitative information to identify graphs for relations that are proportional or linear **F 504.** Attend to the difference between a function modeling a situation and the reality of the situation **F 505.** Understand the concept of a function as having a well-defined output value at each valid input value **F 506.** Understand the concept of domain and range in terms of valid input and output, and in terms of function graphs **F 507.** Interpret statements that use function notation in terms of their context **F 508.** Find the domain of polynomial functions and rational functions **F 509.** Find the range of polynomial functions **F 510.** Find where a rational function's graph has a vertical asymptote **F 511.** Use function notation for simple functions of two variables

ACT College & Career Readiness Standards

MATHEMATICS

Because algebra and functions are closely connected, some Standards apply to both categories.

SCORE RANGE	Topics in the flow to **ALGEBRA (A)**	Topics in the flow to **FUNCTIONS (F)**
28–32	**AF 601.** Solve word problems containing several rates, proportions, or percentages **AF 602.** Build functions and write expressions, equations, and inequalities for common algebra settings (e.g., distance to a point on a curve and profit for variable cost and demand) **AF 603.** Interpret and use information from graphs in the coordinate plane **AF 604.** Given an equation or function, find an equation or function whose graph is a translation by a specified amount up or down	
	A 601. Manipulate expressions and equations **A 602.** Solve linear inequalities when the method involves reversing the inequality sign **A 603.** Match linear inequalities with their graphs on the number line **A 604.** Solve systems of two linear equations **A 605.** Solve quadratic equations **A 606.** Solve absolute value equations	**F 601.** Relate a graph to a situation described qualitatively in terms of faster change or slower change **F 602.** Build functions for relations that are inversely proportional **F 603.** Find a recursive expression for the general term in a sequence described recursively **F 604.** Evaluate composite functions at integer values

Students who achieve the 28–32 level are likely able to use variables fluently so that they can solve the problems with variables in the same way that they can solve problems with numbers, and they can use variables to represent general properties.

ACT College & Career Readiness Standards

MATHEMATICS

Because algebra and functions are closely connected, some Standards apply to both categories.

SCORE RANGE	Topics in the flow to **ALGEBRA (A)**	Topics in the flow to **FUNCTIONS (F)**
33–36	**AF 701.** Solve complex arithmetic problems involving percent of increase or decrease or requiring integration of several concepts (e.g., using several ratios, comparing percentages, or comparing averages) **AF 702.** Build functions and write expressions, equations, and inequalities when the process requires planning and/or strategic manipulation **AF 703.** Analyze and draw conclusions based on properties of algebra and/or functions **AF 704.** Analyze and draw conclusions based on information from graphs in the coordinate plane **AF 705.** Identify characteristics of graphs based on a set of conditions or on a general equation such as $y = ax^2 + c$ **AF 706.** Given an equation or function, find an equation or function whose graph is a translation by specified amounts in the horizontal and vertical directions	
	A 701. Solve simple absolute value inequalities **A 702.** Match simple quadratic inequalities with their graphs on the number line **A 703.** Apply the remainder theorem for polynomials, that $P(a)$ is the remainder when $P(x)$ is divided by $(x - a)$	**F 701.** Compare actual values and the values of a modeling function to judge model fit and compare models **F 702.** Build functions for relations that are exponential **F 703.** Exhibit knowledge of geometric sequences **F 704.** Exhibit knowledge of unit circle trigonometry **F 705.** Match graphs of basic trigonometric functions with their equations **F 706.** Use trigonometric concepts and basic identities to solve problems **F 707.** Exhibit knowledge of logarithms **F 708.** Write an expression for the composite of two simple functions

ACT College & Career Readiness Standards

MATHEMATICS

SCORE RANGE	Topics in the flow to **GEOMETRY (G)**
13–15	**G 201.** Estimate the length of a line segment based on other lengths in a geometric figure **G 202.** Calculate the length of a line segment based on the lengths of other line segments that go in the same direction (e.g., overlapping line segments and parallel sides of polygons with only right angles) **G 203.** Perform common conversions of money and of length, weight, mass, and time within a measurement system (e.g., dollars to dimes, inches to feet, and hours to minutes)
16–19	**G 301.** Exhibit some knowledge of the angles associated with parallel lines **G 302.** Compute the perimeter of polygons when all side lengths are given **G 303.** Compute the area of rectangles when whole number dimensions are given **G 304.** Locate points in the first quadrant
20–23	**G 401.** Use properties of parallel lines to find the measure of an angle **G 402.** Exhibit knowledge of basic angle properties and special sums of angle measures (e.g., 90°, 180°, and 360°) **G 403.** Compute the area and perimeter of triangles and rectangles in simple problems **G 404.** Find the length of the hypotenuse of a right triangle when only very simple computation is involved (e.g., 3-4-5 and 6-8-10 triangles) **G 405.** Use geometric formulas when all necessary information is given **G 406.** Locate points in the coordinate plane **G 407.** Translate points up, down, left, and right in the coordinate plane

22

Students who score in the 1–12 range are most likely beginning to develop the knowledge and skills assessed in the other ranges.

THE ACT COLLEGE READINESS BENCHMARK FOR MATHEMATICS IS 22. Students who achieve this score on the ACT Mathematics Test have a 50% likelihood of achieving a B or better in a first-year College Algebra course at a typical college. The knowledge and skills highly likely to be demonstrated by students who meet the Benchmark are shaded.

ACT College & Career Readiness Standards

MATHEMATICS

SCORE RANGE	Topics in the flow to **GEOMETRY (G)**
24–27	**G 501.** Use several angle properties to find an unknown angle measure **G 502.** Count the number of lines of symmetry of a geometric figure **G 503.** Use symmetry of isosceles triangles to find unknown side lengths or angle measures **G 504.** Recognize that real-world measurements are typically imprecise and that an appropriate level of precision is related to the measuring device and procedure **G 505.** Compute the perimeter of simple composite geometric figures with unknown side lengths **G 506.** Compute the area of triangles and rectangles when one or more additional simple steps are required **G 507.** Compute the area and circumference of circles after identifying necessary information **G 508.** Given the length of two sides of a right triangle, find the third when the lengths are Pythagorean triples **G 509.** Express the sine, cosine, and tangent of an angle in a right triangle as a ratio of given side lengths **G 510.** Determine the slope of a line from points or a graph **G 511.** Find the midpoint of a line segment **G 512.** Find the coordinates of a point rotated 180° around a given center point

ACT College & Career Readiness Standards

MATHEMATICS

SCORE RANGE	Topics in the flow to **GEOMETRY (G)**
28–32	**G 601.** Use relationships involving area, perimeter, and volume of geometric figures to compute another measure (e.g., surface area for a cube of a given volume and simple geometric probability) **G 602.** Use the Pythagorean theorem **G 603.** Apply properties of 30°-60°-90°, 45°-45°-90°, similar, and congruent triangles **G 604.** Apply basic trigonometric ratios to solve right-triangle problems **G 605.** Use the distance formula **G 606.** Use properties of parallel and perpendicular lines to determine an equation of a line or coordinates of a point **G 607.** Find the coordinates of a point reflected across a vertical or horizontal line or across $y = x$ **G 608.** Find the coordinates of a point rotated 90° about the origin **G 609.** Recognize special characteristics of parabolas and circles (e.g., the vertex of a parabola and the center or radius of a circle)
33–36	**G 701.** Use relationships among angles, arcs, and distances in a circle **G 702.** Compute the area of composite geometric figures when planning and/or visualization is required **G 703.** Use scale factors to determine the magnitude of a size change **G 704.** Analyze and draw conclusions based on a set of conditions **G 705.** Solve multistep geometry problems that involve integrating concepts, planning, and/or visualization

Students who achieve the 28–32 level are likely able to use variables fluently so that they can solve problems with variables in the same way that they can solve the problems with numbers, and they can use variables to represent general properties.

ACT College & Career Readiness Standards

MATHEMATICS

SCORE RANGE	Topics in the flow to **STATISTICS AND PROBABILITY (S)**
13–15	**S 201.** Calculate the average of a list of positive whole numbers **S 202.** Extract one relevant number from a basic table or chart, and use it in a single computation
16–19	**S 301.** Calculate the average of a list of numbers **S 302.** Calculate the average given the number of data values and the sum of the data values **S 303.** Read basic tables and charts **S 304.** Extract relevant data from a basic table or chart and use the data in a computation **S 305.** Use the relationship between the probability of an event and the probability of its complement
20–23	**S 401.** Calculate the missing data value given the average and all data values but one **S 402.** Translate from one representation of data to another (e.g., a bar graph to a circle graph) **S 403.** Determine the probability of a simple event **S 404.** Describe events as combinations of other events (e.g., using *and*, *or*, and *not*) **S 405.** Exhibit knowledge of simple counting techniques

Students who score in the 1–12 range are most likely beginning to develop the knowledge and skills assessed in the other ranges.

22

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ACT College & Career Readiness Standards

MATHEMATICS

SCORE RANGE	Topics in the flow to **STATISTICS AND PROBABILITY (S)**
24–27	**S 501.** Calculate the average given the frequency counts of all the data values **S 502.** Manipulate data from tables and charts **S 503.** Compute straightforward probabilities for common situations **S 504.** Use Venn diagrams in counting **S 505.** Recognize that when data summaries are reported in the real world, results are often rounded and must be interpreted as having appropriate precision **S 506.** Recognize that when a statistical model is used, model values typically differ from actual values
28–32	**S 601.** Calculate or use a weighted average **S 602.** Interpret and use information from tables and charts, including two-way frequency tables **S 603.** Apply counting techniques **S 604.** Compute a probability when the event and/or sample space are not given or obvious **S 605.** Recognize the concepts of conditional and joint probability expressed in real-world contexts **S 606.** Recognize the concept of independence expressed in real-world contexts
33–36	**S 701.** Distinguish between mean, median, and mode for a list of numbers **S 702.** Analyze and draw conclusions based on information from tables and charts, including two-way frequency tables **S 703.** Understand the role of randomization in surveys, experiments, and observational studies **S 704.** Exhibit knowledge of conditional and joint probability **S 705.** Recognize that part of the power of statistical modeling comes from looking at regularity in the differences between actual values and model values

Students who achieve the 28–32 level are likely able to use variables fluently so that they can solve problems with variables in the same way that they can solve the problems with numbers, and they can use variables to represent general properties.

Algebra 1 Course-Level Expanded Expectations

NUMBER AND QUANTITY: NQ		
A1.NQ.A	**Extend and use properties of rational exponents.**	
A1.NQ.A.1	Explain how the meaning of rational exponents extends from the properties of integer exponents.	The expectation of the student is to explain how the meaning of rational exponents extends from the properties of integer exponents to rational exponents. (*e.g.*, $\left(5^{\frac{1}{3}}\right)^3 = 5$)
A1.NQ.A.2	Rewrite expressions involving radicals and rational exponents using the properties of exponents. Limit to rational exponents with a numerator of 1.	The expectation of the student is to rewrite expressions involving simple radicals and rational exponents using the properties of exponents. Limit to rational exponents with a numerator of 1. (*e.g.*, $\sqrt[n]{x} = x^{\frac{1}{n}}$)
A1.NQ.B	**Use units to solve problems.**	
A1.NQ.B.3	Use units of measure as a way to understand and solve problems involving quantities. a) Identify, label and use appropriate units of measure within a problem. b) Convert units and rates. c) Use units within problems. d) Choose and interpret the scale and the origin in graphs and data displays.	The expectation of the student is to use units of measure as a way to understand and solve problems involving quantities such as rates, time, length, area and capacity. a. Identify, label and use appropriate units of measure within a context. b. Convert units and rates within and between systems of measure. c. Use units within multi-step problems. (*e.g.*, *An L-shaped concrete slab is composed of a rectangular piece 30 feet 6 inches by 20 feet 4 inches and a second piece 10 feet 8 inches by 8 feet 3 inches. If the slab is 4 inches thick, how many cubic yards (to the nearest greater ¼ cubic yard) need to be ordered?)* d. Choose and interpret the scale and the origin in graphs and data displays.
A1.NQ.B.4	Define and use appropriate quantities for representing a given context or problem.	The expectation of the student is to define and use appropriate quantities for representing a given context or problem.

A1.NQ.B.5	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.	The expectation of the student is to choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (*e.g.*, *Problems involving money are normally computed to the nearest cent. How precise can we measure with any given tool (ruler, calculator, scale, etc.?)*
SEEING STRUCTURE IN EXPRESSIONS: SSE		
A1.SSE.A	**Interpret and use structure.**	
A1.SSE.A.1	Interpret the contextual meaning of individual terms or factors from a given problem that utilizes formulas or expressions.	The expectation of the student is to interpret the contextual meaning of individual terms or factors from a given situation that utilizes formulas or expressions. *(e.g., How does the height affect the volume of a cylinder versus the radius?)*
A1.SSE.A.2	Analyze the structure of polynomials to create equivalent expressions or equations.	The expectation of the student is to analyze the structure of polynomial expressions in order to rewrite the expressions in equivalent forms. *(e.g., Factor a quadratic expression)*
A1.SSE.A.3	Choose and produce equivalent forms of a quadratic expression or equations to reveal and explain properties. a) Find the zeros of a quadratic function by rewriting it in factored form. b) Find the maximum or minimum value of a quadratic function by completing the square.	The expectation of the student is to choose and produce equivalent forms of a quadratic expression to reveal and explain properties of the quantity represented by the expression. a. Find the zeros of a quadratic function by rewriting it in factored form. b. Find the maximum or minimum value of a quadratic function by completing the square.
CREATING EQUATIONS: CED		
A1.CED.A	**Create equations that describe linear, quadratic and exponential relationships.**	
A1.CED.A.1	Create equations and inequalities in one variable and use them to model and/or solve problems.	The expectation of the student is to create equations and inequalities in one variable and use them to model and/or solve problems, including, linear, quadratic and exponential relationships.
A1.CED.A.2	Create and graph linear, quadratic and exponential equations in two variables.	The expectation of the student is to create linear and quadratic (y =ax^2, y = ax^2+b) and exponential (y = ab^x) equations in two variables. Graph the equations on a Cartesian coordinate plane with labels and scales.
A1.CED.A.3	Represent constraints by equations or inequalities and by systems of equations or inequalities, and interpret the data points as a solution or non-solution in a modeling context.	The expectation of the student is to represent constraints by equations or inequalities and by systems of equations or inequalities. Interpret data points as a solution or non-solution in a modeling context.

A1.CED.A.4	Solve literal equations and formulas for a specified variable that highlights a quantity of interest.	The expectation of the student is to solve literal equations and formulas for a specified variable that highlights a quantity of interest.
REASONING WITH EQUATIONS AND INEQUALITIES: REI		
A1.REI.A	**Understand solving equations as a process, and solve equations and inequalities in one variable.**	
A1.REI.A.1	Explain how each step taken when solving an equation or inequality in one variable creates an equivalent equation or inequality that has the same solution(s) as the original.	The expectation of the student is to explain how each step taken when solving an equation or inequality in one variable creates a new equation or inequality that has the same solution as the original.
A1.REI.A.2	Solve problems involving quadratic equations. a) Use the method of completing the square to create an equivalent quadratic equation. b) Derive the quadratic formula. c) Analyze different methods of solving quadratic equations.	The expectation of the student is to solve problems involving quadratic equations in one variable. a. Use the method of completing the square to transform a quadratic equation in x into an equation of the form $(x-p)^2 = q$ that has the same solution. b. Derive the quadratic formula from $ax^2 + bx + c = 0$, (a,b,c any real number) c. Solve quadratic equations by inspection, using the square root property, completing the square, using the quadratic formula and factoring as appropriate to the initial form of the equation. If a student encounter complex solutions, he or she should state “no real solution.” d. Analyze different methods of solving quadratic equations.
A1.REI.B	**Solve systems of equations.**	
A1.REI.B.3	Solve a system of linear equations algebraically and/or graphically.	The expectation of the student is to solve a system of linear equations algebraically and graphically.
A1.REI.B.4	Solve a system consisting of a linear equation and a quadratic equation algebraically and/or graphically.	The expectation of the student is to solve a system consisting of a linear equation and a quadratic function algebraically and graphically.
A1.REI.B.5	Justify that the technique of linear combination produces an equivalent system of equations.	The expectation of the student is to justify that given a system of two equations in two variables, the solution is not changed when one of the equations is replaced by a linear combination of itself.
A1.REI.C	**Represent and solve linear and exponential equations and inequalities graphically.**	

A1.REI.C.6	Explain that the graph of an equation in two variables is the set of all its solutions plotted in the Cartesian coordinate plane.	The expectation of the student is to explain that the graph of an equation in two variables is the set of all its solutions plotted in the Cartesian coordinate plane
A1.REI.C.7	Graph the solution to a linear inequality in two variables.	The expectation of the student is to graph the solution to a linear inequality in two variables.
A1.REI.C.8	Solve problems involving a system of linear inequalities.	The expectation of the student is to solve a system of linear inequalities by graphing, and when appropriate, interpreting the solutions in the context provided.
ARITHMETIC WITH POLYNOMIALS AND RATIONAL EXPRESSIONS: APR		
A1.APR.A	**Perform operations on polynomials.**	
A1.APR.A.1	Add, subtract and multiply polynomials, and understand that polynomials follow the same general rules of arithmetic and are closed under these operations.	The expectation of the student is to add, subtract and multiply polynomials, and understand that polynomials follow the same general rules as arithmetic and are closed under these operations. (e.g., (x^3+2x^2-x)-(3x^3+4x^2-x+2))
A1.APR.A.2	Divide polynomials by monomials.	The expectation of the student is to divide polynomials by monomials.
INTERPRETING FUNCTIONS: IF		
A1.IF.A	**Understand the concept of a function and use function notation.**	
A1.IF.A.1	Understand that a function from one set (domain) to another set (range) assigns to each element of the domain exactly one element of the range. a) Represent a function using function notation. b) Understand that the graph of a function labeled f is the set of all ordered pairs (x, y) that satisfy the equation y=$f(x)$.	The expectation of the student is to extend previous knowledge of a function to apply to general behavior and features of a function. Understand that a function from one set (domain) to another set (range) assigns to each element of the domain exactly one element of the range. a. Represent a function using function notation and explain that $f(x)$ denotes the elements of the range of a function f that correspond to the elements of the domain. b. Understand that the graph of a function labeled f is the set of all ordered pairs (x, y) that satisfy the equation $y = f(x)$.
A1.IF.A.2	Use function notation to evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.	The expectation of the student is to use function notation to evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.

A1.IF.B	**Interpret linear, quadratic and exponential functions in terms of the context.**	
A1.IF.B.3	Using tables, graphs and verbal descriptions, interpret key characteristics of a function that models the relationship between two quantities.	The expectation of the student is to, using tables, graphs and verbal descriptions, interpret the key characteristics of a function that models the relationship between two quantities. Sketch a graph showing key features including: intercepts; intervals where the function is increasing, decreasing, positive or negative; relative maximum or minimum; symmetries; and end behavior.
A1.IF.B.4	Relate the domain and range of a function to its graph and, where applicable, to the quantitative relationship it describes.	The expectation of the student is to relate the domain and range of a function to its graph and, where applicable, to the quantitative relationship it describes.
A1.IF.B.5	Determine the average rate of change of a function over a specified interval and interpret the meaning.	The expectation of the student is given a function in graphical, symbolic or tabular form, determine the average rate of change of the function over a specified interval. Interpret the meaning of the average rate of change in a given context.
A1.IF.B.6	Interpret the parameters of a linear or exponential function in terms of the context.	The expectation of the student is to interpret the parameters of a linear or exponential function in terms of the context. *(e.g., Explain what happen as the values of t increase* $A=300(.96)^t$*.)*
A1.IF.C	**Analyze linear, quadratic and exponential functions using different representations.**	
A1.IF.C.7	Graph functions expressed symbolically and identify and interpret key features of the graph.	The expectation of the student is to graph functions, including piecewise-defined functions (linear, quadratic and exponential), from their symbolic representation and show key features of the graph both by hand and by using technology.
A1.IF.C.8	Translate between different but equivalent forms of a function to reveal and explain properties of the function and interpret these in terms of a context.	The expectation of the student is to translate between different but equivalent forms of a function to reveal and explain different properties of the function and interpret these in terms of a context, (*e.g., slope, intercepts and extreme values).*
A1.IF.C.9	Compare the properties of two functions given different representations.	The expectation of the student is to compare the properties of two functions given different representations. (*e.g., tables, graphs, equations or verbal descriptions)*
BUILDING FUNCTIONS: BF		
A1.BF.A	**Build new functions from existing functions (linear, quadratic and exponential).**	

A1.BF.A.1	Analyze the effect of translations and scale changes on functions.	The expectation of the student is to analyze the effect of translations and scale changes on functions. Describe the effect of the transformations on the graph of $f(x)$ by $kf(x), f(x) + k, f(x + k)$ for specific values of k (any real number). Find the specific value of k given the graphs of $f(x)$ and the graph after a transformation has been performed.
LINEAR, QUADRATIC AND EXPONENTIAL MODELS: LQE		
A1.LQE.A	**Construct and compare linear, quadratic and exponential models and solve problems.**	
A1.LQE.A.1	Distinguish between situations that can be modeled with linear or exponential functions. a) Determine that linear functions change by equal differences over equal intervals. b) Recognize exponential situations in which a quantity grows or decays by a constant percent rate per unit interval.	The expectation of the student is to distinguish between situations that can be modeled with linear or with exponential functions. a. Show that linear functions change by equal differences over equal intervals. b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another. c. Show that exponential functions change by equal factors over equal intervals. (*e.g., by algebraic proof, with a table showing differences or by calculating average rates of change over equal intervals)* d. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.
A1.LQE.A.2	Describe, using graphs and tables, that a quantity increasing exponentially eventually exceeds a quantity increasing linearly or quadratically.	The expectation of the student is to describe, using graphs and tables, a quantity increasing exponentially eventually exceeds a quantity increasing linearly or quadratically.
A1.LQE.A.3	Construct linear, quadratic and exponential equations given graphs, verbal descriptions or tables.	The expectation of the student is to construct linear, quadratic and exponential equations given graphs, verbal descriptions or tables.
A1.LQE.B	**Use arithmetic and geometric sequences.**	
A1.LQE.B.4	Write arithmetic and geometric sequences in recursive and explicit forms, and use them to model situations and translate between the two forms.	The expectation of the student is to write arithmetic and geometric sequences in recursive and explicit forms, use them to model situations and translate between the two forms. Connect arithmetic sequences to linear functions and geometric sequences to exponential functions. (*e.g., Explicit form: f(n)=3n+2; Recursive Form: f(n+1)= f(n) + 1)* Construct arithmetic and geometric sequences, given graphs, verbal descriptions or tables.

A1.LQE.B.5	Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the set of integers.	The expectation of the student is to recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the set of integers.
A1.LQE.B.6	Find the terms of sequences given an explicit or recursive formula.	The expectation of the student is to find the terms of general sequences given an explicit or recursive formula.
DATA AND STATISTICAL ANALYSIS: DS		
A1.DS.A	**Summarize, represent and interpret data.**	
A1.DS.A.1	Analyze and interpret graphical displays of data.	The expectation of the student is to analyze and interpret data plots on the real number line (dot plots, histograms and box plots).
A1.DS.A.2	Use statistics appropriate to the shape of the data distribution to compare center and spread of two or more different data sets.	The expectation of the student is to use statistics appropriate to the shape of the data distribution to compare center (median, mean, mode) and spread (interquartile range, standard deviation*) of two or more different data sets. *The standard deviation should be limited to a small data set with an integral mean. (*e.g., Calculate the standard deviation of a sample of 10 quiz scores with a mean of 23.)*
A1.DS.A.3	Interpret differences in shape, center and spreads in the context of the data sets, accounting for possible effects of outliers.	The expectation of the student is to interpret differences in shape, center and spreads in the context of the data sets, accounting for possible effects of extreme data points (outliers).
A1.DS.A.4	Summarize data in two-way frequency tables. Interpret relative frequencies in the context of the data, and recognize possible associations and trends in the data.	The expectation of the student is to summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal and conditional relative frequencies). Recognize possible associations and trends in the data.

A1.DS.A.5	Construct a scatter plot of bivariate quantitative data describing how the variables are related; determine and use a function that models the relationship. a) Construct a linear function to model bivariate data represented on a scatter plot that minimizes residuals. b) Construct an exponential function to model bivariate data represented on a scatter plot that minimizes residuals.	The expectation of the student is to construct a scatter plot of bivariate quantitative data describing how the variables are related; determine and use a function that models the relationship. Given a table of data (or data in context) for two quantitative variables, represent the relationship on a scatter plot and describe how the variables are related. Identify a function that best describes the relationship and use this function to solve problems. a. Using estimation and calculation, and/or technology, to fit a linear function to bivariate data represented on a scatter plot that minimizes residuals (distances from the mean). b. Using technology, fit an exponential or quadratic function to bivariate data represented on a scatter plot that minimizes residuals.
A1.DS.A.6	Interpret the slope (rate of change) and the y-intercept (constant term) of a linear model in the context of the data.	The expectation of the student is to interpret the slope (rate of change) and the y-intercept (constant term) of a linear model in the context of the data.
A1.DS.A.7	Determine and interpret the correlation coefficient for a linear association.	The expectation of the student is, using available technology, to determine the correlation between two numerical unknowns, interpret the correlation and describe the strengths and weaknesses of the correlation coefficient as a measure of linear association.
A1.DS.A.8	Distinguish between correlation and causation.	The expectation of the student is to distinguish between correlation and causation.

Algebra 2 Course-Level Expanded Expectations

NUMBER AND QUANTITY: NQ

A2.NQ.A	**Extend and use the relationship between rational exponents and radicals.**	
A2.NQ.A.1	Extend the system of powers and roots to include rational exponents.	The expectation of the student is to extend the system of powers and roots to include rational exponents, particularly rational exponents with integer numerators other than 1.
A2.NQ.A.2	Create and recognize equivalent expressions involving radical and exponential forms of expressions.	The expectation of the student is to create and recognize equivalent expressions involving radical and exponential forms of expressions containing exponents, including rational exponents.
A2.NQ.A.3	Add, subtract, multiply and divide radical expressions.	The expectation of the student is to add, subtract, multiply and divide radical expressions. When necessary, rationalize denominators using conjugates.
A2.NQ.A.4	Solve equations involving rational exponents and/or radicals and identify situations where extraneous solutions may result.	The expectation of the student is to solve equations involving rational exponents and/or radicals and manage appropriately the situations where extraneous solutions may result.
A2.NQ.B	**Use complex numbers.**	
A2.NQ.B.5	Represent complex numbers.	The expectation of the student is to represent complex numbers in the form $a + bi$, where a and b are real numbers. The symbol i is defined to be the square root of -1.
A2.NQ.B.6	Add, subtract, multiply and divide complex numbers.	The expectation of the student is to add, subtract, multiply and divide complex numbers. Leave all answers in the form $a + bi$.
A2.NQ.B.7	Know and apply the Fundamental Theorem of Algebra.	The expectation of the student is to know and apply the Fundamental Theorem of Algebra.

SEEING STRUCTURE IN EXPRESSIONS: SSE

A2.SSE.A	**Define and use logarithms.**	
A2.SSE.A.1	Develop the definition of logarithms based on properties of exponents.	The expectation of the student is to define a logarithm of a given base b of a quantity to be the exponent to which you raise the base to get that quantity *(e.g.,* $\log_b(x) = y$ *if and only if* $b^y = x$*).*

A2.SSE.A.2	Use the inverse relationship between exponents and logarithms to solve exponential and logarithmic equations.	The expectation of the student is to use the inverse relationship between exponents and logarithms to solve simple exponential and logarithmic equations. (e.g., *Solve* $2^x = 5$ *and* $\log_2(x) = 3$*.)*
A2.SSE.A.3	Use properties of logarithms to solve equations or find equivalent expressions.	The expectation of the student is to use properties of logarithms to do the following: a. Convert an exponent into a multiplier (factor). b. Convert between a logarithm of factors and the sum of the logarithms of the individual factors. c. Convert between a logarithm of a quotient and the difference of the logarithms of the dividend and divisor.
A2.SSE.A.4	Understand why logarithmic scales are used, and use them to solve problems.	The expectation of the student is to understand why logarithmic scales are used, and use them to solve problems. Use logarithmic scales to compare quantities and solve problems involving logarithms. *(e.g., pH scale, earthquake intensity, light intensity and sound intensity)*

REASONING WITH EQUATIONS AND INEQUALITIES: REI

A2.REI.A	**Solve equations and inequalities.**	
A2.REI.A.1	Create and solve equations and inequalities, including those that involve absolute value.	The expectation of the student is to create and solve equations and inequalities, including those that involve absolute value. These equations and inequalities would include, but wound not be limited to: linear, quadratic, cubic, exponential, step functions and absolute value. The student may use graphical and/or algebraic methods to solve these problems.
A2.REI.A.2	Solve rational equations where numerators and denominators are polynomials and where extraneous solutions may result.	The expectation of the student is to solve rational equations, where numerators and denominators are polynomials and where extraneous solutions may result.
A2.REI.B	**Solve general systems of equations and inequalities.**	
A2.REI.B.3	Create and solve systems of equations that may include non-linear equations and inequalities.	The expectation of the student is to create and solve systems of equations that may include non-linear equations and inequalities. Extend solving systems of equations to finding solutions of systems with two unknowns that include non-linear equations or inequalities. The student may use graphical and/or algebraic methods.

ARITHMETIC WITH POLYNOMIALS AND RATIONALS: APR

A2.APR.A	**Perform operations on polynomials and rational expressions.**	
A2.APR.A.1	Extend the knowledge of factoring to include factors with complex coefficients.	The expectation of the student is to extend the knowledge of factoring to completely factor general polynomial expressions.
A2.APR.A.2	Understand the Remainder Theorem and use it to solve problems.	The expectation of the student is to use factoring techniques to solve general polynomial equations, which could include complex solutions. Extend operations on polynomial expressions to include long division of a polynomial of degree 2 or higher by a binomial. Express the result as a quotient with a remainder. Understand the Remainder Theorem: For a polynomial $p(x)$ and a number a, the remainder on division of $p(x)$ by $(x-a)$ is $p(a)$, so $p(a) = 0$ if and only if $(x-a)$ is a factor of $p(x)$.
A2.APR.A.3	Find the least common multiple of two or more polynomials.	The expectation of the student is to find the least common multiple of two or more polynomials.
A2.APR.A.4	Add, subtract, multiply and divide rational expressions.	The expectation of the student is to add, subtract, multiply and divide rational expressions.
A2.APR.A.5	Identify zeros of polynomials when suitable factorizations are available, and use the zeros to sketch the function defined by the polynomial.	The expectation of the student is to identify zeros of polynomials when suitable factorizations are available, and use the zeros to sketch the function defined by the polynomial.
INTERPRETING FUNCTIONS: IF		
A2.IF.A	**Use and interpret functions.**	

A2.IF.A.1	Identify and interpret key characteristics of functions represented graphically, with tables and with algebraic symbolism to solve problems.	The expectation of the student is to identify domain and range of functions, and identify unique characteristics of functions represented graphically, with tables, with algebraic symbolism and translate between these representations. Function types include general polynomials, square roots, cube roots, absolute value of linear functions, simple piecewise- defined functions, step functions, exponential and logarithmic functions. These unique characteristics include the following: a. *x*- and *y*-intercepts, if any b. end behavior c. limited domains and ranges d. local maxima or minima values e. symmetries f. specific values of the function g. intervals of increasing and decreasing h. points of discontinuity i. vertical or horizontal asymptotes
A2.IF.A.2	Translate between equivalent forms of functions.	The expectation of the student is to translate between equivalent forms of functions. Find equivalent forms of functions to highlight key characteristics.
BUILDING FUNCTIONS: BF		
A2.BF.A	**Create new functions from existing functions.**	
A2.BF.A.1	Create new functions by applying the four arithmetic operations and composition of functions (modifying the domain and range as necessary).	The expectation of the student is to create functions by performing operations on functions, including addition, subtraction, multiplication, division and composition of functions. Modify the domain and range if necessary. (*e.g., to restrict a domain in order to avoid a zero denominator in a quotient of functions*)
A2.BF.A.2	Derive inverses of functions, and compose the inverse with the original function to show that the functions are inverses.	The expectation of the student is to derive inverses of simple functions, and compose the inverse with the original function to prove that the functions are inverses.
A2.BF.A.3	Describe the effects of transformations algebraically and graphically, creating vertical and horizontal translations, vertical and horizontal reflections and dilations (expansions/compressions) for linear, quadratic, cubic, square and cube root, absolute value, exponential and logarithmic functions.	The expectation of the student is to describe the effects of transformations algebraically and graphically, creating vertical and horizontal translations, vertical and horizontal reflections and dilations (scale changes causing expansions or compressions horizontally or vertically) for linear, quadratic, cubic, square and cube root, absolute value, exponential, logarithmic.

FUNCTION MODELING: FM

A2.FM.A	**Use functions to model real-world problems.**	
A2.FM.A.1	Create functions and use them to solve applications of quadratic and exponential function modeling problems.	The expectation of the student is to create functions and use them to solve simple applications of quadratic and exponential function models. The student may use graphical and/or algebraic methods. (*e.g., price-demand-cost-revenue-profit situations, compound interest problems and exponential growth or decay problems)*

DATA AND STATISTICAL ANALYSIS: DS

A2.DS.A	**Make inferences and justify conclusions.**	
A2.DS.A.1	Analyze how random sampling could be used to make inferences about population parameters.	The expectation of the student is to analyze how random sampling could be used to make inferences about a population.
A2.DS.A.2	Determine whether a specified model is consistent with a given data set.	The expectation of the student is to determine whether a specified model is consistent with a given data set. (e*.g., A model says a spinning coin falls heads up with probability 0.5. Would an experimental result of 5 tails in a row cause you to question the model?)*
A2.DS.A.3	Describe and explain the purposes, relationship to randomization and differences, among sample surveys, experiments and observational studies.	The expectation of the student is to describe and explain the purposes, relationship to randomization and differences among sample surveys, experiments and observational studies.
A2.DS.A.4	Use data from a sample to estimate characteristics of the population and recognize the meaning of the margin of error in these estimates.	The expectation of the student is to use data from a sample survey to estimate a population mean or proportion and recognize the meaning of the margin of error in these estimates.
A2.DS.A.5	Describe and explain how the relative sizes of a sample and the population affect the margin of error of predictions.	The expectation of the student is to describe and explain how the relative sizes of a sample and the population affect the margin of error of predictions and thus the validity of these predictions.
A2.DS.A.6	Analyze decisions and strategies using probability concepts.	The expectation of the student is to analyze decisions and strategies using probability concepts.
A2.DS.A.7	Evaluate reports based on data.	The expectation of the student is to evaluate reports based on data.
A2.DS.B	**Fit a data set to a normal distribution.**	

A2.DS.B.8	Know and use the characteristics of normally distributed data sets; predict what percentage of the data will be above or below a given value that is a multiple of standard deviations above or below the mean.	The expectation of the student is given a data set that is known to be normally distributed, predict what percentage of the data will be above or below a given value that is a multiple of standard deviations above or below the mean. *(e.g., Given the mean and standard deviation of heights of adult males, how many of a thousand randomly selected adults males would be expected to be taller than three standard deviations above the mean?)*
A2.DS.B.9	Fit a data set to a distribution using its mean and standard deviation to determine whether the data is approximately normally distributed.	The expectation of the student is to fit a data set to a distribution using its mean and standard deviation to determine whether the data is approximately normally distributed.

Geometry Course-Level Expanded Expectations

CONGRUENCE: CO

G.CO.A	**Experiment with transformations in the plane.**	
G.CO.A.1	Define angle, circle, perpendicular line, parallel line, line segment and ray based on the undefined notions of point, line, distance along a line and distance around a circular arc.	The expectation of the student is to know precise definitions of angle, circle, perpendicular line, parallel line, line segment and ray based on the undefined notions of point, line and distance along a line and distance around a circular arc.
G.CO.A.2	Represent transformations in the plane, and describe them as functions that take points in the plane as inputs and give other points as outputs.	The expectation of the student is to represent transformations in the plane (e.g., transparencies and geometry software); describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not. (*e.g., translation versus horizontal stretch)*
G.CO.A.3	Describe the rotational symmetry and lines of symmetry of two-dimensional figures.	The expectation of the student is given a figure (e.g., rectangle, parallelogram, trapezoid or regular polygon) describe the rotations and reflections that carry it onto itself.
G.CO.A.4	Develop definitions of rotations, reflections and translations in terms of angles, circles, perpendicular lines, parallel lines and line segments.	The expectation of the student is to develop definitions of rotations, reflections and translations in terms of angles, circles, perpendicular lines, parallel lines and line segments.
G.CO.A.5	Demonstrate the ability to rotate, reflect or translate a figure, and determine a possible sequence of transformations between two congruent figures.	The expectation of the student is given a geometric figure and a rotation, reflection or translation, draw the transformed figure using. (e.g., graph paper, tracing paper or geometry software.) Specify a sequence of transformations that will carry a given figure onto another.
G.CO.B	**Understand congruence in terms of rigid motions.**	
G.CO.B.6	Develop the definition of congruence in terms of rigid motions.	The expectation of the student is to use the descriptions of rigid motions (translations, rotations, reflections) to transform figures and predict the effect of a given rigid motion on a given figure; given two figures, use the definition of congruence in terms of rigid motions (preserving size and shape) to decide if they are congruent. (e.g., Is there a combination of rigid motions that transforms the first figure onto the second?)

G.CO.B.7	Develop the criteria for triangle congruence from the definition of congruence in terms of rigid motions.	The expectation of the student is to use the definition of congruence in terms of rigid motions to show that two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent. Explain how the criteria for triangle congruence (ASA, AAS, SAS and SSS) follow from the definition of congruence in terms of rigid motions and that they represent minimum requirements for congruence of any two triangles.
G.CO.C	**Prove geometric theorems.**	
G.CO.C.8	Prove theorems about lines and angles.	The expectation of the student is to prove theorems about lines and angles. (Theorems should include, but are not limited to, the following: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent; points on a perpendicular bisector of a line segment are exactly those equidistant from the segment's endpoints.)
G.CO.C.9	Prove theorems about triangles.	The expectation of the student is to prove theorems about triangles. (Theorems should include, but are not limited to, the following: measures of interior angles of a triangle sum to 180°; base angles of isosceles triangles are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point.)
G.CO.C.10	Prove theorems about polygons.	The expectation of the student is to prove theorems about polygons. (Theorems should include, but are not limited to, the following: opposite sides are congruent, opposite angles are congruent, the diagonals of a parallelogram bisect each other, and conversely, rectangles are parallelograms with congruent diagonals.)
G.CO.D	**Make geometric constructions.**	
G.CO.D.11	Construct geometric figures using various tools and methods.	The expectation of the student is to make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.). a. Construct basic geometric components. (*e.g., copying a segment; copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line)* b. Construct specific geometric shapes. (*e.g., regular hexagons inscribed in circles, equilateral triangles, squares, etc.)*

SIMILARITY, RIGHT TRIANGLES AND TRIGONOMETRY: SRT

G.SRT.A	**Understand similarity in terms of similarity transformations.**	
G.SRT.A.1	Construct and analyze scale changes of geometric figures.	The expectation of the student is to verify experimentally the properties of dilations given by a center and a scale factor: a. A dilation takes a line not passing through the center of the dilation to a parallel line and leaves a line passing through the center unchanged. b. The dilation of a line segment is longer or shorter in the same ratio as given by the scale factor.
G.SRT.A.2	Use the definition of similarity to decide if figures are similar and to solve problems involving similar figures.	The expectation of the student is given two figures, use the definition of similarity in terms of similarity transformations to decide if they are similar; explain using similarity transformations the meaning of similarity for triangles as the equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides.
G.SRT.A.3	Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.	The expectation of the student is to use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.
G.SRT.B	**Prove theorems involving similarity.**	
G.SRT.B.4	Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.	The expectation of the student is to prove theorems about triangles. (Theorems should include, but not be limited to: a line parallel to one side of a triangle divides the other two sides proportionally, and conversely, the Pythagorean Theorem proven using triangle similarity.) Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.
G.SRT.C	**Define trigonometric ratios, and solve problems involving right triangles.**	
G.SRT.C.5	Understand that side ratios in right triangles define the trigonometric ratios for acute angles.	The expectation of the student is to understand, using similarity, that side ratios in right triangles define the trigonometric ratios (sine, cosine, tangent, secant, cosecant, cotangent) for acute angles.
G.SRT.C.6	Explain and use the relationship between the sine and cosine of complementary angles.	The expectation of the student is to explain and use the relationship between the sine and cosine of complementary angles.

G.SRT.C.7	Use trigonometric ratios and the Pythagorean Theorem to solve right triangles.	The expectation of the student is to use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.
G.SRT.C.8	Derive the formula A = 1/2 ab sin(C) for the area of a triangle.	The expectation of the student is to derive the formula A=1/2 ab sin (C) for the area of a triangle.
CIRCLES: C		
G.C.A	**Understand and apply theorems about circles.**	
G.C.A.1	Prove that all circles are similar using similarity transformations.	The expectation of the student is to prove that all circles are similar using similarity transformations (dilations).
G.C.A.2	Identify and describe relationships among inscribed angles, radii and chords of circles.	The expectation of the student is to identify and describe relationships among inscribed angles, radii and chords. (Include, but not limited to, the relationship between central, inscribed and circumscribed angles; inscribed angles on a diameter are right angles; the radius of a circle is perpendicular to the tangent where the radius intersects the circle.)
G.C.A.3	Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle.	The expectation of the student is to construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle.
G.C.B	**Find arc lengths and areas of sectors of circles.**	
G.C.B.4	Derive the formula for the length of an arc of a circle.	The expectation of the student is to derive, using similarity, the fact that the length of the arc intercepted by an angle is proportional to the radius.
G.C.B.5	Derive the formula for the area of a sector of a circle.	The expectation of the student is to derive the formula for the area of a sector of a circle using ratios of arc lengths.
EXPRESSING GEOMETRY PROPERTIES WITH EQUATIONS: GPE		
G.GPE.A	**Translate between the geometric description and the equation for a conic section.**	

G.GPE.A.1	Derive the equation of a circle.	The expectation of the student is to derive the equation of a circle, given the center and radius using the Pythagorean Theorem; complete the square to find the center and radius of a circle given by an equation.
G.GPE.A.2	Derive the equation of a parabola given a focus and directrix.	The expectation of the student is to derive the equation of a parabola given a focus and directrix, using the fact that the distances to the focus and to the directrix are equal from any point on the parabola.
G.GPE.B	**Use coordinates to prove geometric theorems algebraically.**	
G.GPE.B.3	Use coordinates to prove geometric theorems algebraically.	The expectation of the student is to use coordinates to prove simple geometric theorems algebraically. (*e.g., prove or disprove that a figure defined by four given points in the Cartesian coordinate plane is a rectangle; prove or disprove that the point* $(1, \sqrt{3})$ *lies on the circle centered at the origin and containing the point (0, 2).)*
G.GPE.B.4	Prove the slope criteria for parallel and perpendicular lines and use them to solve problems.	The expectation of the student is to prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems. (*e.g., Find the equation of a line parallel or perpendicular to a given line that passes through a given point.)*
G.GPE.B.5	Find the point on a directed line segment between two given points that partitions the segment in a given ratio.	The expectation of the student is to find the point on a directed line segment between two given points that partitions the segment in a given ratio.
G.GPE.B.6	Use coordinates to compute perimeters of polygons and areas of triangles and rectangles.	The expectation of the student is to use coordinates to compute perimeters of polygons and areas of triangles and rectangles. (*e.g., using the distance formula)*
GEOMETRIC MEASUREMENT AND DIMENSION: GMD		
G.GMD.A	**Explain volume formulas and use them to solve problems.**	
G.GMD.A.1	Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid and cone.	The expectation of the student is to give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid and cone. Use dissection arguments, Cavalieri’s principle or informal limit arguments.

G.GMD.A.2	Use volume formulas for cylinders, pyramids, cones, spheres and composite figures to solve problems.	The expectation of the student is to use volume formulas for cylinders, pyramids, cones, spheres and composite figures to solve mathematical modeling problems.
G.GMD.B	**Visualize relationships between two-dimensional and three-dimensional objects.**	
G.GMD.B.3	Identify the shapes of two-dimensional cross-sections of three-dimensional objects.	The expectation of the student is to identify the shapes of two-dimensional cross-sections of three-dimensional objects. (e.g., What is the shape of a plane section parallel to the base of a cylinder? What is the shape of a plane section not parallel to but not intersecting the base of a cube?
G.GMD.B.4	Identify three-dimensional objects generated by transformations of two-dimensional objects.	The expectation of the student is to identify three-dimensional objects generated by transformations of two-dimensional objects.
MODELING WITH GEOMETRY: MG		
G.MG.A	**Apply geometric concepts in modeling situations.**	
G.MG.A.1	Use geometric shapes, their measures and their properties to describe objects.	The expectation of the student is to use geometric shapes, their measures and their properties to describe objects. (*e.g., Modeling a tree trunk or a human torso as a cylinder. Estimate the volume of a water tower using a sphere or cylinder.)*
G.MG.A.2	Apply concepts of density based on area and volume in modeling situations.	The expectation of the student is to apply concepts of density based on area and volume in modeling situations. (*e.g., persons per square mile, BTUs per cubic foot)*
G.MG.A.3	Apply geometric methods to solve design mathematical modeling problems.	The expectation of the student is to apply geometric methods to solve design mathematical modeling problems. (*e.g., Design an object or structure to satisfy physical constraints or minimize cost. Calculate how many boxes a truck can hold.)*
CONDITIONAL PROBABILITY AND RULES THE RULES OF PROBABILITY: CP		
G.CP.A	**Understand independence and conditional probability and use them to interpret data.**	

G.CP.A.1	Describe events as subsets of a sample space using characteristics of the outcomes, or as unions, intersections or complements of other events.	The expectation of the student is to describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections or complements of other events ("or", "and", "not").
G.CP.A.2	Understand the definition of independent events and use it to solve problems.	The expectation of the student is to understand that two events A and B are independent if the probability of A and B occurring together is the product of their probabilities, and use this characterization to determine if they are independent.
G.CP.A.3	Calculate conditional probabilities of events.	The expectation of the student is to understand the conditional probability of A given B as P(A and B)/P(B). Interpret independence of A and B as saying that the conditional probability of A given B is the same as the probability of A. The conditional probability of B given A is the same as the probability of B. Find the conditional probability of A given B as the fraction of B's outcomes that also belong to A. Interpret the answer in terms of the model.
G.CP.A.4	Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities.	The expectation of the student is to construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Using the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities. (*e.g., Collect data from a random sample of students in your school on their favorite subject among math, science and English. Estimate the probability that a randomly selected student from your school will favor science given that the student is in tenth grade. Do the same for other subjects and compare the results.)*
G.CP.A.5	Recognize and explain the concepts of conditional probability and independence in a context.	The expectation of the student is to recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. (*e.g., Compare the chance of having lung cancer if you are a smoker with the chance of being a smoker if you have lung cancer.)*
G.CP.A.6	Apply and interpret the Addition Rule for calculating probabilities.	The expectation of the student is to apply the Addition Rule, P(A or B) = P(A) + P(B) – P(A and B), and interpret the answer in terms of the model.
G.CP.A.7	Apply and Interpret the general Multiplication Rule in a uniform probability model.	The expectation of the student is to apply and interpret the general Multiplication Rule in a uniform probability model.

G.CP.A.8	Use permutations and combinations to solve problems.	The expectation of the student is to use permutations and combinations to solve problems.