

Unit	Lesson	Lesson Objectives
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**Relationships Between Quantities****Literal Equations**

- Determine if expressions are equivalent.
- Solve a literal equation in terms of a given variable.

**Function Operations**

- Combine functions using arithmetic operations, expressing the results both algebraically and graphically.
- Evaluate sums, differences, products, and quotients of functions.

**Relations and Functions**

- Determine if a relation is a function.
- Determine if the function is one-to-one.
- Determine the domain and range of a relation.
- Evaluate function rules.
- Represent a relation in multiple ways, including equations, graphs, words, and tables of values.

**Symmetry**

- Determine the symmetry of a function algebraically.
- Determine the symmetry of a relation from a graph.

**Function Inverses**

- Find the inverse of a function.
- Use composition to verify that functions are inverses.

**Rate of Change**

- Calculate the average rate of change of a function over a specified interval.
- Interpret the average rate of change of a function over a specified interval.
- Solve problems involving direct variation.

**Linear Functions**

- Determine if a function is linear.
- Represent a linear relationship numerically, algebraically, and graphically.

**Performance Task: Going on a Round Trip****Solving One-Variable Equations with Systems**

- Solve a one-variable linear or quadratic equation by graphing a related system of equations.

**Quadratics and Complex Numbers****Solving Quadratic Equations by Factoring**

- Find real solutions for quadratic equations using the zero product property.
- Use key attributes of a quadratic function to solve word problems.

**Quadratic Inequalities**

- Create quadratic inequalities in one variable and use them to solve problems.
- Find real solutions of quadratic inequalities algebraically and graphically.

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**Complex Numbers**

- Determine the absolute value of a complex number.
- Represent complex numbers in the form  $a + bi$  or in the complex plane.
- Represent square roots of negative numbers as multiples of  $i$ .
- Simplify powers of  $i$  using their cyclic nature.

**Operations with Complex Numbers**

- Identify the field properties of complex numbers.
- Perform addition, subtraction, and multiplication of complex numbers.

**Completing the Square**

- Find complex solutions to quadratic equations by completing the square.
- Recognize the pattern of a perfect-square trinomial as the square of a binomial.
- Use the square root property to solve equations.

**The Quadratic Formula**

- Find real and complex solutions of quadratic equations using the quadratic formula.
- Use the discriminant to determine the number and type of roots of a quadratic equation.

**Transformations of Quadratic Functions**

- Describe the effects of changes in  $a$ ,  $h$ , and  $k$  to the graph of a function in the form  $y = a(x - h)^2 + k$ .
- Use completing the square to write quadratic functions in the form  $y = a(x - h)^2 + k$ .

**Modeling with Quadratic Equations**

- Use quadratic equations to model and solve real-world problems.

**Square Root Functions**

- Find the domain of a square root function.
- Find the inverse of a quadratic function.

**The Cube Root Function**

- Graph the cube root function, and translations and reflections of it.
- State the key features of the cube root function, and translations and reflections of it.

**Polynomial Operations****Introduction to Polynomials**

- Identify and classify polynomials.
- Write polynomials in standard form.

**Addition and Subtraction of Polynomials**

- Perform addition and subtraction of polynomials.

**Multiplication of Polynomials**

- Perform multiplication of polynomials.

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**Factoring Polynomials: GCF**

- Determine an appropriate way to factor a polynomial for a given context.
- Determine the greatest common monomial factor of two or more terms.
- Write a polynomial as the product of a monomial and polynomial having the same number of terms.

**Factoring Polynomials: Difference of Squares**

- Determine if a polynomial is factorable by recognizing that it is a difference of two squares and, if so, applying the identity.
- Identify a monomial that is a perfect square and find the square root.

**Factoring Polynomials Completely**

- Analyze polynomial expressions to factor them completely.

**Division of Polynomials**

- Use inverse operations to check the result of polynomial division.
- Use long division to find quotients of polynomials.

**The Binomial Theorem**

- Use the Binomial theorem to expand binomials.
- Use the Binomial theorem to find a specific term in an expansion.

**Polynomial Functions****Synthetic Division and the Remainder Theorem**

- Apply the remainder theorem.
- Use synthetic division to divide a polynomial by a linear factor.

**The Rational Roots Theorem**

- Determine the roots of and factor a polynomial function.
- Use the rational root theorem to determine possible roots of a polynomial function.

**The Fundamental Theorem of Algebra**

- Apply the fundamental theorem of algebra to determine the number of roots of a polynomial function.
- Use the complex conjugate theorem to factor and solve polynomial equations.

**Writing Polynomial Functions from Complex Roots**

- Write polynomial functions from complex roots.

**Quadratic in Form Polynomials**

- Identify fourth degree equations that are quadratic in form and use an appropriate u-substitution.
- Solve fourth degree equations that are quadratic in form.

**Graphing Polynomial Functions**

- Graph polynomial functions using key features.

**Solving Polynomial Equations using Technology**

- Use technology to solve or approximate solutions of one-variable polynomial equations.

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		<b>Geometric Series</b> Apply geometric series to solve mathematical and real-world problems. Find sums of finite and infinite geometric series.
		<b>Rational Functions</b>
		<b>Negative Exponents</b> Evaluate numeric expressions using laws of integer exponents. Simplify single-variable expressions using laws of integer exponents.
		<b>Simplifying Rational Expressions</b> Simplify rational expressions using laws of integer exponents.
		<b>Multiplying and Dividing Rational Expressions</b> Perform multiplication and division of rational expressions.
		<b>Adding and Subtracting Rational Expressions</b> Perform addition and subtraction of rational expressions. Simplify complex rational expressions containing sums or differences.
		<b>Rational Equations</b> Determine the reasonableness of a solution to a rational equation. Solve rational equations and determine extraneous solutions. Use rational equations to model and solve real-world problems.
		<b>Vertical Asymptotes of Rational Functions</b> Determine the vertical asymptotes and holes in the graph of a rational function having the $x$ -axis as its only horizontal asymptote. Solve problems involving inverse variation.
		<b>Graphing Rational Functions</b> Determine the horizontal asymptotes of a rational function. Graph rational functions that have only vertical or horizontal asymptotes.
		<b>Modeling with Rational Functions</b> Model and solve real-world problems using rational functions.
		<b>Radical Functions</b>
		<b>Graphing Radical Functions</b> Determine the domain and range of square root and cube root functions. Relate transformations to the graphs of square root and cube root functions to their parent function.
		<b>Adding and Subtracting Radicals</b> Add and subtract radical expressions. Identify like radicals.
		<b>Multiplying Radicals</b> Perform multiplication of radical expressions.

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		<p><b>Dividing Radicals</b></p> <p>Perform division of radical expressions, rationalizing the denominator when necessary.</p> <p><b>Radical Equations and Extraneous Roots</b></p> <p>Model and solve mathematical and real-world problems using radical equations, and determine extraneous roots.</p>
		<p><b>Exponential and Logarithmic Functions</b></p> <p><b>Graphing Exponential Functions</b></p> <p>Determine the domain and range of exponential functions.</p> <p>Graph exponential functions.</p> <p>Identify exponential functions.</p> <p><b>Solving Exponential Equations by Rewriting the Base</b></p> <p>Solve exponential equations by rewriting bases.</p> <p><b>Graphing Logarithmic Functions</b></p> <p>Determine the domain and range of logarithmic functions.</p> <p>Identify and analyze the graphs of logarithmic functions.</p> <p>Identify logarithmic functions.</p> <p><b>Evaluating Logarithmic Expressions</b></p> <p>Evaluate common logarithms using a calculator.</p> <p>Evaluate logarithmic expressions by converting between logarithmic and exponential forms.</p> <p>Solve logarithmic equations by converting between logarithmic and exponential forms.</p> <p><b>Solving Logarithmic Equations using Technology</b></p> <p>Rewrite logarithmic expressions using the change of base algorithm.</p> <p>Solve a one-variable equation containing logarithms by transforming it into a system of equations.</p> <p><b>Properties of Logarithms</b></p> <p>Evaluate, expand, and simplify logarithmic expressions using properties of logarithms.</p> <p><b>Solving Equations using Properties of Logarithms</b></p> <p>Apply properties of logarithms to solve logarithmic equations.</p> <p>Determine extraneous solutions of logarithmic equations.</p> <p><b>Base <math>e</math></b></p> <p>Analyze exponential and logarithmic functions in base <math>e</math> to determine key features of the graph.</p> <p>Apply properties of logarithms and exponents to solve exponential and logarithmic equations having base <math>e</math>.</p> <p>Determine the domain and range of exponential and logarithmic functions in base <math>e</math>.</p> <p><b>Solving Exponential and Logarithmic Equations</b></p> <p>Solve exponential and logarithmic equations using inverses, properties, and algorithms.</p> <p><b>Modeling with Exponential and Logarithmic Equations</b></p> <p>Model and solve real-world problems using exponential and logarithmic functions.</p>

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**Statistics and Probability****Designing a Study**

- Analyze study types and sampling methods.
- Classify sampling methods.
- Classify study types.
- Determine if a sample is biased.

**Representing Data**

- Describe a data set using measures of central tendency and range.
- Determine if a representation of data is misleading.

**Standard Deviation**

- Calculate variance and standard deviation of a sample or population.
- Determine if a value is within a given z-score.
- Interpret standard deviation as it pertains to the spread of a graph.

**Properties of Probability Distributions**

- Create probability distributions from a data set.
- Identify properties of a probability distribution.
- Solve problems using probability distributions.

**Expected Value**

- Calculate expected values.
- Use expected values to make decisions.

**Binomial Distribution**

- Calculate binomial probabilities.
- Identify a binomial experiment.
- Identify the probability of success, probability of failure, and number of trials for a binomial experiment.

**Introduction to Normal Distributions**

- Apply the z-score formula to solve problems.
- Describe normal distributions using the mean and standard deviation.
- Solve problems using the empirical rule.

**Applications with Standard Normal Distribution**

- Solve problems using the standard normal table.

**Statistical Inferences**

- Make inferences about a population from a sample.

**Hypothesis Testing**

- Determine if a result is statistically significant.
- Perform hypothesis tests on normally distributed data.

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<b>Trigonometric Functions</b>		
<b>Radian Measure</b>		
Convert between degree and radian measure.		
Use the definition of radian measure to calculate arc lengths, radii, and angle measures.		
<b>The Unit Circle</b>		
Compare sine, cosine, and tangent values for angles having the same reference angle.		
Find the sine, cosine, and tangent values of angle measures using the unit circle.		
<b>Reciprocal Trigonometric Functions</b>		
Evaluate the six trigonometric functions for special angles.		
Simplify expressions involving the six trigonometric functions using reciprocal relationships.		
Solve right triangle trigonometry problems involving reciprocal trigonometric functions.		
<b>Evaluating the Six Trigonometric Functions</b>		
Evaluate the six trigonometric functions for angles in degrees or radians based on one or more given trigonometric function values.		
Evaluate the six trigonometric functions for angles in degrees or radians given a point on the terminal ray.		
<b>Graphing Sine and Cosine</b>		
Analyze key features of sine and cosine functions from equations and graphs.		
<b>Changes in Period and Phase Shift of Sine and Cosine Functions</b>		
Relate transformations of the graphs of the sine and cosine functions to the equation.		
<b>Graphing Cosecant and Secant Functions</b>		
Analyze key features of secant and cosecant functions from equations and graphs.		
<b>Graphing Tangent and Cotangent</b>		
Analyze key features of tangent and cotangent functions from equations and graphs.		
<b>Modeling with Periodic Functions</b>		
Model and solve real-world problems using periodic functions.		
<b>Mathematical Modeling</b>		
<b>Linear Programming</b>		
Maximize a function given constraints.		
Represent and solve real-world problems using linear programming.		
<b>Modeling with Systems</b>		
Model and solve real-world problems using linear-quadratic or quadratic-quadratic systems of equations.		
<b>Absolute Value Functions</b>		
Analyze absolute value functions to determine key features of the graph.		
Model and solve mathematical and real-world problems with absolute value functions.		

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**Piecewise Defined Functions**

Determine the domain, range, and continuity of piecewise defined functions.

Evaluate piecewise defined functions.

Graph piecewise defined functions.

**Step Functions**

Analyze step functions to determine key features of the graph.

Evaluate step functions.

Use step functions to model real-world problems.

**Comparing Characteristics of Functions**

Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).

Determine the similarities and differences in characteristics of multiple functions graphically.

Determine the similarities and differences in characteristics of multiple functions symbolically.

Determine the similarities and differences in characteristics of multiple functions tabularly.

**Performance Task: Production Schemes**

Determine the reasonableness of a function model.

Use an appropriate function model to describe random data.

Use function models to make predictions about situations.