



PowerTeaching[®] Math

3rd Edition

Alignment to the Iowa Core for Mathematics

Standards for Mathematical Practice and
Standards for Mathematical Content

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Section I: PowerTeaching Math 3rd Edition Alignment to the Standards for Mathematical Practice

Mathematical Practice 1: Make sense of problems and persevere in solving them.

The PowerTeaching curriculum consistently encourages students to ask questions, look for relationships, plan for solutions, estimate, solve and then assess their reasoning and the reasonableness of their answers, and finally check their work. Students focus on these good habits as a part of the daily PowerTeaching lesson structure as well as in specific strategy lessons throughout the curriculum.

- **Teamwork**—During daily Team Huddle, Team Mastery, and prep for Lightning Round activities, students work with their teammates to discuss, plan for, and solve math problems. Within the team, they must work through disagreements, ensure that each teammate understands and can explain the solution, and encourage each other when problems seem difficult.
- **Extended response**—Many PowerTeaching learning cycles culminate in an extended response lesson. The math problems in these lessons are complex and combine multiple math topics. The teacher modeling, teamwork activities, and individual practice are all centered on solving these real-world problems in steps: understand the problem, find the parts, make a plan, estimate the answer, find the solution, and assess the reasonableness and correctness of the solution. Students are also asked to explain their thinking and make sense of problems daily during Get the Goof and Team Mastery, and while completing homework.
- **Performance Task cycles**—Each PowerTeaching Math level includes at least four performance task cycles. These cycles involve three days of work on a single, rich, real-world context. Students apply the content they have already learned to a real-world scenario in which math is required to solve many interrelated problems, such as in starting your own food truck business (6-2: Computation Skills), designing a bathroom remodel (7-8: Geometry and Shapes), deciding whether to rent or buy a home (8-10: Modeling with Functions), or planning healthy menus (Algebra-3: Equations and Relationships). Students work in teams, with team help, and then individually to make sense of a rich, real-world context and then test out which math tools and models can help them arrive at a reasonable answer.
- **Think Like a Mathematician lessons**—In grades 6–8, students practice various problem-solving strategies at multiple points. Specific lessons introduce and have students practice strategies such as identifying extraneous data, solving simpler problems, and guess and check.

Lessons focusing on MP.1: Make sense of problems and persevere in solving them.

Grade 6

- Unit 1 Cycle 1 Lesson 3—Think Like a Mathematician: Making Sense 1
Unit 1 Cycle 1 Lesson 4—Think Like a Mathematician: Making Sense 2
Unit 1 Cycle 1 Lesson 5—Think Like a Mathematician: Making Sense 3
Unit 6 Cycle 2 Lesson 5—Think Like a Mathematician: Making Sense 4

Grade 7

- Unit 1 Cycle 1 Lesson 3—Think Like a Mathematician: Making Sense 1
Unit 1 Cycle 1 Lesson 4—Think Like a Mathematician: Making Sense 2
Unit 1 Cycle 1 Lesson 5—Think Like a Mathematician: Making Sense 3
Unit 3 Cycle 3 Lessons 1–3—Rational Numbers Performance Task (Underwater Exploration)
Unit 5 Cycle 1 Lesson 6—Think Like a Mathematician: Making Sense 4

Grade 8

- Unit 1 Cycle 1 Lesson 3—Think Like a Mathematician: Making Sense 1
Unit 1 Cycle 1 Lesson 4—Think Like a Mathematician: Making Sense 2
Unit 1 Cycle 1 Lesson 5—Think Like a Mathematician: Making Sense 3
Unit 6 Cycle 2 Lesson 5—Think Like a Mathematician: Making Sense 4

Algebra 1

- Unit 1 Cycle 1 Lesson 3—Think Like a Mathematician: Making Sense 1
Unit 1 Cycle 1 Lesson 4—Think Like a Mathematician: Making Sense 2
Unit 1 Cycle 1 Lesson 5—Think Like a Mathematician: Making Sense 3

Mathematical Practice 2: Reason abstractly and quantitatively.

Throughout PowerTeaching, students will routinely approach math concepts by decontextualizing and contextualizing situations and using both concrete and abstract tools and methods. Given a description of a situation or visual, such as a graph, students decontextualize it to determine the numbers and operations involved to solve the problem, whether numbers represent a ratio, or the relationships between the values. Students also contextualize problems by translating math into real-world situations or visual representations to help them see relationships.

- **Think Like a Mathematician lessons**—In grades 6–8, students practice various problem-solving strategies at multiple points. The problem-solving strategies that students learn help them break apart word problems and real-world math scenarios into the important information, and then represent this information as numeric and algebraic models.
- **Get the Goof/Team Mastery/Homework**—In each cycle, students will apply the problem solving strategies they have learned. Many lessons include real-world math problems. Students learn to represent the solutions to these problems concretely and abstractly. Students are also routinely asked to design a math story for a numeric or algebraic model.
- **Performance Task cycles**—The PowerTeaching curriculum includes quarterly project-based learning opportunities. These activities will be multi-day cycles of learning that include planning, research, modeling, reporting, and presenting. Students will be required to represent their project topic mathematically, use the math to find a solution to the problem they researched or an answer to the question they asked, and then explain how the mathematical model relates back to their original problem or question.

Mathematical Practice 3: Construct viable arguments and critique the reasoning of others.

Students will support their arguments with sound reasoning as well as critique or support the reasoning of others. They will construct their supports and critiques both in writing as well as verbally.

- **Get the Goof**—Each lesson includes a “Get the Goof” activity. Students will discuss a completed problem related to recently studied math topics. They will work with their teams to identify the error in thinking that led to a mistake in the math work. The students will explain the error and correct the math.
- **Random Reporter Rubric**—A part of the daily PowerTeaching routine includes teamwork and team discussion to solve problems. At various points during each lesson, the teacher will use Random Reporter to have a student from each team share their answer and support that answer with their team’s reasoning. During Team Huddle, students work together in their teams to answer the first question from Team Mastery, complete with an explanation of their thinking and the strategies they used to solve the problem. After students have completed the rest of their Team Mastery problems independently, they discuss their answers to the Lightning Round question as a team to make sure everyone has a correct answer and explanation of their thinking. They are given feedback using the Random Reporter rubric for both Team Huddle and the Lightning Round.

Mathematical Practice 4: Model with mathematics.

Students will use tables, graphs, charts and diagrams to represent mathematical information. They will also use number sentences, expressions, and equations to describe a situation. Students will also use the information they gather in tables, graphs, charts, and diagrams to identify patterns, determine relationships, and draw conclusions.

- **Think Like a Mathematician lessons**—In grades 6–8, students practice various problem-solving strategies at multiple points. Specific lessons introduce and have students practice strategies such as building various models, like organized lists, tree diagrams, or number lines.
- **Think Alouds**—Through the Think Alouds in Interactive Instruction and Guided Practice, students are exposed to modeling relationships with ratios and percents, tables, graphs, tape diagrams, formulas, expressions, equations, inequalities, systems of equations, functions, etc.
- **Get the Goof/Team Mastery/Homework**—The ongoing problem solving experiences, word problems, real-world scenarios, and extended response, often require students to represent the data as a model. Students must determine which model would best help them find the solution or answer the question.

Lessons focusing on MP.4: Model with mathematics.

Grade 6

- Unit 3 Cycle 3 Lesson 4—Think Like a Mathematician: Build a Math Model 1
- Unit 4 Cycle 2 Lesson 4—Think Like a Mathematician: Build a Math Model 2

Grade 7

- Unit 2 Cycle 2 Lesson 5—Think Like a Mathematician: Build a Math Model 1
- Unit 4 Cycle 2 Lesson 4—Think Like a Mathematician: Build a Math Model 2

Grade 8

- Unit 3 Cycle 2 Lesson 4—Think Like a Mathematician: Build a Math Model 1
- Unit 4 Cycle 2 Lesson 5—Think Like a Mathematician: Build a Math Model 2

Mathematical Practice 5: Use appropriate tools strategically.

Throughout PowerTeaching Math, students will be guided to use various tools, such as calculators, spreadsheet software, protractors, compasses, estimation and mental math, manipulatives, equivalent fractions, equation structures, and properties of operations to solve math problems and answer questions. They will also be faced with opportunities to choose which tool would best help them solve more complex math problems or real-world scenarios. The students will more often be faced with choices when completing extended response and project-based learning activities.

Mathematical Practice 6: Attend to precision.

Students will use symbols, math vocabulary, and clear explanations in their team discussions and written and oral explanations to provide precise solutions to their problems. Students will also make choices to best represent their solution and reasoning clearly and efficiently. PowerTeaching Math teaches students to check their accuracy as they translate situations into expressions and mathematical sentences, calculate problems using various units of measure, especially when converting between units, preserving balance of equations, representing inequalities on number lines, and thinking critically about statistical data.

- **Random Reporter Rubric**—Students will use the Random Reporter rubric to assess the completeness and clarity of their oral and written explanations. They will also use the rubric to critique the explanations of their peers. Complete explanations include the correct answer, a clear explanation in words, as a diagram, or using symbols to show how they got their answer, and a connection to the mathematical practice they used in solving the problem.
- **Vocabulary/Vocabulary Vault**—Key vocabulary is highlighted in each lesson. The definition is built into the lesson instead of only existing in a separate glossary. Students will see the vocabulary used correctly within the teacher modeling and be expected to use key vocabulary and precise definitions to support their mathematical thinking in their answers. Each cycle, students are encouraged to earn extra team points with Vocabulary Vault by finding and explaining examples of math vocabulary used outside the classroom.

Mathematical Practice 7: Look for and make use of structure.

Specific targeted skills in the PowerTeaching Math curriculum address the topics of structure and patterns. When students can recognize how certain properties, such as the commutative properties of addition and multiplication, or distributive property, can help them rearrange mathematical expressions in different ways to reach the same solution, they are prepared to look at problems in multiple ways and use different methods to solve problems.

- **Think Like a Mathematician lessons**—In grades 6–8, students practice various problem-solving strategies at multiple points. Specific lessons introduce and have students practice strategies such as working backward through problems, finding patterns, and recognizing sequences.
- **Expressions and Equations domain**—Within the Expressions and Equations domain, students will consistently work to make sense of data by defining any patterns they notice and translating those patterns into expressions, equations, and graphs.
- **Formulas and Mathematical Rules**—In the PowerTeaching Math curriculum, students will be guided through instruction, modeling, teamwork, and individual practice, to develop rules and formulas based on their prior knowledge and work with multiple examples. Instead of being given the rule, they will work collaboratively to develop the rule, and then prove it by applying it to new situations.

Lessons focusing on MP.7: Look for and make use of structure.
<p>Grade 6</p> <ul style="list-style-type: none"> Unit 3 Cycle 3 Lesson 4—Think Like a Mathematician: Build a Math Model 1 Unit 5 Cycle 1 Lesson 5—Think Like a Mathematician: Find the Patterns and Structure 1 Unit 7 Cycle 3 Lesson 5—Think Like a Mathematician: Find the Patterns and Structure 2
<p>Grade 7</p> <ul style="list-style-type: none"> Unit 4 Cycle 3 Lesson 5—Think Like a Mathematician: Find the Patterns and Structure 1 Unit 6 Cycle 1 Lesson 6—Think Like a Mathematician: Find the Patterns and Structure 2
<p>Grade 8</p> <ul style="list-style-type: none"> Unit 5 Cycle 2 Lesson 5—Think Like a Mathematician: Find the Patterns and Structure 1 Unit 7 Cycle 2 Lesson 5—Think Like a Mathematician: Find the Patterns and Structure 2
Mathematical Practice 8: Look for and express regularity in repeated reasoning.
<p>Specific targeted skills in the PowerTeaching curriculum address the topic of repeated reasoning to find shortcuts, processes, and formulas. Once students have an understanding of why a particular process works, such as working multiple examples to see that subtracting a number yields the same result as adding the opposite of that number, they can understand why the shortcut, changing subtracting to adding the inverse, works. This can help them solve problems with efficiency and fluency.</p> <ul style="list-style-type: none"> Expressions and Equations domain—Within the Expressions and Equations domain, students will prove that expressions are equivalent, prove or disprove solutions to equations and inequalities, and use the properties of addition and multiplication to solve problems. Geometry domain—Within the Geometry domain, students will apply their knowledge of expressions and equations to geometry and derive formulas for area, volume, and surface area.

Section II: Grade 6 Alignment to the Standards for Mathematical Content

Grade 6	
Ratios and Proportional Relationships	
Understand ratio concepts and use ratio reasoning to solve problems	
Standard for Mathematical Content 6.RP.A.1: Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities.	
<ul style="list-style-type: none">• Unit 5 Cycle 1 Lesson 1—What are ratios?• Unit 6 Cycle 1 Lesson 5—Rate and Ratio Problem Solving• Unit 6 Cycle 3 Lessons 1–3—Ratio and Percent Applications Performance Task (Preparing for a Dinner Fundraiser)	
Standard for Mathematical Content 6.RP.A.2: Understand the concept of a unit rate a/b associated with a ratio $a:b$ with $b \neq 0$, and use rate language in the context of a ratio relationship.	
<ul style="list-style-type: none">• Unit 5 Cycle 1 Lesson 3—Rate and Unit Rate• Unit 6 Cycle 1 Lesson 5—Rate and Ratio Problem Solving• Unit 6 Cycle 3 Lessons 1–3—Ratio and Percent Applications Performance Task (Preparing for a Dinner Fundraiser) <p>Lessons in other grade levels:</p> <ul style="list-style-type: none">• Grade 7 Unit 4 Cycle 1 Lesson 1—Basic Unit Rates	
Standard for Mathematical Content 6.RP.A.3: Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations.	
<ol style="list-style-type: none">a. Make tables of equivalent ratios relating quantities with whole-number measurements, find missing values in the tables, and plot the pairs of values on the coordinate plane. Use tables to compare ratios.b. Solve unit rate problems including those involving unit pricing and constant speed.c. Find a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means 30/100 times the quantity); solve problems involving finding the whole, given a part and the percent.d. Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities.	

- Unit 5 Cycle 1 Lesson 2—Ratios and Tables
- Unit 5 Cycle 1 Lesson 4—Comparing Rates
- Unit 6 Cycle 1 Lesson 1—Converting Measurements
- Unit 6 Cycle 1 Lesson 2—Problem Solving with Unit Rates
- Unit 6 Cycle 1 Lesson 3—Graphing Equivalent Ratios
- Unit 6 Cycle 1 Lesson 4—Problem Solving with Ratios and Tape Diagrams
- Unit 6 Cycle 1 Lesson 5—Rate and Ratio Problem Solving
- Unit 6 Cycle 2 Lesson 1—Understanding Percent
- Unit 6 Cycle 2 Lesson 2—Comparing and Ordering Percents, Fractions, and Decimals
- Unit 6 Cycle 2 Lesson 3—Solving Percent Problems
- Unit 6 Cycle 2 Lesson 4—Problem Solving with Percents
- Unit 6 Cycle 3 Lessons 1–3—Ratio and Percent Applications Performance Task (Preparing for a Dinner Fundraiser)
- Unit 12 Cycle 1 Lesson 1—Converting Measurements
- Unit 12 Cycle 1 Lesson 2—Measurements and Linear Relationships
- Unit 12 Cycle 1 Lesson 3—Measurement in Problem Solving

Lessons in other grade levels:

- Grade 7 Unit 5 Cycle 1 Lesson 1—Understanding Percent

The Number System

Apply and extend previous understandings of multiplication and division to divide fractions by fractions.

Standard for Mathematical Content 6.NS.A.1: Interpret and compute quotients of fractions, and solve word problems involving division of fractions by fractions, e.g., by using visual fraction models and equations to represent the problem.

- Unit 3 Cycle 2 Lesson 1—Estimating the Value of Fractions
- Unit 3 Cycle 2 Lesson 2—Multiplying Fractions
- Unit 3 Cycle 2 Lesson 3—Multiplying Mixed Numbers
- Unit 3 Cycle 3 Lesson 1—Dividing Whole Numbers by Fractions
- Unit 3 Cycle 3 Lesson 2—Dividing Fractions by Fractions
- Unit 3 Cycle 3 Lesson 3—Problem Solving with Multiplying and Dividing Fractions

Compute fluently with multi-digit numbers and find common factors and multiples.
Standard for Mathematical Content 6.NS.B.2: Fluently divide multi-digit numbers using the standard algorithm.
<ul style="list-style-type: none"> • Unit 2 Cycle 1 Lesson 1—Mental Math • Unit 2 Cycle 1 Lesson 2—Estimation • Unit 2 Cycle 1 Lesson 3—Whole Number Division 1 • Unit 2 Cycle 1 Lesson 4—Whole Number Division 2 • Unit 2 Cycle 3 Lessons 1–3—Computation Skills Performance Task (Starting a Food Truck Business)
Standard for Mathematical Content 6.NS.B.3: Fluently add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation.
<ul style="list-style-type: none"> • Unit 2 Cycle 2 Lesson 1—Estimating with Decimals • Unit 2 Cycle 2 Lesson 2—Adding and Subtracting Decimals • Unit 2 Cycle 2 Lesson 3—Multiplying Decimals • Unit 2 Cycle 2 Lesson 4—Dividing Decimals • Unit 2 Cycle 2 Lesson 5—Problem Solving with Decimals • Unit 2 Cycle 3 Lessons 1–3—Computation Skills Performance Task (Starting a Food Truck Business)
Standard for Mathematical Content 6.NS.B.4: Find the greatest common factor of two whole numbers less than or equal to 100 and the least common multiple of two whole numbers less than or equal to 12. Use the distributive property to express a sum of two whole numbers 1–100 with a common factor as a multiple of a sum of two whole numbers with no common factor.
<ul style="list-style-type: none"> • Unit 2 Cycle 3 Lessons 1–3—Computation Skills Performance Task (Starting a Food Truck Business) • Unit 3 Cycle 1 Lesson 1—Greatest Common Factor • Unit 3 Cycle 1 Lesson 2—Least Common Multiple • Unit 3 Cycle 1 Lesson 3—Problem Solving with GCF and LCM
Apply and extend previous understandings of numbers to the system of rational numbers.
Standard for Mathematical Content 6.NS.C.5: Understand that positive and negative numbers are used together to describe quantities having opposite directions or values (e.g., temperature above/below zero, elevation above/below sea level, credits/debits, positive/negative electric charge); use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation.
<ul style="list-style-type: none"> • Unit 4 Cycle 1 Lesson 1—Exploring Integers

Standard for Mathematical Content 6.NS.C.6: Understand a rational number as a point on the number line. Extend number line diagrams and coordinate axes familiar from previous grades to represent points on the line and in the plane with negative number coordinates.

- a. Recognize opposite signs of numbers as indicating locations on opposite sides of 0 on the number line; recognize that the opposite of the opposite of a number is the number itself, e.g., $\neg(\neg 3) = 3$, and that 0 is its own opposite.
- b. Understand signs of numbers in ordered pairs as indicating locations in quadrants of the coordinate plane; recognize that when two ordered pairs differ only by signs, the locations of the points are related by reflections across one or both axes.
- c. Find and position integers and other rational numbers on a horizontal or vertical number line diagram; find and position pairs of integers and other rational numbers on a coordinate plane.

- Unit 4 Cycle 1 Lesson 2—Graphing Ordered Pairs in All Quadrants

Lessons in other grade levels:

- Grade 7 Unit 2 Cycle 1 Lesson 1—Definition of Rational Numbers

Standard for Mathematical Content 6.NS.C.7: Understand ordering and absolute value of rational numbers.

- a. Interpret statements of inequality as statements about the relative position of two numbers on a number line diagram.
- b. Write, interpret, and explain statements of order for rational numbers in real-world contexts.
- c. Understand the absolute value of a rational number as its distance from 0 on the number line; interpret absolute value as magnitude for a positive or negative quantity in a real-world situation.
- d. Distinguish comparisons of absolute value from statements about order.

- Unit 4 Cycle 2 Lesson 1—Comparing and Ordering Integers
- Unit 4 Cycle 2 Lesson 2—Absolute Value

Standard for Mathematical Content 6.NS.C.8: Solve real-world and mathematical problems by graphing points in all four quadrants of the coordinate plane. Include use of coordinates and absolute value to find distances between points with the same first coordinate or the same second coordinate.

- Unit 4 Cycle 1 Lesson 3—Exploring Graphing
- Unit 4 Cycle 2 Lesson 3—Problem Solving with Coordinates
- Unit 12 Cycle 2 Lesson 4—Area of Complex Shapes

Expressions and Equations	
Apply and extend previous understandings of arithmetic to algebraic expressions.	
Standard for Mathematical Content 6.EE.A.1: Write and evaluate numerical expressions involving whole-number exponents.	
<ul style="list-style-type: none"> • Unit 7 Cycle 1 Lesson 1—Understanding Exponents • Unit 7 Cycle 1 Lesson 2—Order of Operations • Unit 7 Cycle 1 Lesson 3—Writing and Evaluating Numeric Expressions <p>Lessons in other grade levels:</p> <ul style="list-style-type: none"> • Grade 7 Unit 6 Cycle 1 Lesson 5—Writing and Evaluating Expressions 	
Standard for Mathematical Content 6.EE.A.2: Write, read, and evaluate expressions in which letters stand for numbers.	
<ol style="list-style-type: none"> a. Write expressions that record operations with numbers and with letters standing for numbers. b. Identify parts of an expression using mathematical terms (sum, term, product, factor, quotient, coefficient); view one or more parts of an expression as a single entity. c. Evaluate expressions at specific values of their variables. Include expressions that arise from formulas used in real-world problems. Perform arithmetic operations, including those involving whole-number exponents, in the conventional order when there are no parentheses to specify a particular order (Order of Operations). 	
<ul style="list-style-type: none"> • Unit 7 Cycle 2 Lesson 1—Introduction to Variables • Unit 7 Cycle 2 Lesson 2—Algebraic Expressions and Vocabulary • Unit 7 Cycle 2 Lesson 3—Writing Expressions 1 • Unit 7 Cycle 2 Lesson 4—Writing Expressions 2 • Unit 7 Cycle 3 Lesson 1—Evaluating Expressions 1 • Unit 7 Cycle 3 Lesson 2—Evaluating Expressions 2 • Unit 7 Cycle 3 Lesson 3—Expressions and Patterns • Unit 7 Cycle 3 Lesson 4—Writing and Evaluating Algebraic Expressions 	

<p>Standard for Mathematical Content 6.EE.A.3: Apply the properties of operations to generate equivalent expressions.</p>
<ul style="list-style-type: none"> • Unit 8 Cycle 1 Lesson 1—Combining Like Terms • Unit 8 Cycle 1 Lesson 2—Properties of Addition • Unit 8 Cycle 2 Lesson 1—Properties of Multiplication • Unit 8 Cycle 2 Lesson 2—Greatest Common Factors of Monomials • Unit 8 Cycle 2 Lesson 3—Distributive Property
<p>Standard for Mathematical Content 6.EE.A.4: Identify when two expressions are equivalent (i.e., when the two expressions name the same number regardless of which value is substituted into them).</p>
<ul style="list-style-type: none"> • Unit 8 Cycle 1 Lesson 3—Proving Expressions Equivalent 1 • Unit 8 Cycle 2 Lesson 4—Proving Expressions Equivalent 2
<p>Reason about and solve one-variable equations and inequalities.</p>
<p>Standard for Mathematical Content 6.EE.B.5: Understand solving an equation or inequality as a process of answering a question: which values from a specified set, if any, make the equation or inequality true? Use substitution to determine whether a given number in a specified set makes an equation or inequality true.</p>
<ul style="list-style-type: none"> • Unit 9 Cycle 1 Lesson 1—Defining Equations • Unit 9 Cycle 1 Lesson 2—Solutions to Equations • Unit 9 Cycle 1 Lesson 3—Solving Equations • Unit 9 Cycle 1 Lesson 4—Geometry and Equations
<p>Standard for Mathematical Content 6.EE.B.6: Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set.</p>
<p>Lessons in each cycle of PowerTeaching Math focus on solving real-world problems. This standard is a reviewed concept in the following:</p> <ul style="list-style-type: none"> • Unit 9 Cycle 2 Lesson 4—Solving Equations to Answer Questions • Unit 9 Cycle 3 Lesson 3—Writing and Solving Equations

Standard for Mathematical Content 6.EE.B.7: Solve real-world and mathematical problems by writing and solving equations of the form $x + p = q$ and $px = q$ for cases in which p , q and x are all nonnegative rational numbers.

- Unit 9 Cycle 2 Lesson 1—Inverse Operations
- Unit 9 Cycle 2 Lesson 2—Solving Addition and Subtraction Equations
- Unit 9 Cycle 2 Lesson 3—Solving Multiplication and Division Equations
- Unit 9 Cycle 2 Lesson 4—Solving Equations to Answer Questions
- Unit 9 Cycle 3 Lesson 1—Choosing the Correct Equation 1
- Unit 9 Cycle 3 Lesson 2—Choosing the Correct Equation 2
- Unit 9 Cycle 3 Lesson 3—Writing and Solving Equations

Standard for Mathematical Content 6.EE.B.8: Write an inequality of the form $x > c$ or $x < c$ to represent a constraint or condition in a real-world or mathematical problem. Recognize that inequalities of the form $x > c$ or $x < c$ have infinitely many solutions; represent solutions of such inequalities on number line diagrams.

- Unit 10 Cycle 1 Lesson 1—Introduction to Inequalities
- Unit 10 Cycle 1 Lesson 2—Graphing Inequalities
- Unit 10 Cycle 1 Lesson 3—Solutions in Inequalities
- Unit 10 Cycle 1 Lesson 4—Problem Solving with Inequalities

Represent and analyze quantitative relationships between dependent and independent variables.

Standard for Mathematical Content 6.EE.C.9: Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation.

- Unit 11 Cycle 1 Lesson 1—Independent and Dependent Variables
- Unit 11 Cycle 1 Lesson 2—Tables and Equations 1
- Unit 11 Cycle 1 Lesson 3—Tables and Equations 2
- Unit 11 Cycle 1 Lesson 4—Graphing Equations

Geometry	
Solve real-world and mathematical problems involving area, surface area, and volume.	
Standard for Mathematical Content 6.G.A.1: Find the area of right triangles, other triangles, special quadrilaterals, and polygons by composing into rectangles or decomposing into triangles and other shapes; apply these techniques in the context of solving real-world and mathematical problems.	
<ul style="list-style-type: none"> • Unit 12 Cycle 2 Lesson 2—Area of Rectangles and Triangles • Unit 12 Cycle 2 Lesson 3—Area of Quadrilaterals • Unit 12 Cycle 2 Lesson 4—Area of Complex Shapes • Unit 12 Cycle 2 Lesson 5—Problem Solving with Area • Unit 13 Cycle 3 Lessons 1–3—Volume and Surface Area Performance Task (Kitchen Remodel) <p>Lessons in other grade levels:</p> <ul style="list-style-type: none"> • Grade 7 Unit 8 Cycle 1 Lesson 1—Area, Perimeter, and Volume 	
Standard for Mathematical Content 6.G.A.2: Find the volume of a right rectangular prism with fractional edge lengths by packing it with unit cubes of the appropriate unit fraction edge lengths, and show that the volume is the same as would be found by multiplying the edge lengths of the prism. Apply the formulas $V = lwh$ and $V = bh$ to find volumes of right rectangular prisms with fractional edge lengths in the context of solving real-world and mathematical problems.	
<ul style="list-style-type: none"> • Unit 13 Cycle 1 Lesson 1—Unit Fraction Cubes • Unit 13 Cycle 1 Lesson 2—Finding Volume 1 • Unit 13 Cycle 1 Lesson 3—Finding Volume 2 • Unit 13 Cycle 1 Lesson 4—Additive and Subtractive Volumes • Unit 13 Cycle 1 Lesson 5—Problem Solving with Volume • Unit 13 Cycle 3 Lessons 1–3—Volume and Surface Area Performance Task (Kitchen Remodel) <p>Lessons in other grade levels:</p> <ul style="list-style-type: none"> • Grade 7 Unit 8 Cycle 1 Lesson 1—Area, Perimeter, and Volume 	
Standard for Mathematical Content 6.G.A.3: Draw polygons in the coordinate plane given coordinates for the vertices; use coordinates to find the length of a side joining points with the same first coordinate or the same second coordinate. Apply these techniques in the context of solving real-world and mathematical problems.	
<ul style="list-style-type: none"> • Unit 4 Cycle 2 Lesson 3—Problem Solving with Coordinates • Unit 13 Cycle 3 Lessons 1–3—Volume and Surface Area Performance Task (Kitchen Remodel) 	

Standard for Mathematical Content 6.G.A.4: Represent three-dimensional figures using nets made up of rectangles and triangles, and use the nets to find the surface area of these figures. Apply these techniques in the context of solving real-world and mathematical problems.

- Unit 13 Cycle 2 Lesson 1—Nets
- Unit 13 Cycle 2 Lesson 2—Surface Area of Prisms
- Unit 13 Cycle 2 Lesson 3—Surface Area of Pyramids
- Unit 13 Cycle 2 Lesson 4—Problem Solving with Surface Area
- Unit 13 Cycle 3 Lessons 1–3—Volume and Surface Area Performance Task (Kitchen Remodel)

Statistics and Probability

Develop understanding of statistical variability.

Standard for Mathematical Content 6.SP.A.1: Recognize a statistical question as one that anticipates variability in the data related to the question and accounts for it in the answers.

- Unit 14 Cycle 1 Lesson 1—Statistical Questions 1
- Unit 14 Cycle 1 Lesson 2—Statistical Questions 2
- Unit 14 Cycle 1 Lesson 3—Variability
- Unit 15 Cycle 3 Lessons 1–3—Statistics Performance Task (Family Vacation)

Standard for Mathematical Content 6.SP.A.2: Understand that a set of data collected to answer a statistical question has a distribution which can be described by its center, spread, and overall shape.

- Unit 15 Cycle 1 Lesson 1—Describing the Distribution of Numerical Data
- Unit 15 Cycle 1 Lesson 2—Creating a Box Plot
- Unit 15 Cycle 1 Lesson 3—Comparing Data Shown on Box Plots
- Unit 15 Cycle 3 Lessons 1–3—Statistics Performance Task (Family Vacation)

Standard for Mathematical Content 6.SP.A.3: Recognize that a measure of center for a numerical data set summarizes all of its values with a single number, while a measure of variation describes how its values vary with a single number.

- Unit 15 Cycle 2 Lesson 1—Measures of Center 1
- Unit 15 Cycle 2 Lesson 2—Measures of Center 2
- Unit 15 Cycle 2 Lesson 3—Measures of Variability
- Unit 15 Cycle 2 Lesson 4—Describing Data
- Unit 15 Cycle 3 Lessons 1–3—Statistics Performance Task (Family Vacation)

Summarize and describe distributions.

Standard for Mathematical Content 6.SP.B.4: Display numerical data in plots on a number line, including dot plots, histograms, and box plots.

- Unit 14 Cycle 2 Lesson 1—Categorical Data
- Unit 14 Cycle 2 Lesson 2—Numeric Data
- Unit 14 Cycle 2 Lesson 3—Line Plots
- Unit 14 Cycle 2 Lesson 4—Histograms
- Unit 15 Cycle 1 Lesson 2—Creating a Box Plot

Standard for Mathematical Content 6.SP.B.5: Summarize numerical data sets in relation to their context, such as by:

- a. Reporting the number of observations.
- b. Describing the nature of the attribute under investigation, including how it was measured and its units of measurement.
- c. Giving quantitative measures of center (median and/or mean) and variability (interquartile range and/or mean absolute deviation), as well as describing any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data were gathered.
- d. Relating the choice of measures of center and variability to the shape of the data distribution and the context in which the data were gathered.

- Unit 14 Cycle 2 Lesson 5—Line Graphs
- Unit 14 Cycle 2 Lesson 6—Data Displays
- Unit 15 Cycle 2 Lesson 1—Measures of Center 1
- Unit 15 Cycle 2 Lesson 2—Measures of Center 2
- Unit 15 Cycle 2 Lesson 3—Measures of Variability
- Unit 15 Cycle 2 Lesson 4—Describing Data
- Unit 15 Cycle 3 Lessons 1–3—Statistics Performance Task (Family Vacation)

Lessons in other grade levels:

- Grade 7 Unit 13 Cycle 1 Lesson 1—Read and Interpret a Numerical Data Display

Section III: Grade 7 Alignment to the Standards for Mathematical Content

Grade 7

Ratios and Proportional Relationships

Analyze proportional relationships and use them to solve real-world and mathematical problems.

Standard for Mathematical Content 7.RP.A.1: Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units.

- Unit 4 Cycle 1 Lesson 1—Basic Unit Rates
- Unit 4 Cycle 1 Lesson 2—Unit Rates with Fractions
- Unit 4 Cycle 1 Lesson 3—Problem Solving with Unit Rates
- Unit 5 Cycle 2 Lessons 1–3—Ratios and Percents Performance Task (Starting a Sports Team)

Standard for Mathematical Content 7.RP.A.2: Recognize and represent proportional relationships between quantities.

- a. Decide whether two quantities are in a proportional relationship, e.g., by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin.
- b. Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.
- c. Represent proportional relationships by equations.
- d. Explain what a point (x, y) on the graph of a proportional relationship means in terms of the situation, with special attention to the points $(0, 0)$ and $(1, r)$ where r is the unit rate.

- Unit 4 Cycle 2 Lesson 1—Defining Proportional Relationships
- Unit 4 Cycle 2 Lesson 2—Solving Proportions
- Unit 4 Cycle 2 Lesson 3—Proportions in Tables and Graphs
- Unit 4 Cycle 2 Lesson 4—Problem Solving with Proportions 1
- Unit 4 Cycle 3 Lesson 1—Constant of Proportionality
- Unit 4 Cycle 3 Lesson 2—Represent a Proportion as an Equation
- Unit 4 Cycle 3 Lesson 3—Interpret Points of a Proportional Relationship
- Unit 4 Cycle 3 Lesson 4—Problem Solving with Proportions 2
- Unit 5 Cycle 2 Lessons 1–3—Ratios and Percents Performance Task (Starting a Sports Team)
- Unit 6 Cycle 1 Lesson 3—Writing Expressions with Percents

Standard for Mathematical Content 7.RP.A.3: Use proportional relationships to solve multistep ratio and percent problems.

- Unit 5 Cycle 1 Lesson 2—Discounts and Markups
- Unit 5 Cycle 1 Lesson 3—Percent Change and Percent Error
- Unit 5 Cycle 1 Lesson 4—Simple Interest
- Unit 5 Cycle 1 Lesson 2—Multistep Percent Problems
- Unit 5 Cycle 2 Lessons 1–3—Ratios and Percents Performance Task (Starting a Sports Team)

The Number System

Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers.

Standard for Mathematical Content 7.NS.A.1: Apply and extend previous understandings of addition and subtraction to add and subtract rational numbers; represent addition and subtraction on a horizontal or vertical number line diagram.

- a. Describe situations in which opposite quantities combine to make 0.
- b. Understand $p + q$ as the number located a distance $|q|$ from p , in the positive or negative direction depending on whether q is positive or negative. Show that a number and its opposite have a sum of 0 (are additive inverses). Interpret sums of rational numbers by describing real-world contexts.
- c. Understand subtraction of rational numbers as adding the additive inverse, $p - q = p + (-q)$. Show that the distance between two rational numbers on the number line is the absolute value of their difference, and apply this principle in real-world contexts.
- d. Apply properties of operations as strategies to add and subtract rational numbers.

- Unit 2 Cycle 1 Lesson 2—Adding Opposites
- Unit 2 Cycle 1 Lesson 3—Adding Rational Numbers 1
- Unit 2 Cycle 1 Lesson 4—Adding Rational Numbers 2
- Unit 2 Cycle 2 Lesson 1—Subtracting Integers
- Unit 2 Cycle 2 Lesson 2—Using Properties to Subtract Rational Numbers
- Unit 2 Cycle 2 Lesson 3—Subtracting Rational Numbers
- Unit 2 Cycle 2 Lesson 4—Adding and Subtracting Rational Numbers
- Unit 3 Cycle 3 Lessons 1–3—Rational Numbers Performance Task (Underwater Exploration)

Standard for Mathematical Content 7.NS.A.2: Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers.

- a. Understand that multiplication is extended from fractions to rational numbers by requiring that operations continue to satisfy the properties of operations, particularly the distributive property, leading to products such as $(-1)(-1) = 1$ and the rules for multiplying signed numbers. Interpret products of rational numbers by describing real-world contexts.
- b. Understand that integers can be divided, provided that the divisor is not zero, and every quotient of integers (with non-zero divisor) is a rational number. If p and q are integers, then $(-p)/q = (-p)/q = p/(-q)$. Interpret quotients of rational numbers by describing real-world contexts.
- c. Apply properties of operations as strategies to multiply and divide rational numbers.
- d. Convert a rational number to a decimal using long division; know that the decimal form of a rational number terminates in 0s or eventually repeats.

- Unit 3 Cycle 1 Lesson 1—Multiplying Integers
- Unit 3 Cycle 1 Lesson 2—Using Properties to Multiply Integers
- Unit 3 Cycle 1 Lesson 3—Multiplying Rational Numbers
- Unit 3 Cycle 1 Lesson 4—Multiplying Rational Numbers to Solve Real-World Problems
- Unit 3 Cycle 2 Lesson 1—Using Properties to Divide Integers
- Unit 3 Cycle 2 Lesson 2—Dividing Rational Numbers
- Unit 3 Cycle 2 Lesson 3—Rational Numbers as Decimals
- Unit 3 Cycle 3 Lessons 1–3—Rational Numbers Performance Task (Underwater Exploration)

Standard for Mathematical Content 7.NS.A.3: Solve real-world and mathematical problems involving the four operations with rational numbers.

- Unit 3 Cycle 2 Lesson 4—Using the Four Operations to Solve Real-World Problems
- Unit 3 Cycle 3 Lessons 1–3—Rational Numbers Performance Task (Underwater Exploration)

Expressions and Equations	
Use properties of operations to generate equivalent expressions.	
Standard for Mathematical Content 7.EE.A.1: Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.	
<ul style="list-style-type: none"> • Unit 6 Cycle 1 Lesson 1—Equivalent Algebraic Expressions • Unit 6 Cycle 1 Lesson 2—Evaluating Algebraic Expressions 	
Standard for Mathematical Content 7.EE.A.2: Understand that rewriting an expression in different forms in a problem context can shed light on the problem and how the quantities in it are related.	
<ul style="list-style-type: none"> • Unit 6 Cycle 1 Lesson 4—Writing Expressions Multiple Ways 	
Solve real-life and mathematical problems using numerical and algebraic expressions and equations.	
Standard for Mathematical Content 7.EE.B.3: Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies.	
<ul style="list-style-type: none"> • Unit 7 Cycle 1 Lesson 3—Writing and Solving Equations for Real-World Situations • Unit 7 Cycle 2 Lesson 3—Solving Inequalities to Answer Questions • Unit 7 Cycle 2 Lesson 4—Writing and Solving Inequalities for Real-World Situations 	
Standard for Mathematical Content 7.EE.B.4: Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities.	
<ol style="list-style-type: none"> a. Solve word problems leading to equations of the form $px + q = r$ and $p(x + q) = r$, where p, q, and r are specific rational numbers. Solve equations of these forms fluently. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach. b. Solve word problems leading to inequalities of the form $px + q > r$ or $px + q < r$, where p, q, and r are specific rational numbers. Graph the solution set of the inequality and interpret it in the context of the problem. 	
<ul style="list-style-type: none"> • Unit 7 Cycle 1 Lesson 1—Solving Two-Step Equations • Unit 7 Cycle 1 Lesson 2—Solving Equations with Rational Numbers • Unit 7 Cycle 2 Lesson 1—Solving Single-Step Inequalities • Unit 7 Cycle 2 Lesson 2—Solving Multiple-Step Inequalities • Unit 7 Cycle 2 Lesson 4—Writing and Solving Inequalities for Real-World Situations 	

Geometry	
Draw, construct, and describe geometrical figures and describe the relationships between them.	
Standard for Mathematical Content 7.G.A.1: Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale.	
<ul style="list-style-type: none"> • Unit 8 Cycle 1 Lesson 2—Using Scale Drawings to Find Length • Unit 8 Cycle 1 Lesson 3—Completing Scale Drawings • Unit 8 Cycle 1 Lesson 4—Using Scale Drawings to Find Area and Perimeter • Unit 8 Cycle 1 Lesson 5—Using Scale Drawings to Find Volume and Surface Area 	
Standard for Mathematical Content 7.G.A.2: Draw (freehand, with ruler and protractor, and with technology) geometric shapes with given conditions. Focus on constructing triangles from three measures of angles or sides, noticing when the conditions determine a unique triangle, more than one triangle, or no triangle.	
<ul style="list-style-type: none"> • Unit 8 Cycle 2 Lesson 3—Constructing Quadrilaterals • Unit 8 Cycle 2 Lesson 4—Constructing Triangles 1 • Unit 8 Cycle 2 Lesson 5—Constructing Triangles 2 • Unit 9 Cycle 2 Lesson 1—Identifying Types of Angles 	
Standard for Mathematical Content 7.G.A.3: Describe the two-dimensional figures that result from slicing three-dimensional figures, as in plane sections of right rectangular prisms and right rectangular pyramids.	
<ul style="list-style-type: none"> • Unit 8 Cycle 2 Lesson 2—2-D Figures Within 3-D Figures <p>The following lesson reviews Standard for Mathematical Content 5.G.B.4: Classify two-dimensional figures in a hierarchy based on properties.</p> <ul style="list-style-type: none"> • Unit 8 Cycle 2 Lesson 1—Identifying 2-D Shapes 	
Solve real-life and mathematical problems involving angle measure, area, surface area, and volume.	
Standard for Mathematical Content 7.G.B.4: Know the formulas for the area and circumference of a circle and use them to solve problems; give an informal derivation of the relationship between the circumference and area of a circle.	
<ul style="list-style-type: none"> • Unit 9 Cycle 1 Lesson 1—Pi and the Parts of Circles • Unit 9 Cycle 1 Lesson 2—Circumference • Unit 9 Cycle 1 Lesson 3—Area of Circles • Unit 9 Cycle 1 Lesson 4—Problem Solving with Circles 	

Standard for Mathematical Content 7.G.B.5: Use facts about supplementary, complementary, vertical, and adjacent angles in a multi-step problem to write and solve simple equations for an unknown angle in a figure.

- Unit 9 Cycle 2 Lesson 1—Identifying Types of Angles
- Unit 9 Cycle 2 Lesson 2—Complementary and Supplementary Angles
- Unit 9 Cycle 2 Lesson 3—Adjacent and Vertical Angles
- Unit 9 Cycle 2 Lesson 4—Problem Solving with Angles

Standard for Mathematical Content 7.G.B.6: Solve real-world and mathematical problems involving area, volume and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms.

- Unit 8 Cycle 3 Lessons 1–3—Geometry Performance Task (Bathroom Remodel)
- Unit 10 Cycle 1 Lesson 1—Volume of Prisms
- Unit 10 Cycle 1 Lesson 2—Volume of Pyramids
- Unit 10 Cycle 1 Lesson 3—Volume of Cones and Cylinders
- Unit 10 Cycle 1 Lesson 4—Problem Solving with Volume
- Unit 10 Cycle 2 Lesson 1—Surface Area of Prisms
- Unit 10 Cycle 2 Lesson 2—Surface Area of Pyramids
- Unit 10 Cycle 2 Lesson 3—Surface Area of Cones and Cylinders
- Unit 10 Cycle 2 Lesson 4—Problem Solving with Surface Area

Statistics and Probability

Use random sampling to draw inferences about a population.

Standard for Mathematical Content 7.SP.A.1: Understand that statistics can be used to gain information about a population by examining a sample of the population; generalizations about a population from a sample are valid only if the sample is representative of that population. Understand that random sampling tends to produce representative samples and support valid inferences.

- Unit 12 Cycle 1 Lesson 1—Understanding Random Sampling
- Unit 12 Cycle 1 Lesson 2—Characteristics of Random Sampling
- Unit 12 Cycle 1 Lesson 3—Good vs. Bad Random Samples

Standard for Mathematical Content 7.SP.A.2: Use data from a random sample to draw inferences about a population with an unknown characteristic of interest. Generate multiple samples (or simulated samples) of the same size to gauge the variation in estimates or predictions.

- Unit 12 Cycle 2 Lesson 1—Analyzing a Random Sample
- Unit 12 Cycle 2 Lesson 2—Creating a Random Sample
- Unit 12 Cycle 2 Lesson 3—Conducting a Survey of a Random Sample

Draw informal comparative inferences about two populations.
Standard for Mathematical Content 7.SP.B.3: Informally assess the degree of visual overlap of two numerical data distributions with similar variabilities, measuring the difference between the centers by expressing it as a multiple of a measure of variability.
<ul style="list-style-type: none"> • Unit 13 Cycle 1 Lesson 2—Compare and Contrast Number Data • Unit 13 Cycle 1 Lesson 3—Compare and Contrast Graphs • Unit 13 Cycle 2 Lesson 4—Problem Solving with Data Distributions
Standard for Mathematical Content 7.SP.B.4: Use measures of center and measures of variability for numerical data from random samples to draw informal comparative inferences about two populations.
<ul style="list-style-type: none"> • Unit 13 Cycle 2 Lesson 1—Find Measures of Center and Variability • Unit 13 Cycle 2 Lesson 2—Compare and Contrast Measures of Center • Unit 13 Cycle 2 Lesson 3—Compare and Contrast Measures of Variability • Unit 13 Cycle 2 Lesson 4—Problem Solving with Data Distributions
Investigate chance processes and develop, use, and evaluate probability models.
Standard for Mathematical Content 7.SP.C.5: Understand that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of the event occurring. Larger numbers indicate greater likelihood. A probability near 0 indicates an unlikely event, a probability around 1/2 indicates an event that is neither unlikely nor likely, and a probability near 1 indicates a likely event.
<ul style="list-style-type: none"> • Unit 11 Cycle 1 Lesson 1—Understanding Probability • Unit 11 Cycle 1 Lesson 2—Decimal and Percent Probability • Unit 11 Cycle 1 Lesson 3—Describing Probability • Unit 11 Cycle 3 Lessons 1–3—Probability Performance Task (Consumer Contest)
Standard for Mathematical Content 7.SP.C.6: Approximate the probability of a chance event by collecting data on the chance process that produces it and observing its long-run relative frequency, and predict the approximate relative frequency given the probability.
<ul style="list-style-type: none"> • Unit 11 Cycle 1 Lesson 1—Understanding Probability • Unit 11 Cycle 1 Lesson 2—Decimal and Percent Probability • Unit 11 Cycle 1 Lesson 3—Describing Probability • Unit 11 Cycle 2 Lesson 2—Uniform Experimental Probability • Unit 11 Cycle 2 Lesson 3—Nonuniform Experimental Probability • Unit 11 Cycle 3 Lessons 1–3—Probability Performance Task (Consumer Contest)

Standard for Mathematical Content 7.SP.C.7: Develop a probability model and use it to find probabilities of events. Compare probabilities from a model to observed frequencies; if the agreement is not good, explain possible sources of the discrepancy.

- a. Develop a uniform probability model by assigning equal probability to all outcomes, and use the model to determine probabilities of events.
- b. Develop a probability model (which may not be uniform) by observing frequencies in data generated from a chance process.

- Unit 11 Cycle 2 Lesson 2—Uniform Experimental Probability
- Unit 11 Cycle 2 Lesson 3—Nonuniform Experimental Probability
- Unit 11 Cycle 3 Lessons 1–3—Probability Performance Task (Consumer Contest)

Standard for Mathematical Content 7.SP.C.8: Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation.

- a. Understand that, just as with simple events, the probability of a compound event is the fraction of outcomes in the sample space for which the compound event occurs.
- b. Represent sample spaces for compound events using methods such as organized lists, tables and tree diagrams. For an event described in everyday language (e.g., "rolling double sixes"), identify the outcomes in the sample space which compose the event.
- c. Design and use a simulation to generate frequencies for compound events.

- Unit 11 Cycle 2 Lesson 1—Probability of Independent Compound Events
- Unit 11 Cycle 2 Lesson 4—Independent and Dependent Events
- Unit 11 Cycle 3 Lessons 1–3—Probability Performance Task (Consumer Contest)

Section IV: Grade 8 Alignment to the Standards for Mathematical Content

Grade 8

The Number System

Know that there are numbers that are not rational, and approximate them by rational numbers.

Standard for Mathematical Content 8.NS.A.1: Know that numbers that are not rational are called irrational. Understand informally that every number has a decimal expansion; for rational numbers show that the decimal expansion repeats eventually, and convert a decimal expansion which repeats eventually into a rational number.

- Unit 2 Cycle 1 Lesson 1—Defining Irrational Numbers
- Unit 2 Cycle 1 Lesson 2—Classifying Numbers
- Unit 2 Cycle 1 Lesson 3—Converting a Decimal Expansion

Standard for Mathematical Content 8.NS.A.2: Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions (e.g., π^2).

- Unit 2 Cycle 1 Lesson 1—Defining Irrational Numbers
- Unit 2 Cycle 1 Lesson 2—Classifying Numbers
- Unit 2 Cycle 1 Lesson 4—Ordering Rational and Irrational Numbers
- Unit 2 Cycle 1 Lesson 5—Estimating and Comparing Irrational Expressions

Expressions and Equations

Work with radicals and integer exponents.

Standard for Mathematical Content 8.EE.A.1: Know and apply the properties of integer exponents to generate equivalent numerical expressions.

- Unit 3 Cycle 1 Lesson 1—Properties of Powers 1
- Unit 3 Cycle 1 Lesson 2—Properties of Powers 2
- Unit 3 Cycle 3 Lessons 1–3—Rational and Irrational Numbers Performance Task (Volcano Exploration)

Lessons in other grade levels:

- Algebra 1 Unit 4 Cycle 1 Lesson 1—Properties of Integer Exponents

Standard for Mathematical Content 8.EE.A.2: Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$, where p is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that $\sqrt{2}$ is irrational.

- Unit 3 Cycle 1 Lesson 3—Square and Cube Roots
- Unit 3 Cycle 1 Lesson 4—Simplifying Square Roots
- Unit 3 Cycle 1 Lesson 5—Solving Equations with Exponents
- Unit 3 Cycle 3 Lessons 1–3—Rational and Irrational Numbers Performance Task (Volcano Exploration)

Lessons in other grade levels:

- Algebra 1 Unit 4 Cycle 1 Lesson 2—Square Roots
- Algebra 1 Unit 4 Cycle 1 Lesson 3—Cube Roots

Standard for Mathematical Content 8.EE.A.3: Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other.

- Unit 3 Cycle 2 Lesson 1—Estimating with Powers of 10
- Unit 3 Cycle 2 Lesson 2—Scientific Notation 1
- Unit 3 Cycle 3 Lessons 1–3—Rational and Irrational Numbers Performance Task (Volcano Exploration)

Standard for Mathematical Content 8.EE.A.4: Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities (e.g., use millimeters per year for seafloor spreading). Interpret scientific notation that has been generated by technology.

- Unit 3 Cycle 2 Lesson 2—Scientific Notation 1
- Unit 3 Cycle 2 Lesson 3—Scientific Notation 2
- Unit 3 Cycle 3 Lessons 1–3—Rational and Irrational Numbers Performance Task (Volcano Exploration)

Understand the connections between proportional relationships, lines, and linear equations.

Standard for Mathematical Content 8.EE.B.5: Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.

- Unit 7 Cycle 1 Lesson 1—Analyzing Graphs of Proportional Relationships
- Unit 7 Cycle 1 Lesson 2—Finding the Slope of Proportional Relationships
- Unit 7 Cycle 1 Lesson 3—Comparing Proportional Relationships
- Unit 7 Cycle 2 Lesson 4—Linear Graphs and Real-World Situations

Standard for Mathematical Content 8.EE.B.6: Use similar triangles to explain why the slope m is the same between any two distinct points on a non-vertical line in the coordinate plane; 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 .

- Unit 7 Cycle 1 Lesson 3—Comparing Proportional Relationships
- Unit 7 Cycle 2 Lesson 1—Exploring Linear Relationships
- Unit 7 Cycle 2 Lesson 2—Triangles and Slope
- Unit 7 Cycle 2 Lesson 3—Finding the Slope and the Equation
- Unit 7 Cycle 2 Lesson 4—Linear Graphs and Real-World Situations

Analyze and solve linear equations and pairs of simultaneous linear equations.

Standard for Mathematical Content 8.EE.C.7: Solve linear equations in one variable.

- a. Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form $x = a$, $a = a$, or $a = b$ results (where a and b are different numbers).
- b. Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.

- Unit 8 Cycle 1 Lesson 1—Solving Linear Equations 1
- Unit 8 Cycle 1 Lesson 2—Solving Geometric Equations
- Unit 8 Cycle 1 Lesson 3—Solving Linear Equations 2
- Unit 8 Cycle 1 Lesson 4—No Solution, Many Solutions, One Solution
- Unit 8 Cycle 1 Lesson 5—Working with Solutions

Standard for Mathematical Content 8.EE.C.8: Analyze and solve pairs of simultaneous linear equations.

- a. Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously.
- b. Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations. Solve simple cases by inspection.
- c. Solve real-world and mathematical problems leading to two linear equations in two variables.

- Unit 11 Cycle 1 Lesson 1—Introduction to Simultaneous Linear Equations
- Unit 11 Cycle 1 Lesson 2—Solving Simultaneous Linear Equations 1
- Unit 11 Cycle 1 Lesson 3—Solving Simultaneous Linear Equations 2
- Unit 11 Cycle 1 Lesson 4—Problem Solving with Simultaneous Linear Equations
- Unit 11 Cycle 2 Lesson 1—Writing Equations for Given Intersecting Lines
- Unit 11 Cycle 2 Lesson 2—Graphing Lines for a Given Solution
- Unit 11 Cycle 2 Lesson 3—Solving Systems of Linear Equations for Real-World Situations
- Unit 11 Cycle 2 Lesson 4—Graphing Systems of Linear Equations for Real-World Situations

Functions
Define, evaluate, and compare functions.
Standard for Mathematical Content 8.F.A.1: Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.
<ul style="list-style-type: none"> • Unit 9 Cycle 1 Lesson 1—Definition of a Function • Unit 9 Cycle 1 Lesson 2—Describing Functions in Words • Unit 10 Cycle 3 Lessons 1–3—Linear Functions Performance Task (Renting vs. Buying a Home)
Standard for Mathematical Content 8.F.A.2: Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).
<ul style="list-style-type: none"> • Unit 9 Cycle 1 Lesson 3—Comparing Functions 1 • Unit 10 Cycle 2 Lesson 3—Comparing Functions 2 • Unit 10 Cycle 3 Lessons 1–3—Linear Functions Performance Task (Renting vs. Buying a Home)
Standard for Mathematical Content 8.F.A.3: Interpret the equation $y = mx + b$ as defining a linear function, whose graph is a straight line; give examples of functions that are not linear.
<ul style="list-style-type: none"> • Unit 9 Cycle 1 Lesson 4—Linear vs. Nonlinear Functions • Unit 10 Cycle 3 Lessons 1–3—Linear Functions Performance Task (Renting vs. Buying a Home) <p>Lessons in other grade levels:</p> <ul style="list-style-type: none"> • Algebra 1 Unit 6 Cycle 2 Lesson 1—Linear Functions • Algebra 1 Unit 6 Cycle 2 Lesson 2—Exponential Functions
Use functions to model relationships between quantities.
Standard for Mathematical Content 8.F.B.4: Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values.
<ul style="list-style-type: none"> • Unit 10 Cycle 1 Lesson 1—Representing Functions • Unit 10 Cycle 1 Lesson 2—Functions and Real-World Situations • Unit 10 Cycle 1 Lesson 3—Rate of Change and Initial Value of a Function • Unit 10 Cycle 2 Lesson 4—Sketching Functions • Unit 10 Cycle 3 Lessons 1–3—Linear Functions Performance Task (Renting vs. Buying a Home)

Standard for Mathematical Content 8.F.B.5: Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.

- Unit 10 Cycle 2 Lesson 1—Exploring Distance-Time Graphs
- Unit 10 Cycle 2 Lesson 2—Matching Distance-Time Graphs
- Unit 10 Cycle 2 Lesson 4—Sketching Functions
- Unit 10 Cycle 3 Lessons 1–3—Linear Functions Performance Task (Renting vs. Buying a Home)

Geometry

Understand congruence and similarity using physical models, transparencies, or geometry software.

Standard for Mathematical Content 8.G.A.1: Verify experimentally the properties of rotations, reflections, and translations:

- a. Lines are taken to lines, and line segments to line segments of the same length.
- b. Angles are taken to angles of the same measure.
- c. Parallel lines are taken to parallel lines.

- Unit 5 Cycle 1 Lesson 1—Experimenting with Translations
- Unit 5 Cycle 1 Lesson 2—Experimenting with Reflections
- Unit 5 Cycle 1 Lesson 3—Experimenting with Rotations
- Unit 5 Cycle 1 Lesson 4—Rotations and Circles

Standard for Mathematical Content 8.G.A.2: Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them.

- Unit 5 Cycle 2 Lesson 3—Combining Transformations
- Unit 5 Cycle 2 Lesson 4—Verifying Congruence
- Unit 6 Cycle 3 Lessons 1–3—Geometry Performance Task (Architecture, Maps, and Art)

<p>Standard for Mathematical Content 8.G.A.3: Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.</p>
<ul style="list-style-type: none"> • Unit 5 Cycle 2 Lesson 1—The Effects of Transformations • Unit 5 Cycle 2 Lesson 2—Reasoning About Transformations • Unit 6 Cycle 2 Lesson 3—Dilations on the Coordinate Plane • Unit 6 Cycle 3 Lessons 1–3—Geometry Performance Task (Architecture, Maps, and Art)
<p>Standard for Mathematical Content 8.G.A.4: Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them.</p>
<ul style="list-style-type: none"> • Unit 6 Cycle 2 Lesson 1—Reasoning with Similar Triangles • Unit 6 Cycle 2 Lesson 2—Real-World Scale Problems • Unit 6 Cycle 2 Lesson 3—Dilations on the Coordinate Plane • Unit 6 Cycle 2 Lesson 4—Verifying Similarity • Unit 6 Cycle 3 Lessons 1–3—Geometry Performance Task (Architecture, Maps, and Art)
<p>Standard for Mathematical Content 8.G.A.5: Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles.</p>
<ul style="list-style-type: none"> • Unit 6 Cycle 1 Lesson 1—Exploring Vertical Angles • Unit 6 Cycle 1 Lesson 2—Lines and Transversals • Unit 6 Cycle 1 Lesson 3—Parallel Lines • Unit 6 Cycle 1 Lesson 4—Triangle Angle Sum Theorem
<p>Understand and apply the Pythagorean Theorem.</p>
<p>Standard for Mathematical Content 8.G.B.6: Explain a proof of the Pythagorean Theorem and its converse.</p>
<ul style="list-style-type: none"> • Unit 4 Cycle 1 Lesson 1—Exploring Right Triangles • Unit 4 Cycle 2 Lesson 4—Problem Solving with the Pythagorean Theorem <p>Lessons in other grade levels:</p> <ul style="list-style-type: none"> • Algebra 1 Unit 14 Cycle 1 Lesson 1—The Pythagorean Theorem and Its Converse

Standard for Mathematical Content 8.G.B.7: Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.

- Unit 4 Cycle 1 Lesson 2—The Pythagorean Theorem 1
- Unit 4 Cycle 1 Lesson 3—The Pythagorean Theorem 2
- Unit 4 Cycle 1 Lesson 4—Special Right Triangles
- Unit 4 Cycle 2 Lesson 1—The Converse of the Pythagorean Theorem
- Unit 4 Cycle 2 Lesson 3—The Pythagorean Theorem and 3-D Figures
- Unit 4 Cycle 2 Lesson 4—Problem Solving with the Pythagorean Theorem

Lessons in other grade levels:

- Algebra 1 Unit 14 Cycle 1 Lesson 2—Using the Pythagorean Theorem

Standard for Mathematical Content 8.G.B.8: Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.

- Unit 4 Cycle 2 Lesson 2—The Pythagorean Theorem and the Coordinate System
- Unit 4 Cycle 2 Lesson 4—Problem Solving with the Pythagorean Theorem

Lessons in other grade levels:

- Algebra 1 Unit 14 Cycle 1 Lesson 3—Special Right Triangles
- Algebra 1 Unit 14 Cycle 1 Lesson 4—The Distance Formula

Solve real-world and mathematical problems involving volume of cylinders, cones, and spheres.

Standard for Mathematical Content 8.G.C.9: Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.

- Unit 12 Cycle 1 Lesson 1—Volume of Cylinders
- Unit 12 Cycle 1 Lesson 2—Volume of Cones
- Unit 12 Cycle 1 Lesson 3—Volume of Spheres
- Unit 12 Cycle 1 Lesson 4—Problem Solving with Volume
- Unit 12 Cycle 2 Lesson 1—Percent and Fractional Volume
- Unit 12 Cycle 2 Lesson 2—Is Volume Additive?
- Unit 12 Cycle 2 Lesson 3—Measuring Volume with Objects
- Unit 12 Cycle 2 Lesson 4—Filling Containers

Statistics and Probability	
Investigate patterns of association in bivariate data.	
Standard for Mathematical Content 8.SP.A.1: Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.	
<ul style="list-style-type: none"> • Unit 13 Cycle 1 Lesson 1—Constructing and Interpreting Scatterplots • Unit 13 Cycle 1 Lesson 3—Linear vs. Nonlinear Associations 1 • Unit 13 Cycle 3 Lessons 1–3—Real-World Data Associations Performance Task (Analyzing Survey Data) 	
Standard for Mathematical Content 8.SP.A.2: Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line.	
<ul style="list-style-type: none"> • Unit 13 Cycle 1 Lesson 2—Lines of Best Fit • Unit 13 Cycle 3 Lessons 1–3—Real-World Data Associations Performance Task (Analyzing Survey Data) 	
Standard for Mathematical Content 8.SP.A.3: Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept.	
<ul style="list-style-type: none"> • Unit 13 Cycle 1 Lesson 2—Lines of Best Fit • Unit 13 Cycle 1 Lesson 3—Linear vs. Nonlinear Associations 1 • Unit 13 Cycle 1 Lesson 4—Linear vs. Nonlinear Associations 2 • Unit 13 Cycle 1 Lesson 5—Problem Solving with Scatterplots • Unit 13 Cycle 3 Lessons 1–3—Real-World Data Associations Performance Task (Analyzing Survey Data) 	
Standard for Mathematical Content 8.SP.A.4: Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible association between the two variables.	
<ul style="list-style-type: none"> • Unit 13 Cycle 2 Lesson 1—Frequency Tables • Unit 13 Cycle 2 Lesson 2—Interpreting Two-Way Tables 1 • Unit 13 Cycle 2 Lesson 3—Interpreting Two-Way Tables 2 • Unit 13 Cycle 2 Lesson 4—Constructing Two-Way Tables • Unit 13 Cycle 3 Lessons 1–3—Real-World Data Associations Performance Task (Analyzing Survey Data) 	

Section V: Algebra 1 Alignment to the Standards for Mathematical Content

In PowerTeaching Math 3rd Edition, the Algebra 1 curriculum is intended for eighth-grade students on an accelerated track in mathematics. This course is traditional algebra 1 high school content plus key content from the grade 8 standards, including the Pythagorean Theorem and the introduction to functions. Note that the Grade 8 Alignment to the Standards for Mathematical Content (Section IV) indicates where the PowerTeaching Math Algebra 1 course covers grade 8 standards. Content covered in in this Algebra 1 course does not include all Algebra or high school standards.

Algebra 1	
High School—Number and Quantity / The Real Number System	
Perform arithmetic operations on polynomials.	
Standard for Mathematical Content HSN.RN.A.1: Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents.	
<ul style="list-style-type: none">• Unit 4 Cycle 1 Lesson 4—Rational Exponents• Unit 4 Cycle 1 Lesson 5—Rewriting Expressions with Radicals and Rational Exponents	
Standard for Mathematical Content HSN.RN.A.2: Rewrite expressions involving radicals and rational exponents using the properties of exponents.	
<ul style="list-style-type: none">• Unit 4 Cycle 1 Lesson 5—Rewriting Expressions with Radicals and Rational Exponents• Unit 14 Cycle 2 Lessons 1–3—Functions in Context Performance Task (Genetics in Medicine) Lessons in other grade levels: <ul style="list-style-type: none">• Grade 8 Unit 3 Lesson 4—Simplifying Square Roots	
Use properties of rational and irrational numbers.	
Standard for Mathematical Content HSN.RN.B.3: Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational.	
<ul style="list-style-type: none">• Unit 14 Cycle 1 Lesson 4—The Distance Formula	

High School—Number and Quantity / Quantities
Reason quantitatively and use units to solve problems.
Standard for Mathematical Content HSN.Q.A.1: Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.
<ul style="list-style-type: none"> • Unit 2 Cycle 1 Lesson 1—Units as a Guide to Solving Problems • Unit 2 Cycle 1 Lesson 2—Units in Formulas • Unit 2 Cycle 1 Lesson 3—Units and Graphing • Unit 2 Cycle 2 Lesson 2—Quantities in Scientific Notation • Unit 14 Cycle 2 Lessons 1–3—Functions in Context Performance Task (Genetics in Medicine)
Standard for Mathematical Content HSN.Q.A.2: Define appropriate quantities for the purpose of descriptive modeling.
<ul style="list-style-type: none"> • Unit 2 Cycle 2 Lesson 1—Defining Quantities • Unit 2 Cycle 2 Lesson 4—Quantities in Complex Problems
Standard for Mathematical Content HSN.Q.A.3: Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
<ul style="list-style-type: none"> • Unit 2 Cycle 2 Lesson 3—Accuracy with Quantities

High School—Algebra / Seeing Structure in Expressions
Interpret the structure of expressions.
Standard for Mathematical Content HSA.SSE.A.1: Interpret expressions that represent a quantity in terms of its context.
<ol style="list-style-type: none"> a. Interpret parts of an expression, such as terms, factors, and coefficients. b. Interpret complicated expressions by viewing one or more of their parts as a single entity.
<ul style="list-style-type: none"> • Unit 2 Cycle 3 Lesson 1—Parts of Expressions • Unit 2 Cycle 3 Lesson 2—Describing Complicated Algebraic Expressions • Unit 2 Cycle 3 Lesson 3—Expressions in Context • Unit 2 Cycle 3 Lesson 4—Writing Complicated Expressions • Unit 11 Cycle 1 Lesson 1—Parts of an Expression • Unit 14 Cycle 2 Lessons 1–3—Functions in Context Performance Task (Genetics in Medicine)

<p>Standard for Mathematical Content HSA.SSE.A.2: Use the structure of an expression to identify ways to rewrite it.</p>
<ul style="list-style-type: none"> • Unit 11 Cycle 1 Lesson 2—Factoring Quadratic Expressions 1 • Unit 11 Cycle 1 Lesson 3—Rewriting Quadratic and Exponential Expressions
<p>Write expressions in equivalent forms to solve problems.</p>
<p>Standard for Mathematical Content HSA.SSE.B.3: Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.</p> <ol style="list-style-type: none"> Factor a quadratic expression to reveal the zeros of the function it defines. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines. Use the properties of exponents to transform expressions for exponential functions.
<ul style="list-style-type: none"> • Unit 11 Cycle 2 Lesson 1—Factoring Quadratic Expressions 2 • Unit 11 Cycle 2 Lesson 2—Completing the Square • Unit 11 Cycle 2 Lesson 3—Transforming Exponential Expressions

<p>High School—Algebra / Arithmetic with Polynomials and Rational Expressions</p>
<p>Perform arithmetic operations on polynomials.</p>
<p>Standard for Mathematical Content HSA.APR.A.1: Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.</p>
<ul style="list-style-type: none"> • Unit 11 Cycle 3 Lesson 1—Adding and Subtracting Polynomials • Unit 11 Cycle 3 Lesson 2—Multiplying Polynomials • Unit 11 Cycle 3 Lesson 3—Combining Polynomials in Context
<p>High School—Algebra / Creating Equations</p>
<p>Create equations that describe numbers or relationships.</p>
<p>Standard for Mathematical Content HSA.CED.A.1: Create equations and inequalities in one variable and use them to solve problems.</p>
<ul style="list-style-type: none"> • Unit 3 Cycle 1 Lesson 1—Creating Equations and Inequalities in One Variable • Unit 12 Cycle 1 Lesson 1—Creating Equations and Inequalities in One Variable 2

<p>Standard for Mathematical Content HSA.CED.A.2: Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.</p>
<ul style="list-style-type: none"> • Unit 3 Cycle 1 Lesson 2—Creating Equations in Two Variables • Unit 12 Cycle 1 Lesson 2—Creating Equations in Two Variables 2 • Unit 14 Cycle 2 Lessons 1–3—Functions in Context Performance Task (Genetics in Medicine)
<p>Standard for Mathematical Content HSA.CED.A.3: Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context.</p>
<ul style="list-style-type: none"> • Unit 3 Cycle 1 Lesson 3—Representing Constraints • Unit 3 Cycle 3 Lessons 1–3—Equations and Inequalities Performance Task (Planning Healthy Menus)
<p>Standard for Mathematical Content HSA.CED.A.4: Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.</p>
<ul style="list-style-type: none"> • Unit 3 Cycle 1 Lesson 4—Rearranging Linear Formulas • Unit 12 Cycle 1 Lesson 3—Solving Formulas for a Given Variable

<p>High School—Algebra / Reasoning with Equations and Inequalities</p>
<p>Understand solving equations as a process of reasoning and explain the reasoning.</p>
<p>Standard for Mathematical Content HSA.REI.A.1: Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.</p>
<ul style="list-style-type: none"> • Unit 3 Cycle 2 Lesson 1—Equation Proofs
<p>Solve equations and inequalities in one variable.</p>
<p>Standard for Mathematical Content HSA.REI.B.3: Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.</p>
<ul style="list-style-type: none"> • Unit 3 Cycle 2 Lesson 2—Solving Equations • Unit 3 Cycle 2 Lesson 3—Solving Linear Inequalities • Unit 3 Cycle 3 Lessons 1–3—Equations and Inequalities Performance Task (Planning Healthy Menus) • Unit 14 Cycle 2 Lessons 1–3—Functions in Context Performance Task (Genetics in Medicine)

Standard for Mathematical Content HSA.REI.B.4: Solve quadratic equations in one variable.

- Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x - p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form.
- Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as $a \pm bi$ for real numbers a and b .

- Unit 12 Cycle 2 Lesson 1—Solving Quadratic Equations by Factoring
- Unit 12 Cycle 2 Lesson 2—Deriving the Quadratic Formula
- Unit 12 Cycle 2 Lesson 3—Solving Quadratic Equations Using the Quadratic Formula
- Unit 12 Cycle 3 Lessons 1–3—Quadratic and Exponential Equations Performance Task (Hotel Revenue)

Solve systems of equations.

Standard for Mathematical Content HSA.REI.C.5: Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions.

- Unit 5 Cycle 2 Lesson 1—Solving Systems of Equations Using Algebra 1
- Unit 5 Cycle 2 Lesson 2—Solving Systems of Equations Using Algebra 2
- Unit 5 Cycle 2 Lesson 4—Problem Solving with Systems of Equations
- Unit 12 Cycle 3 Lessons 1–3—Quadratic and Exponential Equations Performance Task (Hotel Revenue)

Standard for Mathematical Content HSA.REI.C.6: Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.

- Unit 5 Cycle 2 Lesson 3—Solving Systems of Equations Using Graphing Technology
- Unit 5 Cycle 2 Lesson 4—Problem Solving with Systems of Equations

Represent and solve equations and inequalities graphically.

Standard for Mathematical Content HSA.REI.D.10: Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).

- Unit 5 Cycle 1 Lesson 1—Solutions to Equations in Two Variables

Standard for Mathematical Content HSA.REI.D.11: Explain why the x -coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where $f(x)$ and/or $g(x)$ are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.

- Unit 5 Cycle 1 Lesson 2—Intersections on Graphs
- Unit 5 Cycle 1 Lesson 3—Graphing Solutions to Systems of Equations

Standard for Mathematical Content HSA.REI.D.12: Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.

- Unit 5 Cycle 3 Lesson 1—Graphing Linear Inequalities
- Unit 5 Cycle 3 Lesson 2—Solutions to Inequalities in Context
- Unit 5 Cycle 3 Lesson 3—Solving Systems of Inequalities

High School—Functions / Interpreting Functions

Understand the concept of a function and use function notation.

Standard for Mathematical Content HSF.IF.A.1: Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x is an element of its domain, then $f(x)$ denotes the output of f corresponding to the input x . The graph of f is the graph of the equation $y = f(x)$.

- Unit 6 Cycle 1 Lesson 1—Defining Functions
- Unit 6 Cycle 1 Lesson 2—Domain and Range

Standard for Mathematical Content HSF.IF.A.2: Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.

- Unit 6 Cycle 1 Lesson 3—Evaluating Functions

Standard for Mathematical Content HSF.IF.A.3: Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers.

- Unit 6 Cycle 2 Lesson 3—Arithmetic Sequences as Functions
- Unit 6 Cycle 2 Lesson 4—Geometric Sequences as Functions
- Unit 7 Cycle 2 Lessons 1–3—Constructing Functions Performance Task (Photography)

Interpret functions that arise in applications in terms of the context.
Standard for Mathematical Content HSF.IF.B.4: For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship.
<ul style="list-style-type: none"> • Unit 7 Cycle 1 Lesson 2—Functions and Graphs 1 • Unit 7 Cycle 2 Lessons 1–3—Constructing Functions Performance Task (Photography) • Unit 13 Cycle 1 Lesson 4—Interpreting Quadratic Functions
Standard for Mathematical Content HSF.IF.B.5: Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.
<ul style="list-style-type: none"> • Unit 7 Cycle 1 Lesson 3—Functions and Graphs 2 • Unit 13 Cycle 1 Lesson 4—Interpreting Quadratic Functions
Standard for Mathematical Content HSF.IF.B.6: Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.
<ul style="list-style-type: none"> • Unit 7 Cycle 1 Lesson 1—Rate of Change • Unit 13 Cycle 1 Lesson 4—Interpreting Quadratic Functions
Analyze functions using different representations.
Standard for Mathematical Content HSF.IF.C.7: Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.
<ol style="list-style-type: none"> a. Graph linear and quadratic functions and show intercepts, maxima, and minima. b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions. c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior. e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.
<ul style="list-style-type: none"> • Unit 8 Cycle 1 Lesson 1—Graphing and Analyzing Linear and Quadratic Functions • Unit 8 Cycle 1 Lesson 2—Graphing and Analyzing Exponential Functions • Unit 13 Cycle 1 Lesson 1—Graphing Linear and Quadratic Functions • Unit 13 Cycle 1 Lesson 2—Graphing Absolute Value, Step, and Piecewise Functions

Standard for Mathematical Content HSF.IF.C.8: Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.

- a. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.
- b. Use the properties of exponents to interpret expressions for exponential functions. For example, identify percent rate of change in functions such as $y = (1.02)^t$, $y = (0.97)^t$, $y = (1.01)12^t$, $y = (1.2)^{t/10}$, and classify them as representing exponential growth or decay.

- Unit 13 Cycle 1 Lesson 3—Rewriting Functions

Standard for Mathematical Content HSF.IF.C.9: Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).

- Unit 8 Cycle 1 Lesson 3—Comparing Functions 1
- Unit 13 Cycle 1 Lesson 5—Comparing Functions 2

High School—Functions / Building Functions

Build a function that models a relationship between two quantities.

Standard for Mathematical Content HSF.BF.A.1: Write a function that describes a relationship between two quantities.

- a. Determine an explicit expression, a recursive process, or steps for calculation from a context.
- b. Combine standard function types using arithmetic operations.
- c. Compose functions.

- Unit 8 Cycle 2 Lesson 1—Using Context to Find an Explicit Expression, a Recursive Process, or Steps for Calculation
- Unit 8 Cycle 2 Lesson 2—Combining Functions 1
- Unit 9 Cycle 2 Lessons 1–3—Modeling Functions Performance Task (Commuting Cost Models)
- Unit 13 Cycle 2 Lesson 1—Writing a Function from Context
- Unit 13 Cycle 2 Lesson 2—Combining Functions 2

Standard for Mathematical Content HSF.BF.A.2: Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.

- Unit 7 Cycle 2 Lessons 1–3—Constructing Functions Performance Task (Photography)
- Unit 8 Cycle 2 Lesson 3—Modeling Situations with Arithmetic Sequences
- Unit 8 Cycle 2 Lesson 4—Modeling Situations with Geometric Sequences

Build new functions from existing functions.

Standard for Mathematical Content HSF.BF.B.3: Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $kf(x)$, $f(kx)$, and $f(x + k)$ for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology.

- Unit 8 Cycle 3 Lesson 1—Vertical Translations of Linear Functions
- Unit 8 Cycle 3 Lesson 2—Vertical Translations of Exponential Functions
- Unit 8 Cycle 3 Lesson 3—Scaling Functions
- Unit 9 Cycle 2 Lessons 1–3—Modeling Functions Performance Task (Commuting Cost Models)
- Unit 13 Cycle 2 Lesson 3—Building New Functions 1
- Unit 13 Cycle 2 Lesson 4—Building New Functions 2

Standard for Mathematical Content HSF.BF.B.4: Find inverse functions.

- a. Solve an equation of the form $f(x) = c$ for a simple function f that has an inverse and write an expression for the inverse.

- Unit 13 Cycle 2 Lesson 5—Finding the Inverse of a Function

High School—Functions / Linear, Quadratic, and Exponential Models**Construct and compare linear, quadratic, and exponential models and solve problems.**

Standard for Mathematical Content HSF.LE.A.1: Distinguish between situations that can be modeled with linear functions and with exponential functions.

- a. Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals.
- b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.
- c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.

- Unit 9 Cycle 1 Lesson 1—Exponential and Linear Patterns of Growth
- Unit 9 Cycle 1 Lesson 2—Fitting Linear and Exponential Functions to the Same Points
- Unit 9 Cycle 2 Lessons 1–3—Modeling Functions Performance Task (Commuting Cost Models)

Standard for Mathematical Content HSF.LE.A.2: Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).

- Unit 9 Cycle 1 Lesson 3—Constructing Linear and Exponential Functions
- Unit 9 Cycle 2 Lessons 1–3—Modeling Functions Performance Task (Commuting Cost Models)

<p>Standard for Mathematical Content HSF.LE.A.3: Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.</p>
<ul style="list-style-type: none"> • Unit 9 Cycle 1 Lesson 4—Comparing Linear and Exponential Function Models • Unit 9 Cycle 2 Lessons 1–3—Modeling Functions Performance Task (Commuting Cost Models) • Unit 13 Cycle 1 Lesson 5—Comparing Functions 2 • Unit 13 Cycle 3 Lessons 1–3—Linear vs. Quadratic Functions Performance Task (Free-Falling Objects)
<p>Interpret expressions for functions in terms of the situation they model.</p>
<p>Standard for Mathematical Content HSF.LE.B.5: Interpret the parameters in a linear or exponential function in terms of a context.</p>
<ul style="list-style-type: none"> • Unit 9 Cycle 1 Lesson 5—Interpreting Parameters of Linear and Exponential Functions • Unit 9 Cycle 2 Lessons 1–3—Modeling Functions Performance Task (Commuting Cost Models)

<p align="center">High School—Statistics and Probability / Interpreting Categorical and Quantitative Data</p>
<p>Summarize, represent, and interpret data on a single count or measurement variable.</p>
<p>Standard for Mathematical Content HSS.ID.A.1: Represent data with plots on the real number line (dot plots, histograms, and box plots).</p>
<ul style="list-style-type: none"> • Unit 10 Cycle 1 Lesson 1—Dot Plots, Histograms, and Box Plots
<p>Standard for Mathematical Content HSS.ID.A.2: Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.</p>
<ul style="list-style-type: none"> • Unit 10 Cycle 1 Lesson 2—Summary Statistics
<p>Standard for Mathematical Content HSS.ID.A.3: Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).</p>
<ul style="list-style-type: none"> • Unit 10 Cycle 1 Lesson 3—Interpreting Graphs in Context
<p>Summarize, represent, and interpret data on two categorical and quantitative variables.</p>
<p>Standard for Mathematical Content HSS.ID.B.5: 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.</p>
<ul style="list-style-type: none"> • Unit 10 Cycle 2 Lesson 1—Categorical Data in Frequency Tables

<p>Standard for Mathematical Content HSS.ID.B.6: Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.</p> <ol style="list-style-type: none"> Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Informally assess the fit of a function by plotting and analyzing residuals. Fit a linear function for a scatter plot that suggests a linear association.
<ul style="list-style-type: none"> Unit 10 Cycle 2 Lesson 2—Constructing Scatter Plots for Bivariate Data Unit 10 Cycle 2 Lesson 3—Residuals Unit 10 Cycle 2 Lesson 4—Line of Best Fit
<p>Interpret linear models.</p>
<p>Standard for Mathematical Content HSS.ID.C.7: Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.</p>
<ul style="list-style-type: none"> Unit 10 Cycle 3 Lesson 1—Interpreting Slope and Intercept of a Linear Function in Context
<p>Standard for Mathematical Content HSS.ID.C.8: Compute (using technology) and interpret the correlation coefficient of a linear fit.</p>
<ul style="list-style-type: none"> Unit 10 Cycle 3 Lesson 2—Correlation Coefficient
<p>Standard for Mathematical Content HSS.ID.C.9: Distinguish between correlation and causation.</p>
<ul style="list-style-type: none"> Unit 10 Cycle 3 Lesson 3—Correlation vs. Causation