Pitsco MATH

Hands-on Curriculum Solutions for Math
Integrated Math • Algebra Readiness • Algebra I

PITSCO EDUCATION

Pitsco **MATH**

Hands-on Curriculum
Solutions for Math

Pitsco Education has been developing curriculum solutions and products for more than 40 years. Every product and curriculum offering places a heavy emphasis on incorporating extensive hands-on learning activities and real-world learning experiences, giving educators and students critical connections to the STEM concepts being delivered in the classroom. Pitsco Education math solutions connect mathematical practices to content and provide the real-world relevance to learning math.

Implementing Pitsco Education as your math solution means students of all learning styles, academic abilities, and socioeconomic backgrounds are able to experience academic success on their way to becoming college and workforce ready.

According to Anson High School Principal Charles Murphy, the old way of teaching Algebra I is not effective with many of today's students. "Our kids really are a 'show me why' type generation. 'Why?' and 'Why does this matter?' are the two questions kids ask."

The Pitsco Education Algebra program at Anson High School shows why and how algebra applies to the real world through a combination of Individualized Prescriptive Lessons™ (IPLs™), hands-on Modules, and MATH *Connections*.

Solution Components

Pitsco Education Math solutions effectively combine key learning components such as factual knowledge, procedural proficiency, and conceptual understanding with project-based activities. This powerful combination results in rigorous learning and relevant application and gives students meaningful opportunities to recognize and apply core math concepts and practices beyond the walls of the classroom.

A variety of components make Pitsco Math implementations customizable and strategic to meet a variety of learning styles. Components can be implemented individually to supplement an existing math course or can be combined as full-course implementations to match standards and pacing guides.

A customized scope and sequence using a variety of solution components will be created through a consultative process.

Pitsco MATH

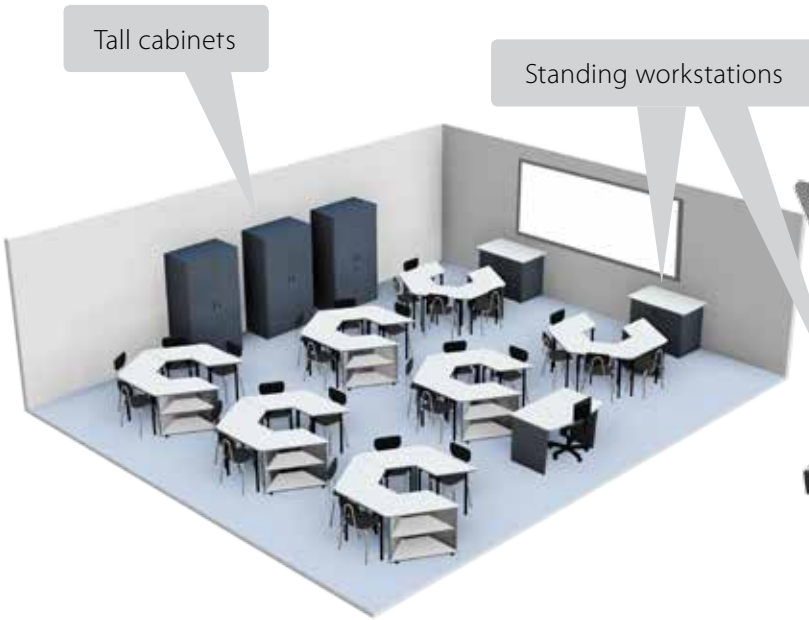
Changing the Learning Environment

The dynamic nature of the environment in a Pitsco Math classroom requires a different approach to facilitation. The wide range of hands-on equipment and materials and the incorporation of different types of instruction require a flexible learning environment.

Whether you are implementing whole-class solutions or student-directed instruction, Pitsco's FLEX furniture is durable and lightweight, which allows for easy reconfiguration to accommodate any Pitsco Math solution implementation. The trapezoid desk design can be reconfigured to accommodate individual as well as group seating. Storage cabinets serve as standing workstations for easy access to hands-on equipment and materials during cooperative learning activities, providing a high-quality alternative when space is limited.

Like all Pitsco furniture, FLEX is designed and built in Pitsco's own manufacturing facility with the same level of quality our customers have enjoyed since 1989.

- Standing workstations serve as mobile storage cabinets.
- Easy reconfiguration allows for a variety of seating arrangements.
- Designed and built in the USA.



Learning Content **Management System**

Synergy ITC, Pitsco's fully integrated cloud-based content management system, provides teachers with all the resources they need to manage and monitor student activity and performance. Teachers can schedule and monitor assignments, administer assessments, evaluate student data, and more . . . all from one management system.

Synergy ITC is intuitive and provides all the features teachers expect from a content-delivery and student-data management system, including diagnostic reports and real-time alignment capabilities. An extensive help site is available for easy troubleshooting and feature explanations.

- Intuitive, cloud-based management system
- Schedule and monitor assignments, administer assessments, evaluate student data, and more
- Extensive help site available

IPLs

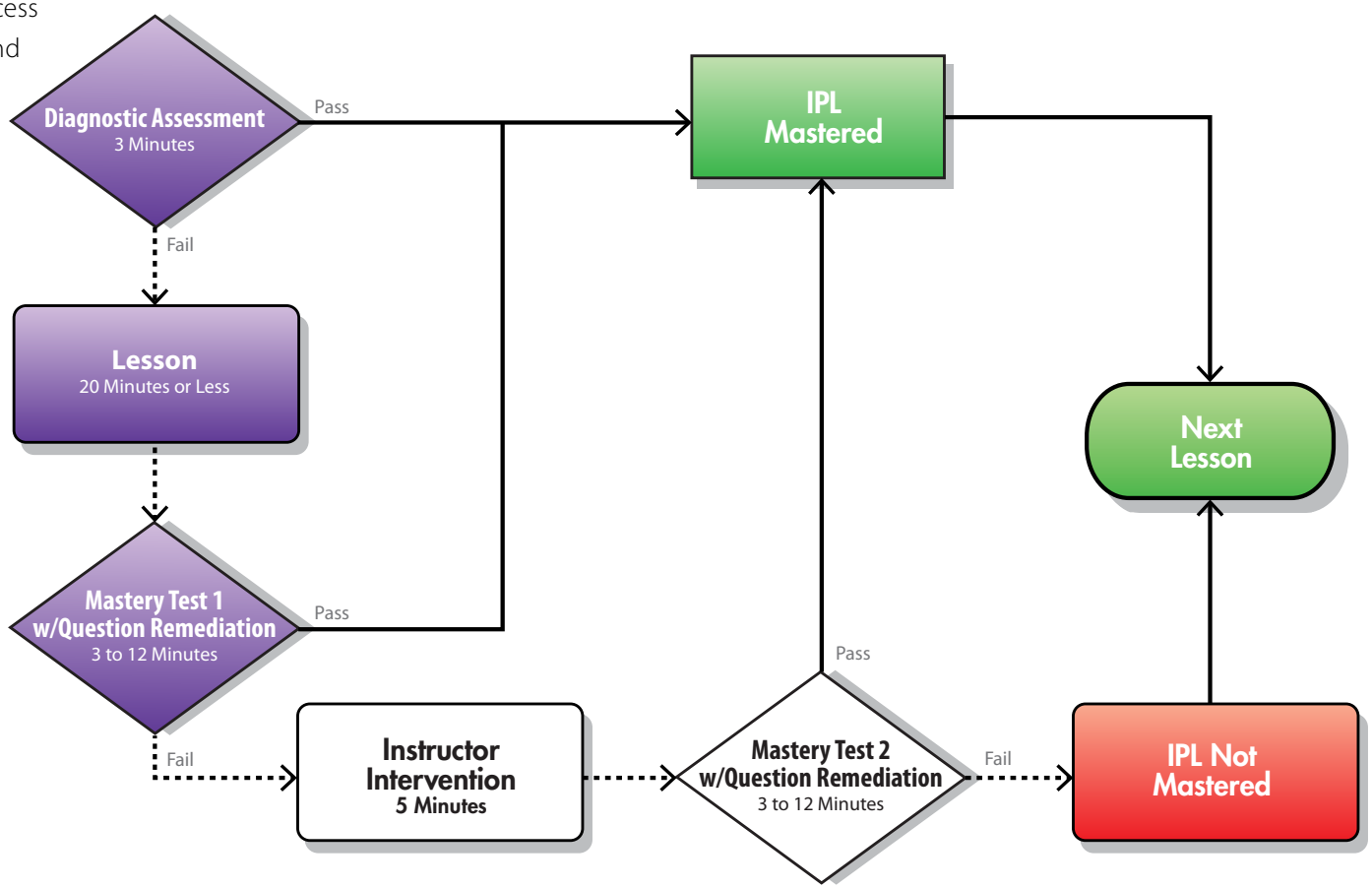
Individualized Prescriptive Lessons™ (IPLs)

Individualization in education is a critical component of any curriculum that successfully engages students and addresses their individual learning styles and needs. Individualized Prescriptive Lessons™ (IPLs) have been designed to first assess a student's level of understanding of core math concepts using formative assessments. Based upon the results of each assessment, every student is prescribed lessons in math concepts for which they need targeted instruction. Each lesson begins with a practice test, and students then proceed with the lesson in preparation for successfully completing a mastery test at its conclusion. Students must pass each prescribed mastery test before moving on to their next assignment. The curriculum includes interactive checkpoints using text entry, drag-and-drop, and multiple-choice actions, and students receive instant feedback for both correct and incorrect answers. Concept boxes are included throughout the curriculum, highlighting key concepts during each lesson. IPLs are computer based and used exclusively in combination with hands-on MATH *Connections*. The MATH *Connections* are designed specifically to provide real-world learning opportunities that culminate the math concepts taught in the IPLs.

- Uses one-to-one, computer-based instruction
- Incorporates targeted instruction through diagnostic assessments
- Provides clickable vocabulary and interactive checkpoints with just-in-time feedback

IPL Instructional Workflow

IPLs are designed using a mastery learning model. Students begin each IPL with a diagnostic assessment to determine each student's level of knowledge. The workflow illustrated below outlines the process students follow to master each concept delivered in the IPLs. The computer-based instruction targets each student to build mastery and gives teachers the opportunity for one-on-one intervention for those students who require additional practice. If a student fails the first mastery test, the student is prevented from continuing the lesson, and our *Synergy* management system alerts teachers via computer and/or mobile device that intervention is needed. The process enables each student to learn and progress at his or her own pace and provides targeted student-teacher interaction at the moment of need.



MATH *Connections*

MATH *Connections* are small group, team-based activities that serve to reinforce students' understanding of a series of math concepts delivered in their individualized instruction. Every MATH *Connection* has been designed and written to provide students the opportunity to apply concepts learned in the IPLs to real-world activities and scenarios. Each MATH *Connection* has been written as a culminating hands-on activity and aligned to a specific series of IPLs and math concepts. MATH *Connections* enable students to apply what they learn in the IPLs and reinforce for students how the math concepts they are learning relate to the world around them. These MATH *Connections* provide students with a strong foundation in core mathematics. Each MATH *Connection* includes both a student and a teacher guide; an instructional whole-class presentation; individual assessments; and engaging, hands-on activities and materials.

- Provides real-world, hands-on activities and related materials
- Combines whole-class and small group activities
- Each MATH *Connection* includes a teacher's guide, teacher presentation, individual assessment, and all materials necessary for the activity.

MATH *Connections*

The MATH Connections titles below are listed in the suggested order the students learn them.


Integers


Introduction to Decimals


Decimal Operations


Introduction to Fractions


Operations with Fractions I


Operations with Fractions II


Real Number System

Properties of
Real Numbers


Ratios and Percents


Equations


Linear Equations
and Graphing


Transformations


Angles


Angle Relationships


Triangles


Polygons


Circles


Prisms and Pyramids


Inequalities


Absolute Value


Functions


Exponents


Radicals


Special Equations


Systems of Equations


Matrices


Polynomials


Quadratics


Factoring


Exponential Equations


Sets


Data Graphs I


Data Graphs II


Logic and Sequences

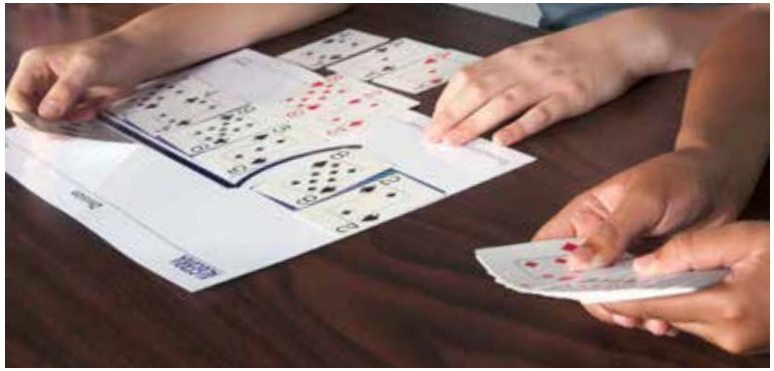

Probability


Units


Accuracy

MATH *Connections*

Integers



MATH CONNECTIONS

Students play up to 11 games to practice basic skills. The teacher determines which games are needed.

Game 1 – Addition of integers – positive numbers

Game 2 – Addition of integers – positive and negative numbers

Game 3 – Addition of integers – increased difficulty of positive and negative numbers

Game 4 – Subtraction of integers

Game 5 – Multiplication of integers

Game 6 – Is one integer a factor of the other?

Game 7 – Addition of two-digit integers – positive numbers

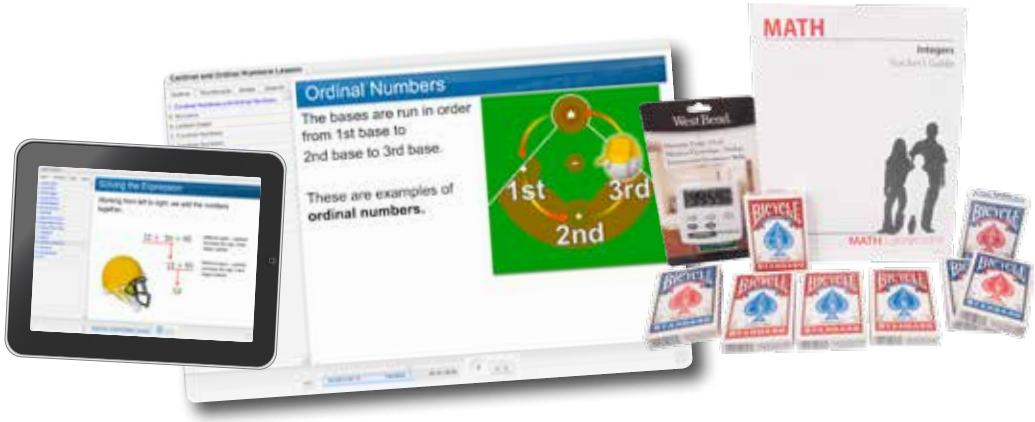
Game 8 – Addition of two-digit integers – positive and negative numbers

Game 9 – Subtraction of two-digit integers

Game 10 – Multiplication of two-digit integers

Game 11 – Division of a two-digit integer into a four-digit integer (use remainder)

IPLS	MATH CONCEPTS
Speaking Math	• Define common math vocabulary. • Explore the four basic operations and their solutions. • Form equations and expressions.
Place Value	• Define digit and place value. • Order numbers using digits. • Compare digits and place value.
Integers	• Define natural numbers, whole numbers, and integers. • Identify positive and negative integers and their relationship to zero. • Order integers using a number line.
Adding Integers	• Calculate total yards by adding integers.
Subtracting Integers	• Subtract integers.
Multiplying and Dividing Integers	• Multiply integers. • Divide integers.



Introduction to Decimals

MATH CONNECTIONS

The teacher leads a series of games through a *PowerPoint*. Students practice recognizing, creating, saying, and rounding decimals using cards. Students compare decimals and order them as if on a number line.

IPLS	MATH CONCEPTS
Decimal Numbers	• Learn about decimal numbers and their place values. • Find out how to correctly say decimal numbers. • Discover how decimal numbers can be visually represented.
Rounding Decimals	• Learn how to round decimal numbers. • Learn how to round to a specific place value. • Use rounding to estimate a sum.
Ordering Decimals	• Plot decimals on a number line. • Order decimals. • Compare decimals.

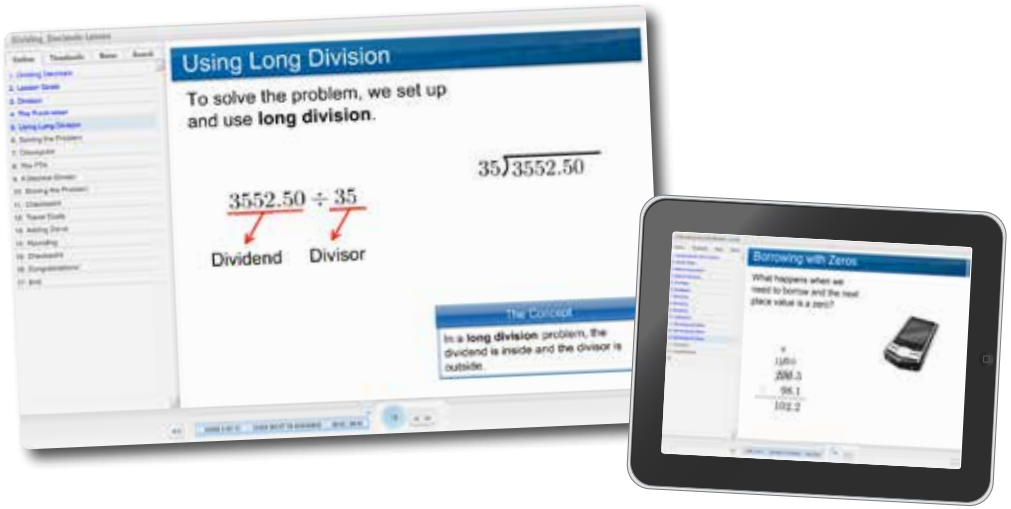
Decimal Operations

MATH CONNECTIONS

Students play a four-inning baseball game.

Inning 1 – Addition of decimals
Inning 2 – Subtraction of decimals
Inning 3 – Multiplication of decimals
Inning 4 – Division of decimals

IPLS	MATH CONCEPTS
Adding Decimals	• Determine how to set up a decimal problem. • Add decimals to decimals. • Add decimals to whole numbers.
Subtracting Decimals	• Learn a procedure to subtract decimals. • Learn to subtract decimals by borrowing.
Multiplying Decimals	• Multiply decimals by whole numbers. • Multiply decimals by other decimal numbers.
Dividing Decimals	• Divide decimals by whole numbers. • Divide decimals by decimals.



Introduction to Fractions

MATH CONNECTIONS

Students create a unique bingo card. Then, they play bingo by simplifying fractions that are given by the teacher as improper numbers, mixed numbers, or an unsimplified fraction.

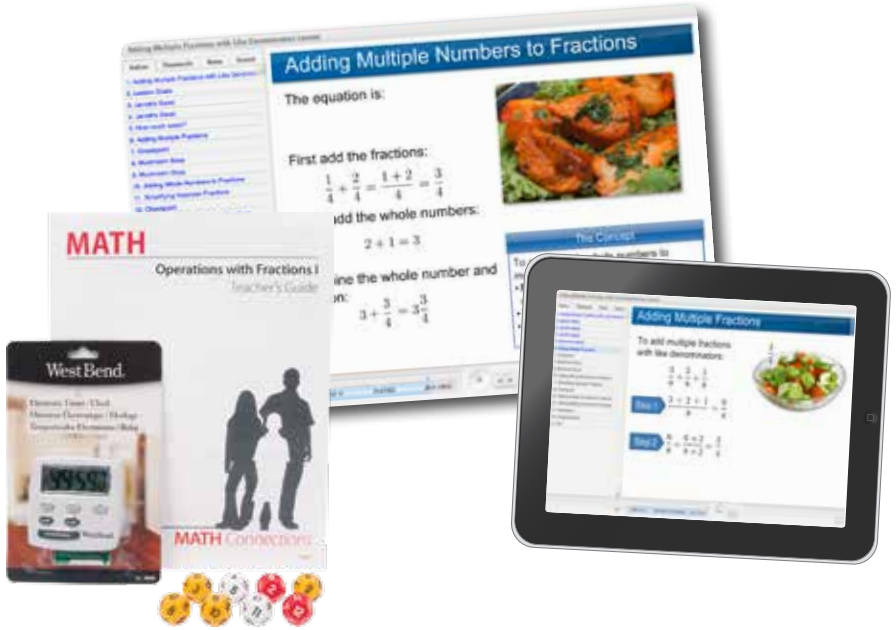
IPLS	MATH CONCEPTS
Graphical Representation of Fractions	• Learn the meaning of numerator and denominator. • Convert a fraction from a graphical representation to a numerical representation. • Convert a fraction from a numerical representation to a graphical representation.
Interpretation of Fractions	• Learn to state fractions in words. • Write a numerical form of a fraction from its word form. • Recognize and use special common fractions.
Improper Fractions and Mixed Numbers	• Recognize and define improper fractions. • Recognize and define mixed numbers. • Determine when to use an improper fraction or a mixed number.
Converting Between Mixed Numbers & Improper Fractions	• Convert improper fractions to mixed numbers. • Convert mixed numbers to improper fractions.
Representing Fractions on a Number Line	• Divide a number line into fractions. • Represent proper fractions on a number line. • Represent improper fractions on a number line. • Represent mixed numbers on a number line.
Factoring	• Define factors. • Find the factors of a number. • Find common factors.
Simplifying Fractions	• Find the greatest common factor (GCF). • Simplify fractions using division. • Compare fractions by simplifying.

MATH *Connections*

Operations with Fractions I

MATH CONNECTIONS

Students play a game using dice to generate the numbers in the numerator and denominator for the fractions. Students add and subtract fractions with like and unlike denominators. Students also add and subtract improper fractions. Students simplify their answers.

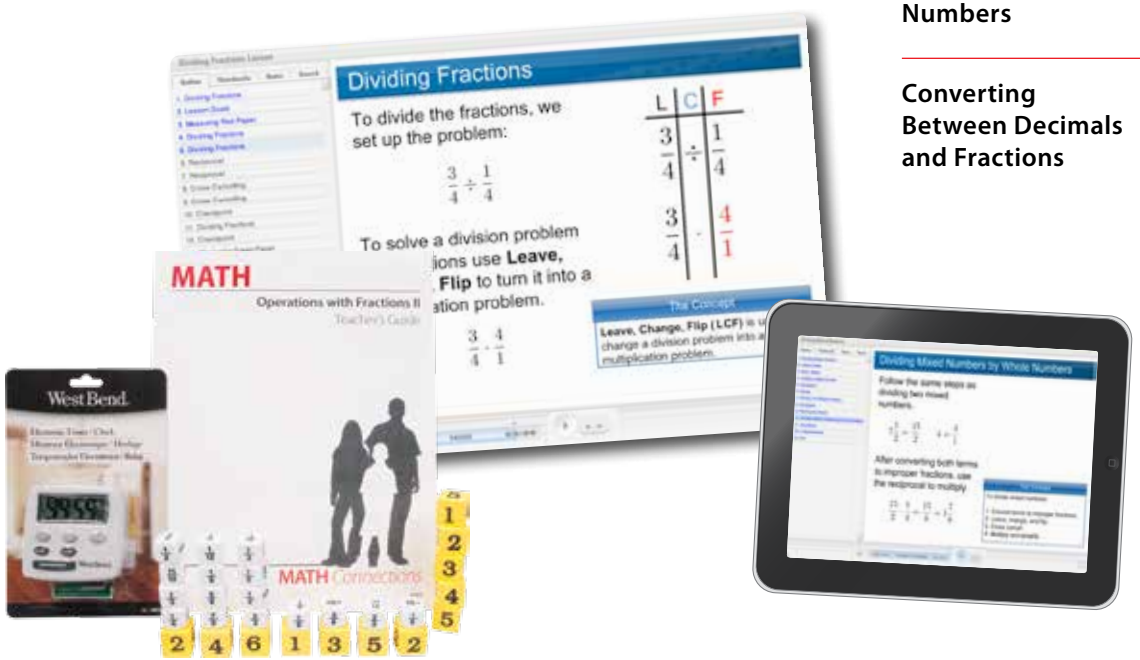


IPLS	MATH CONCEPTS
Adding Fractions with Like Denominators	• Add fractions with like denominators. • Convert the number 1 into a fraction. • Add fractions to whole numbers.
Adding Multiple Fractions with Like Denominators	• Add multiple fractions with like denominators. • Add multiple fractions and whole numbers.
Adding Mixed Numbers	• Add fractions to mixed numbers. • Add mixed numbers by converting to improper fractions. • Add mixed numbers by combining like terms.
Least Common Multiples	• Determine common multiples. • Determine least common multiples for two or more numbers.
Adding Fractions with Unlike Denominators	• Use a least common multiple to find a least common denominator. • Add fractions and mixed numbers with unlike denominators.
Subtracting Fractions with Like Denominators	• Subtract fractions with like denominators. • Convert whole numbers to fractions. • Subtract fractions from whole numbers.
Subtracting Fractions with Unlike Denominators	• Use the least common multiple to find the least common denominator of two fractions. • Subtract fractions with unlike denominators. • Subtract fractions from whole numbers.
Subtracting Multiple Fractions	• Subtract more than two fractions with unlike denominators. • Convert whole numbers to fractions. • Subtract more than two fractions from a whole number.
Subtracting Mixed Numbers	• Subtract fractions from mixed numbers. • Subtract mixed numbers using like terms. • Subtract mixed numbers by converting to improper fractions.

Operations with Fractions II

MATH CONNECTIONS

The teacher leads a series of activities through which students practice multiplying and dividing mixed numbers. Students create fractions through the use of fraction and number cubes.



IPLS	MATH CONCEPTS
Multiplying Fractions	• Multiply fractions with like denominators. • Multiply fractions with unlike denominators. • Multiply fractions by whole numbers.
Multiplying Mixed Numbers	• Multiply mixed numbers. • Multiply mixed numbers and whole numbers. • Multiply more than two mixed numbers.
Dividing Fractions	• Find the reciprocal of a fraction. • Divide two fractions. • Divide a whole number by a fraction.
Dividing Mixed Numbers	• Create and use a reciprocal. • Divide mixed numbers.
Converting Between Decimals and Fractions	• Convert decimals to fractions. • Convert fractions to decimals. • Compare fractions and decimals.

Real Number System

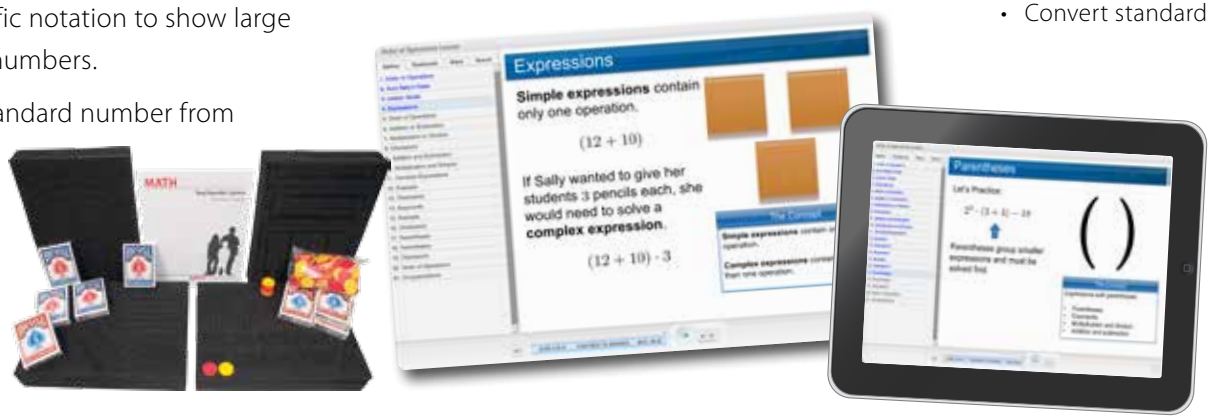
MATH CONNECTIONS

Students participate in several activities to work with the real number system. The teacher chooses to do all the activities or has students complete only those that he or she feels the students need to practice most.

Included Activities:

- Create decimals and place them on a number line.
- Solve equations using order of operations.
- Create the factorization for given numbers.
- Create prime factor trees for numbers.
- Use scientific notation to show large and small numbers.
- Create a standard number from scientific notation.

IPLS	MATH CONCEPTS
Real Number System	• Define set, subset, and superset. • Define the real number system and its subsets, which are rational, irrational, integer, whole, and natural. • Classify numbers according to their sets.
Ordering Numbers	• Order numbers using the number line. • Order numbers by converting to decimals.
Order of Operations	• Apply the order of operations to solve simple and complex expressions.
Prime Factorization	• Learn about prime and composite numbers. • Find factors of natural numbers. • Find prime factorizations of natural numbers.
Scientific Notation 1	• Compare positive powers of 10. • Convert scientific notation to standard form. • Write large numbers in scientific notation.
Scientific Notation 2	• Compare negative powers of 10. • Convert scientific notation to standard form. • Convert standard form to scientific notation.



Properties of Real Numbers

MATH CONNECTIONS

Students use cards and dice with math symbols to demonstrate examples of the properties of real numbers. The students play a properties matching game.

IPLS	MATH CONCEPTS
Properties of Equality 1	• Apply the Reflexive Property of Equality of real numbers. • Use the Symmetric Property of Equality of real numbers. • Explore the Transitive Property of Equality of real numbers.
Properties of Equality 2	• Apply the Addition Property of Equality. • Apply the Subtraction Property of Equality. • Apply the Multiplication Property of Equality. • Apply the Division Property of Equality.
Substitution	• Use substitution to solve one-variable equations. • Use substitution to solve two-variable equations. • Substitute expressions in variables.
Commutative Properties	• Explore the Commutative Property of Addition. • Apply the Commutative Property of Multiplication.
Associative Properties	• Explore the Associative Properties of Addition and Multiplication to evaluate expressions. • Use the Associative Properties of Addition and Multiplication to solve expressions.
Identity and Inverse Properties	• Apply the Additive and Multiplicative Identity Properties. • Explore the Additive and Multiplicative Inverse Properties. • Determine multiplication by zero.
Distributive Property	• Apply the Distributive Property over addition and subtraction. • Apply the Distributive Property using variables.

Ratios and Percents

MATH CONNECTIONS

Students use a car and roll ramp to obtain data for use with ratios and percentages.

IPLS	MATH CONCEPTS
Percents	• Define percent. • Represent percents graphically. • Convert percents to decimals and decimals to percents. • Convert fractions to percents and percents to fractions.
Percent Change	• Calculate percent change. • Determine if percent change is an increase or a decrease.
Simple Interest	• Calculate simple interest.
Compound Interest	• Learn how to calculate compound interest.
Introduction to Ratios	• Explore concepts related to ratios. • Identify different types of ratios. • Determine if two ratios are equivalent.
Proportions and Unknowns	• Explore the concepts of proportions. • Identify the different parts of a proportion. • Apply knowledge of proportions to solve for unknowns.

Equations

MATH CONNECTIONS

Students use a hydraulic trainer to verify equations containing one or two variables.

IPLS	MATH CONCEPTS
Combining Like Terms	• Identify different parts of a term. • Locate like terms. • Combine like terms using addition and subtraction.
Solving One-Step Equations	• Solve for an unknown in one-step equations.
One-Step Equation Word Problems	• Solve one-step equations from word problems. • Solve one-step equations with decimals and fractions.
Multistep Equations	• Solve multistep equations.
Rate Equations	• Solve problems using the percentage formula. • Solve problems using the distance formula.
Simplifying to Solve Equations	• Simplify to solve equations.
Variables and Variation	• Identify and solve direct variation equations. • Identify and solve inverse variation equations.
Viability	• Define viability and substitution. • Use viability and substitution to check answers

Linear Equations and Graphing

MATH CONNECTIONS

Students build and time LEGO® cars on a ramp to determine speed. Students create linear equations. Students compare and contrast the relationships between the parts of the equations and their meanings in the experiments. They create graphs of the equations using a graph board.

IPLS	MATH CONCEPTS
The Coordinate Plane	• Define and identify parts of the coordinate plane. • Identify the quadrants of the coordinate plane. • Plot ordered pairs.
Distance and Midpoint Formulas	• Calculate the distance between two points using the Distance Formula. • Determine the midpoint between two points using the Midpoint Formula.
Linear and Nonlinear	• Determine if a graph is linear or nonlinear. • Determine if an equation will generate a linear or nonlinear graph.
Slope	• Calculate the slope of a line using the slope equation. • Classify slopes as positive, negative, zero, and undefined. • Determine the slope of a line given a graph of the line.
Slope-Intercept Form	• Write an equation in slope-intercept form. • Graph an equation in slope-intercept form. • Find an equation from a graph.
Standard Form	• Write an equation in standard form. • Graph an equation in standard form.
Point-Slope Form	• Write an equation in point-slope form. • Graph an equation in point-slope form. • Find an equation from a graph.

Transformations

MATH CONNECTIONS

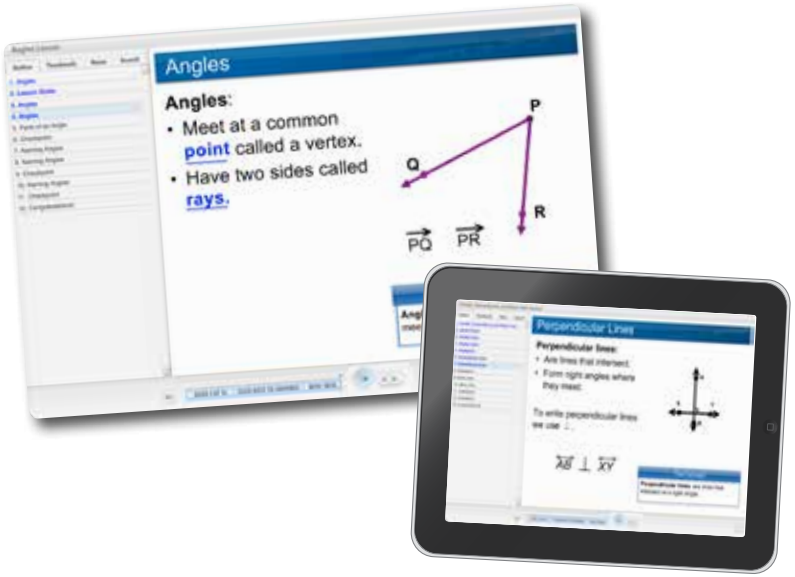
Students use a geometry board with pegs and rubber bands, MIRAs, and graph boards to practice transformations.

IPLS	MATH CONCEPTS
Points, Lines, and Shapes	• Plot ordered pairs. • Connect plotted points. • Create shapes from plotted points.
Translations	• Apply translation to plotted points. • Apply translation to plotted lines. • Apply translation to plotted shapes.
Reflections	• Understand the line of reflection. • Reflect points across the x- and y-axes. • Reflect shapes across the x- and y-axes. • Reflect shapes across a given line.
Rotations	• Determine an object's rotational symmetry. • Identify the angle of rotation. • Rotate shapes on the coordinate plane.
Dilations	• Plot points for dilated shapes. • Identify the scale factor of a shape. • Plot shapes around the center of dilation.

Angles

MATH CONNECTIONS

Students use a geometry board with pegs and rubber bands and graph boards to create lines, angles, and transversals.



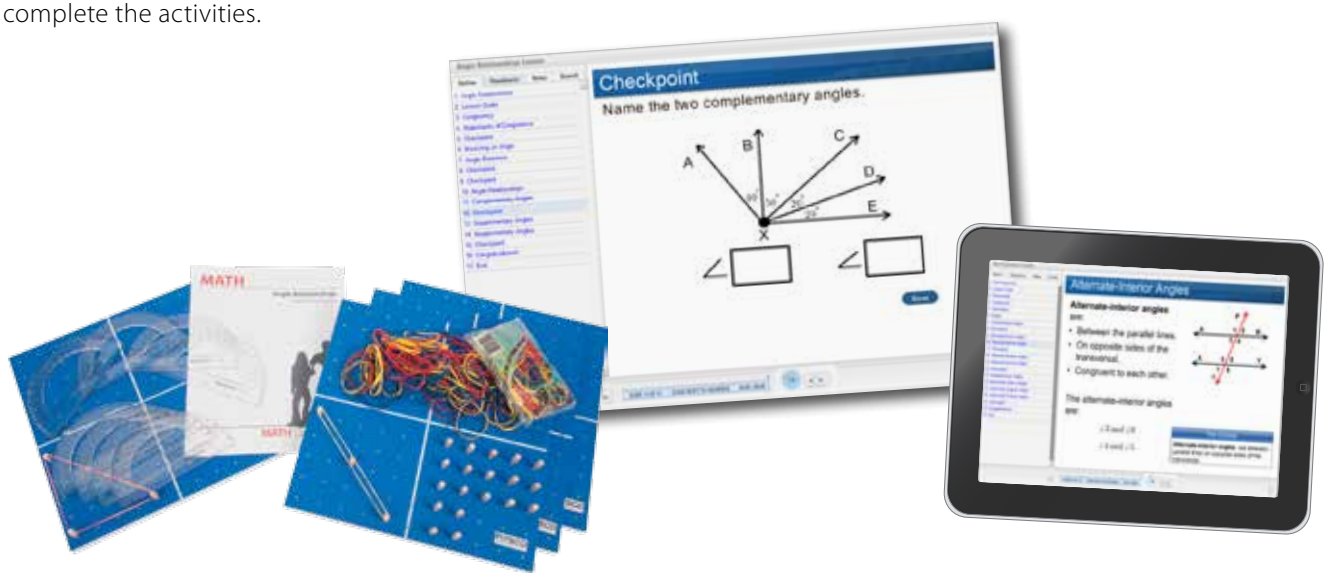
IPLS	MATH CONCEPTS
Introduction to Geometry	• Define and name points. • Define and name lines, rays, and segments. • Define and name planes.
Parallel, Perpendicular, and Skew Lines	• Define and label parallel lines. • Define and label perpendicular lines. • Define and label skew lines.
Angles	• Name the parts of an angle. • Name angles using the vertex. • Name angles using three points.
Measuring Angles	• Use a protractor to measure angles. • Name angles by their measures.
Constructing Angles	• Construct angles using a ruler, compass, and protractor. • Bisect a line using a compass and ruler.

Angle Relationships

MATH CONNECTIONS

Using a geometry board, pegs, and rubber bands, students create parallel and perpendicular lines, identify and measure angles, identify and create complementary and supplementary angles, and identify angle relationships with a transversal. The geometry boards, a *PowerPoint* for content review, and all necessary resources are included to complete the activities.

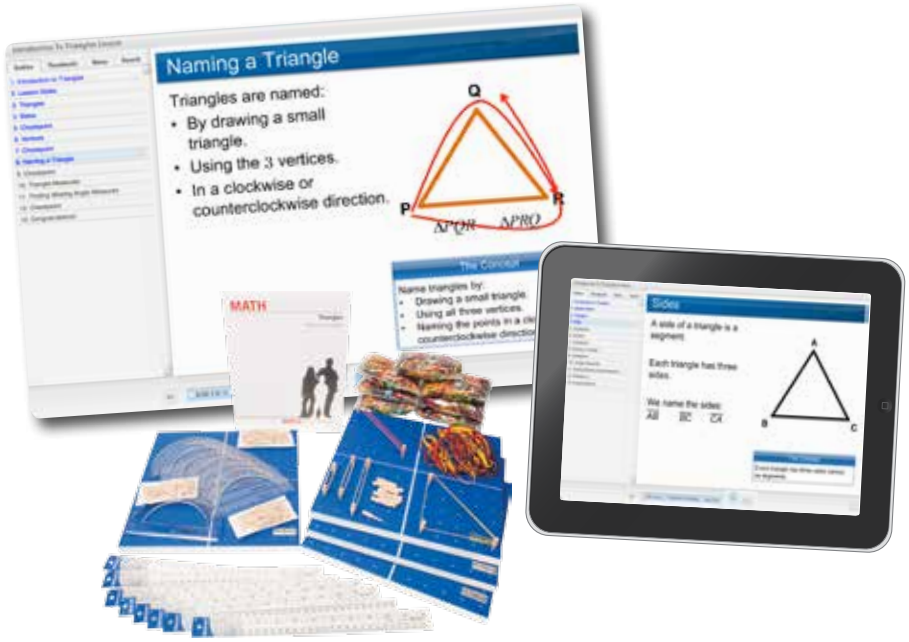
IPLS	MATH CONCEPTS
Angle Relationships	• Define and identify congruent angles. • Define and identify an angle bisector. • Define and identify complementary and supplementary angles.
Equations and Angle Properties	• Define adjacent angles and vertical angles. • Solve equations to find missing adjacent and vertical angles.
The Transversal	• Define and identify a transversal. • Define and identify corresponding angles.



Triangles

MATH CONNECTIONS

Students identify, measure, and create a variety of triangles and congruent triangles. They determine ratios in a given triangle including sine, cosine, and tangent. Students use geometry boards, pegs, rubber bands, protractors, rulers, and graph boards during the activity.



IPLS	MATH CONCEPTS
Introduction to Triangles	• Define and label the parts of a triangle. • Name triangles. • Calculate missing angle measures.
Congruent Triangles	• Prove congruency with the Side-Side-Side Theorem. • Prove congruency with the Side-Angle-Side Theorem. • Prove congruency with the Angle-Side-Angle Theorem.
Classifying Triangles	• Identify and classify triangles by their angle measures. • Identify and classify triangles by their side lengths.
Similar Triangles	• Write proportions for similar triangles. • Prove two triangles similar using SSS and SAS Similarity. • Prove two triangles similar using AA Similarity.
Sine, Cosine, and Tangent	• Write and identify sine, cosine, and tangent ratios. • Solve for the missing side of a right triangle using sine, cosine, and tangent ratios.
Trigonometric Ratios	• Find the missing angles of right triangles using sine, cosine, and tangent.
Inequality, Right Triangles, & the Pythagorean Theorem	• Use the Triangle Inequality Theorem to determine whether you can draw a triangle. • Identify the parts of a right triangle. • Solve for the missing side of a right triangle using the Pythagorean Theorem.

Polygons

MATH CONNECTIONS

Students use polygon shapes, paper, rulers, and graph boards to work with polygons. Students compare, measure, and create polygons.

IPLS	MATH CONCEPTS
Introduction to Polygons	• Identify polygons. • Name polygons by their sides. • Classify polygons as regular or irregular.
Missing Angles of Polygons	• Calculate the total degrees of all the angles of a polygon. • Find missing angle measures in polygons.
Quadrilaterals, Rectangles, and Squares	• Learn and identify the properties of quadrilaterals. • Identify rectangles and their properties. • Identify squares and their properties.
The Parallelogram & the Rhombus	• Identify a parallelogram and its properties. • Identify a rhombus and its properties.
Trapezoids & Kites	• Identify a trapezoid and its properties. • Identify a kite and its properties.
Perimeter	• Find the perimeter of quadrilaterals. • Find the perimeter of regular polygons. • Find the perimeter of irregular polygons.
Area	• Find the area of a rectangle. • Find the area of a triangle. • Find the area of a trapezoid.
Area of Irregular Shapes	• Break irregular shapes into polygons. • Calculate the area of irregular shapes. • Find the area of shaded portions of circles.
Polygons on the Coordinate Plane	• Define polygon. • Plot points on a coordinate plane. • Find side lengths of a polygon using subtraction. • Find side lengths of a polygon using the Pythagorean Theorem.

Circles

MATH CONNECTIONS

Students calculate the area of circles; use circumference to determine radius; and calculate the volume and surface area of cones, cylinders, and spheres. Students use card stock to create a package and then create a scaled version of the package.

IPLS	MATH CONCEPTS
Circles	• Identify the diameter and radius of a circle. • Identify chords in a circle. • Identify arcs in a circle.
Circumference and Area	• Evaluate expressions with pi. • Find the circumference of a circle. • Find the area of a circle.
Cylinders	• Define a cylinder and its parts. • Find the surface area of a cylinder. • Find the volume of a cylinder.
Cones	• Identify a cone and its parts. • Calculate the surface area of a cone. • Calculate the volume of a cone.
Spheres	• Identify spheres and their parts. • Find the surface area of a sphere. • Find the volume of a sphere.

Prisms and Pyramids

MATH CONNECTIONS

Students identify and construct prisms and pyramids using straws and pipe cleaners. Students calculate the area and volume of prisms and pyramids and identify their nets.

IPLS	MATH CONCEPTS
Cubes	• Identify a cube and its parts. • Calculate the surface area of a cube. • Calculate the volume of a cube.
Rectangular Prisms	• Identify rectangular prisms and their properties. • Find the surface area of a rectangular prism. • Find the volume of a rectangular prism.
Triangular Prisms	• Identify the base and height of a triangular prism. • Find the surface area of a triangular prism. • Find the volume of a triangular prism.
Rectangular Pyramids	• Identify the height of a rectangular pyramid. • Find the surface area of a rectangular pyramid. • Find the volume of a rectangular pyramid.
Triangular Pyramids	• Identify the parts of a triangular pyramid. • Find the surface area of a triangular pyramid. • Find the volume of a triangular pyramid.
Nets	• Identify the nets of prisms. • Identify the nets of pyramids. • Identify the nets of cylinders and cones.
Cross Sections	• Identify rectangular and triangular prisms. • Find two-dimensional cross sections of three-dimensional shapes. • Identify triangular and rectangular pyramids. • Define cross section, horizontal slice, and vertical slice.

Inequalities

MATH CONNECTIONS

Students use cards, dice, math symbols, Wikki Stix, and graph boards to solve and graph inequalities and compound inequalities. Students use a number line or a coordinate grid to show solutions.

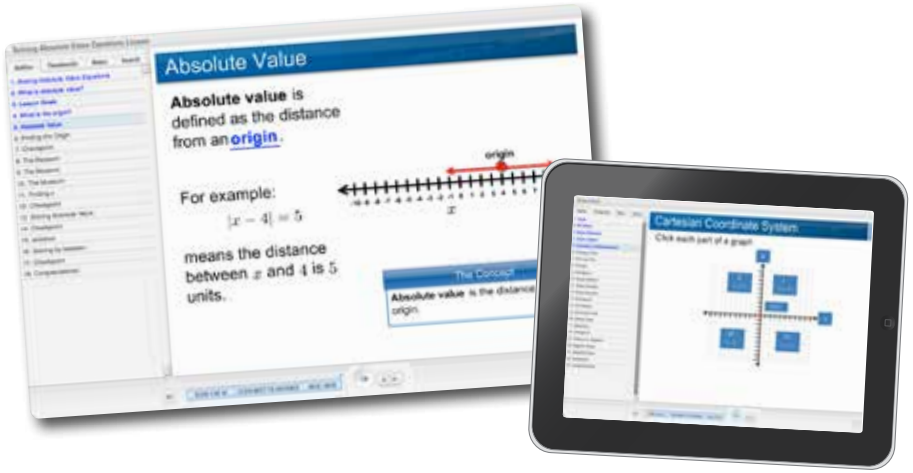
IPLS	MATH CONCEPTS
Inequalities	• Set up inequalities from verbal sentences. • Graph inequalities on a number line.
Solving Inequalities	• Solve simple inequalities using algebra properties.
Solving Compound Inequalities	• Write a compound inequality. • Solve a compound inequality.
Linear Inequalities 1	• Write inequalities. • Convert inequalities into slope-intercept format. • Graph inequalities.
Linear Inequalities 2	• Write linear inequalities using negative numbers. • Change the sign of linear inequalities. • Graph inequalities using a sign change.

Absolute Value

MATH CONNECTIONS

Students shoot straw rockets at a target and keep track of the distance from the target – negative distance in front of the target, positive distance beyond the target. Students create a table and then use absolute value to determine the total distance from the target. Students use their graph boards to plot absolute value equations.

IPLS	MATH CONCEPTS
Absolute Value	• Relate the absolute value of a number with distance from a starting point. • Use math to simplify the absolute value of numbers.
Solving Absolute Value Equations	• Apply the rules of absolute value. • Solve absolute value equations.
Graphing Absolute Value	• Find ordered pairs of absolute value equations and inequalities. • Graph absolute value equations. • Graph absolute value inequalities.



Functions

MATH CONNECTIONS

Students use dice to create domains for given functions including linear, quadratic, absolute value, and step functions. Students graph the functions on a graph board.

IPLS	MATH CONCEPTS
Functions	• Identify a function and its notation. • Determine the domain and range of a function. • Determine whether a relation is a function.
Special Functions	• Use and solve linear and quadratic functions. • Use and solve absolute value and step functions.
Graphing Functions	• Identify the graphs of linear, quadratic, and absolute value functions. • Identify the graph of a step function. • Use the vertical line test to determine if a graph is a function.

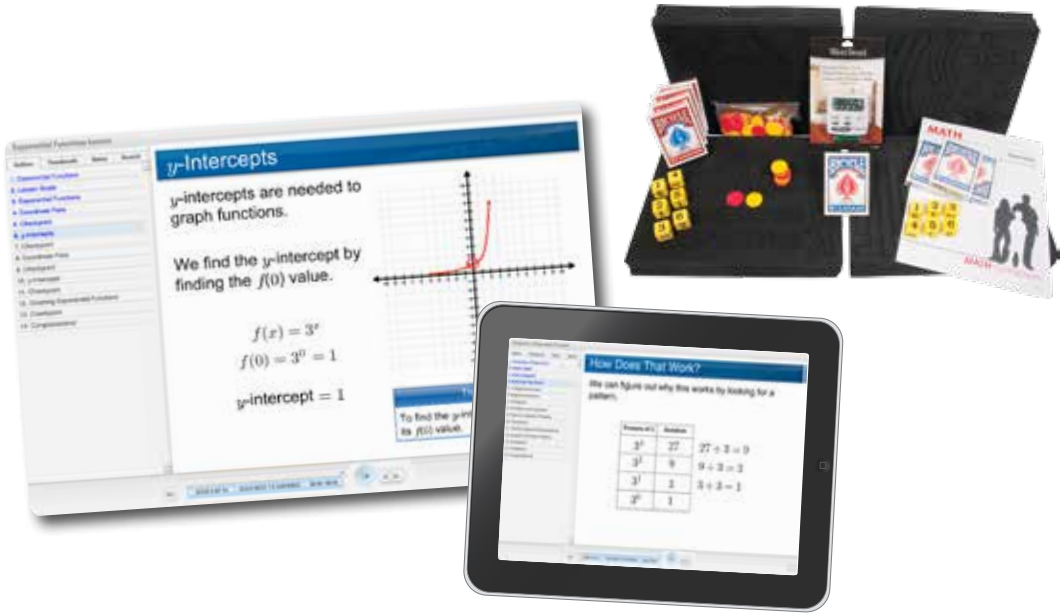
Exponents

MATH CONNECTIONS

Students have the opportunity to play up to 10 games to practice using exponents. The teacher decides which games will be played.

- **Game 1** – Create an exponential expression and the repeated multiplication problem expressed.
- **Game 2** – Create an exponential expression and the numerical answer.
- **Game 3** – Create a decimal number with an exponent and the numerical answer.
- **Game 4** – Create a fraction with an exponent and the numerical answer.
- **Game 5** – Create positive and negative numbers with exponents and the numerical answers.
- **Game 6** – Product of Powers Property
- **Game 7** – Power of a Power Property
- **Game 8** – Power of a Product Property
- **Game 9** – Negative exponents
- **Game 10** – Quotient of Powers Property

IPLS	MATH CONCEPTS
Exponents	• Write repeated multiplications in exponential form. • Find the value of exponential expressions.
Properties of Exponents 1	• Explore the Product of Powers Property. • Explore the Power of a Power Property. • Explore the Power of a Product Property.
Properties of Exponents 2	• Explore zero exponents. • Explore negative exponents. • Explore and apply the Quotient of Powers Property. • Explore and apply the Power of a Quotient Property.



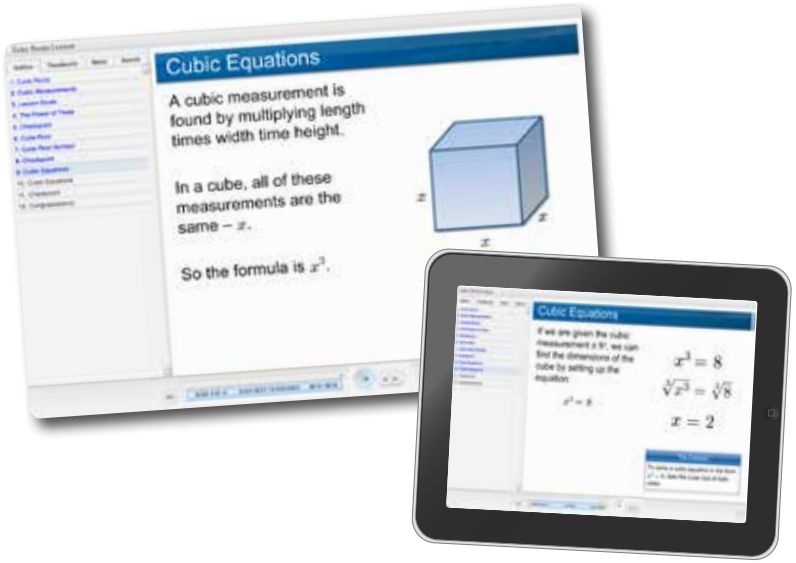
MATH *Connections*

Radicals

MATH CONNECTIONS

Students use cards, math symbols, and graph boards to practice using and simplifying radicals and radical expressions.

IPLS	MATH CONCEPTS
Perfect Squares and Square Roots	• Identify perfect squares. • Find the square root of perfect squares. • Approximate the square root of whole numbers.
Cube Roots	• Find cube roots of numbers. • Solve cubic equations.
Simplifying Square Roots	• Find the principal and negative square root. • Simplify square roots to find the exact answer.
Radical Expressions	• Simplify radical expressions.
Radical Expressions – Operations	• Identify and solve direct variation equations. • Identify and solve inverse variation equations.

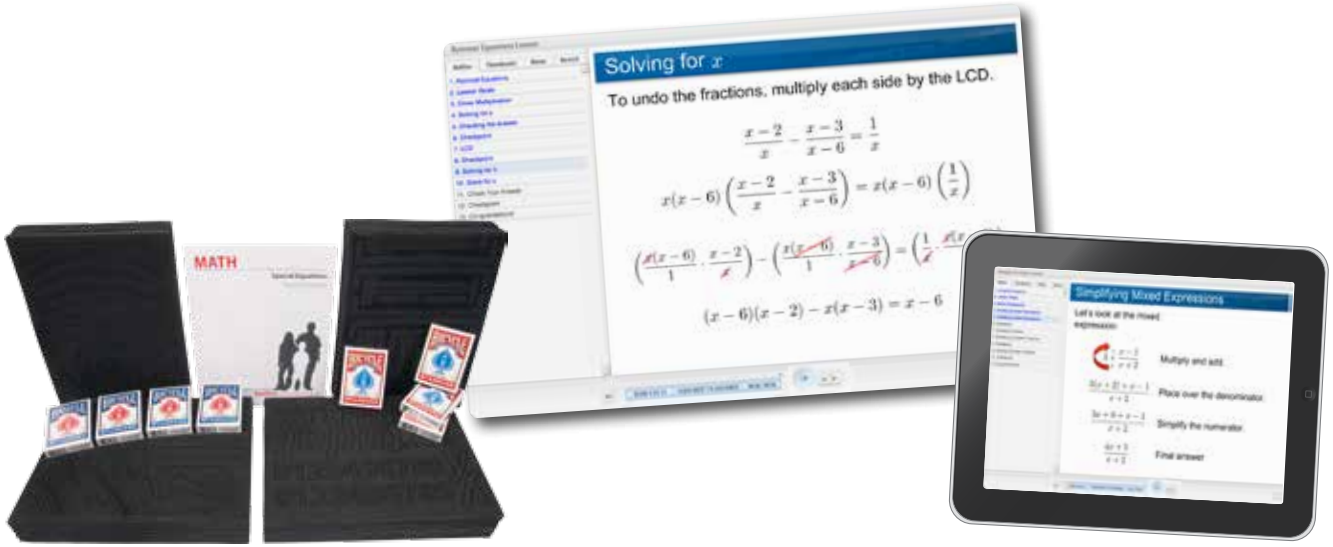


Special Equations

IPLS	MATH CONCEPTS
Radical Equations	• Solve radical equations with x on one side.
Complex Fractions	• Define mixed expressions and complex fractions. • Simplify mixed expressions and complex fractions.
Rational Equations	• Solve for x in rational equations.

MATH CONNECTIONS

Students solve rational expressions and equations and simplify complex fractions and mixed expressions using cards, math symbols, and graph boards.



Systems of Equations

MATH CONNECTIONS

Students use cards, dice, math symbols, rulers, and graph boards to solve systems of equations. Students graph some solutions. They use substitution and elimination to solve other systems of equations. Students also solve systems of inequalities.

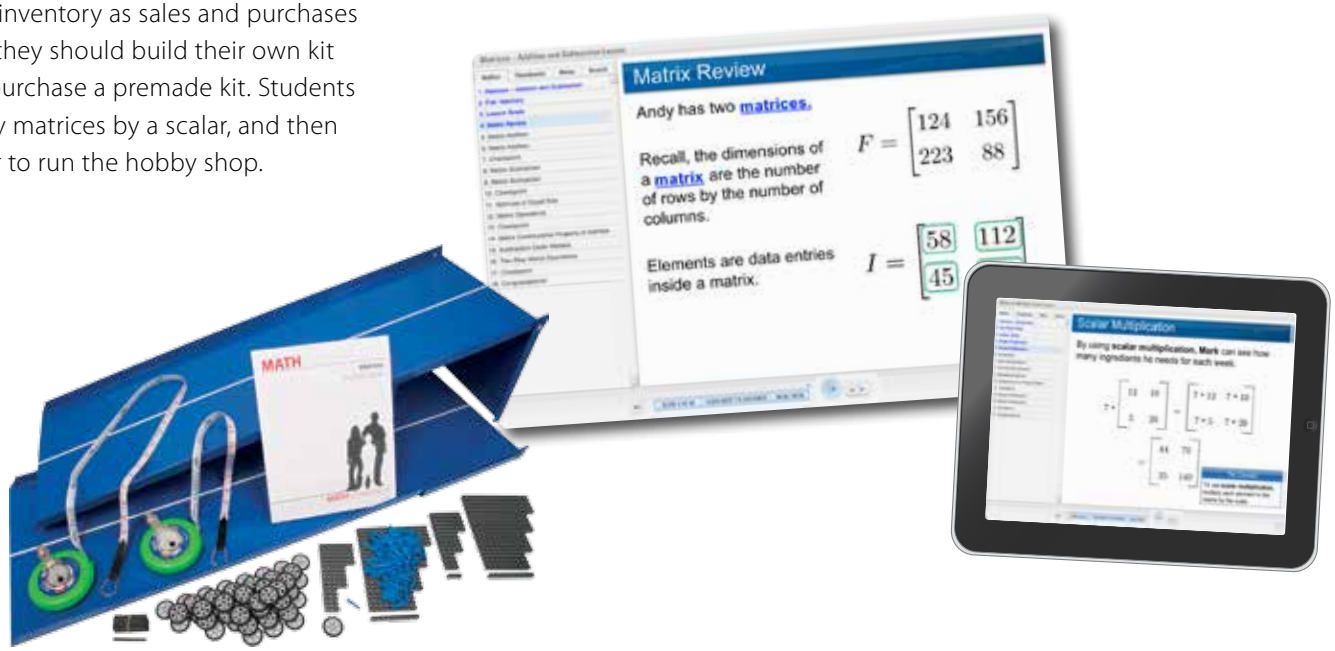
IPLS	MATH CONCEPTS
Systems of Equations – Graphs	• Define system of linear equations. • Find solutions to systems of linear equations by using graphs. • Determine the number of solutions to a system of linear equations.
Systems of Equations – Substitution	• Isolate a variable in an equation. • Solve systems of linear equations using substitution.
Systems of Equations – Elimination	• Use elimination to solve systems of equations. • Use systems of equations to solve story problems.
Systems of Inequalities	• Solve systems of linear inequalities by graphing.

Matrices

MATH CONNECTIONS

Students build and use a LEGO® car to measure distance traveled when only the hubs are used and again when rubber tires are added. The two matrices are compared. Students are given the scenario of running a hobby shop that has several types of car kits for sale. They use matrices to keep track of inventory as sales and purchases are made. Then, they determine if they should build their own kit with raw materials or continue to purchase a premade kit. Students add and subtract matrices, multiply matrices by a scalar, and then multiply matrices together in order to run the hobby shop.

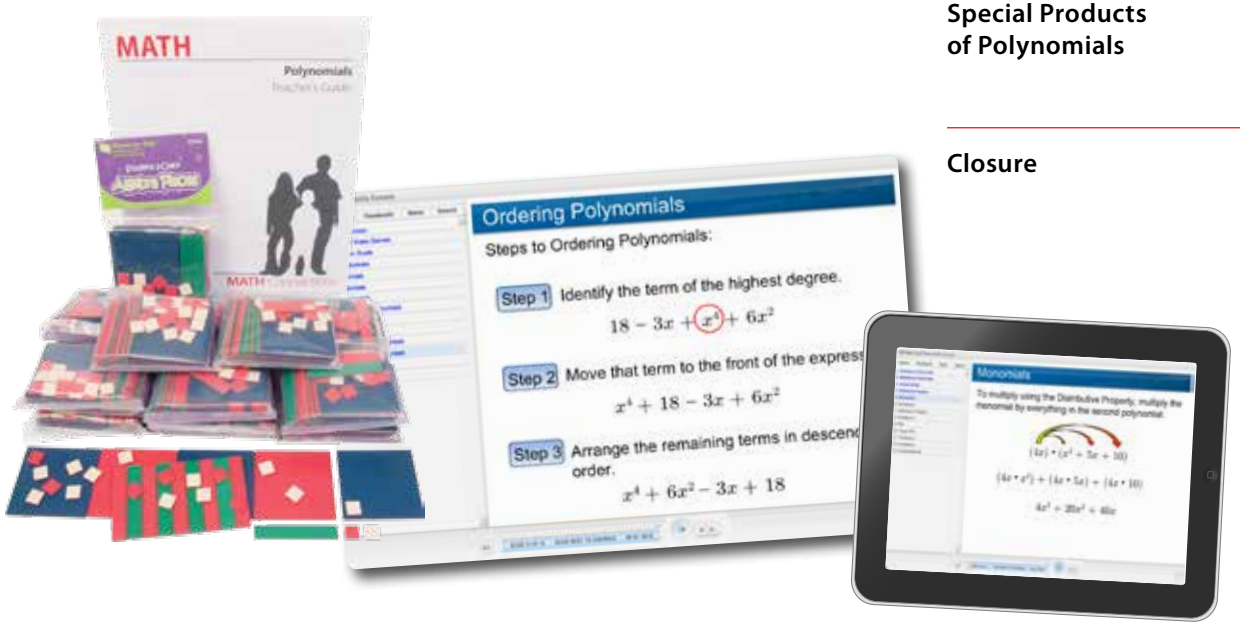
IPLS	MATH CONCEPTS
Matrices – Data Collection	• Learn how to use matrix notation. • Use matrices to store and interpret data.
Matrices – Addition and Subtraction	• Add matrices. • Subtract matrices. • Learn about matrices of equal size.
Matrices – Multiplication	• Learn how to multiply matrices by a scalar. • Learn how to multiply matrices together.



Polynomials

MATH CONNECTIONS

The teacher leads students through the activity. Students use algebra tiles and graph boards to add, subtract, and multiply polynomials.



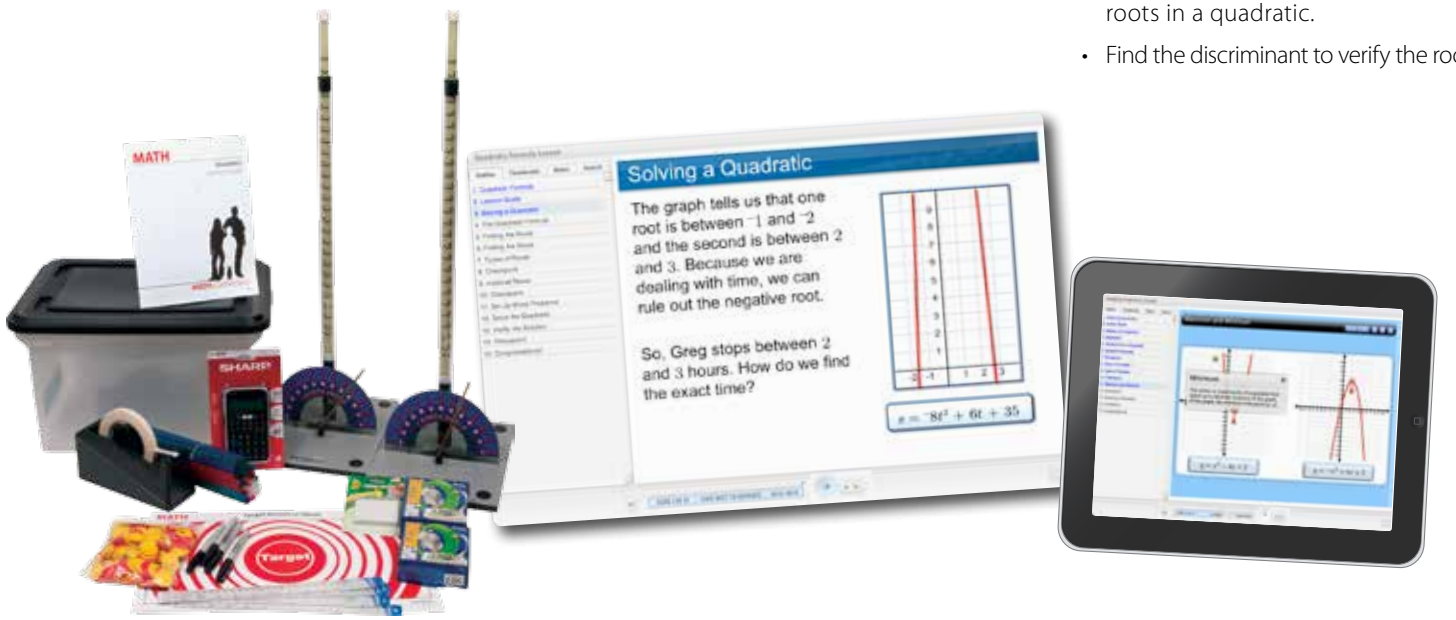
IPLS	MATH CONCEPTS
Monomials	• Identify monomial expressions. • Multiply monomials. • Divide monomials.
Polynomials	• Identify different types of polynomials. • Find the degree of polynomials. • Order polynomials.
Adding & Subtracting Polynomials	• Add polynomials. • Subtract polynomials.
Multiplying Polynomials	• Multiply polynomials with the Distributive Property. • Multiply polynomials using the FOIL method.
Special Products of Polynomials	• Find the square of a sum. • Find the square of a difference. • Find the product of a sum and a difference.
Closure	• Apply closure to the Real Number System. • Apply closure to polynomials. • Determine a counterexample.

Quadratics

MATH CONNECTIONS

Students use straw rockets to view the shape of a parabola. Students model the trajectory of a straw rocket using quadratic equations. Students solve quadratic equations to predict where their rocket will land. Students use a graph board to answer questions about quadratic equations.

IPLS	MATH CONCEPTS
Graphing Quadratics 1	• Identify quadratics. • Find the maximum or minimum on a graph. • Graph quadratics.
Graphing Quadratics 2	• Find the axis of symmetry of a parabola. • Graph a quadratic using the axis of symmetry. • Adjust the width of a parabola. • Shift a parabola by changing the constant.
Solving Quadratics by Graphing	• Solve a quadratic by graphing. • Identify the types of solutions a quadratic can have.
Quadratic Formula	• Solve quadratics using the Quadratic Formula.
The Discriminant	• Use the discriminant to find the number of real roots in a quadratic. • Find the discriminant to verify the roots of a quadratic.

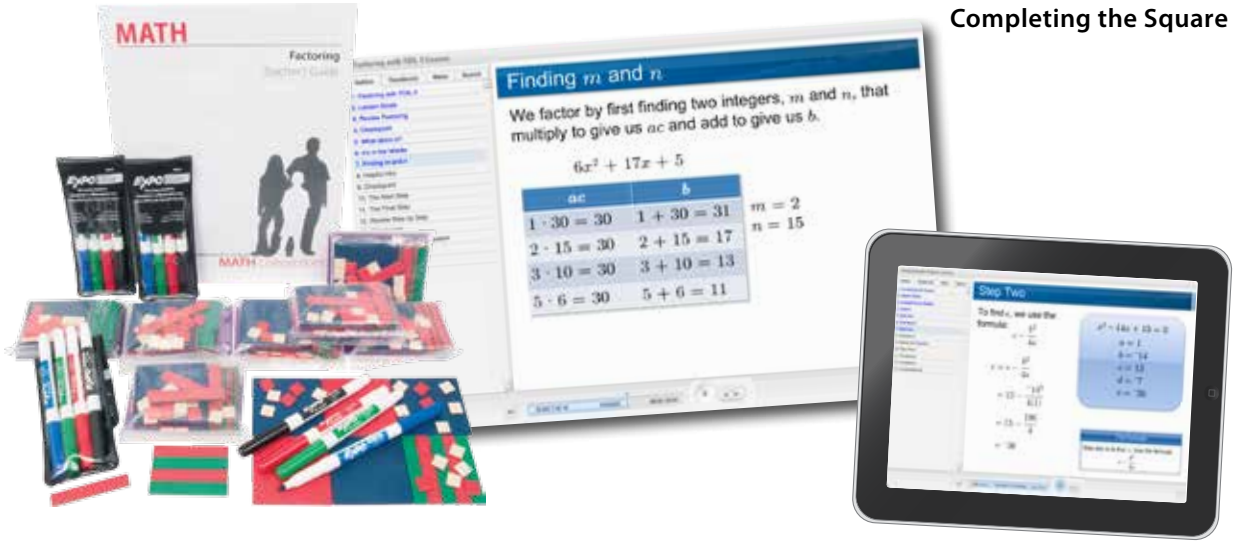


Factoring

MATH CONNECTIONS

Students practice factoring integers; algebraic expressions; and polynomials using cards, math symbols, and graph boards. Students use the Distributive Property, FOIL, perfect squares, and completing the square methods along with simple prime factorization.

IPLS	MATH CONCEPTS
Factoring Algebraic Terms	• Factor to find the GCF. • Factor algebraic terms.
Factoring with the Distributive Property	• Factor simple algebraic expressions using the Distributive Property.
Factoring with FOIL 1	• Factor quadratics in the form $x^2 + bx + c$ using FOIL. • Solve factored quadratics.
Factoring with FOIL 2	• Factor quadratics in the form $ax^2 + bx + c$ using FOIL. • Solve factored quadratics.
Factoring Perfect Square Trinomials	• Identify perfect square trinomials. • Factor perfect square trinomials. • Apply the Perfect Square Property.
Completing the Square	• Solve quadratic equations by completing the square.



Exponential Equations

MATH CONNECTIONS

Students will create a graph using circles to represent exponential growth and decay. They create the range from a given domain for an exponential function. Students then transfer the information to the graph board.

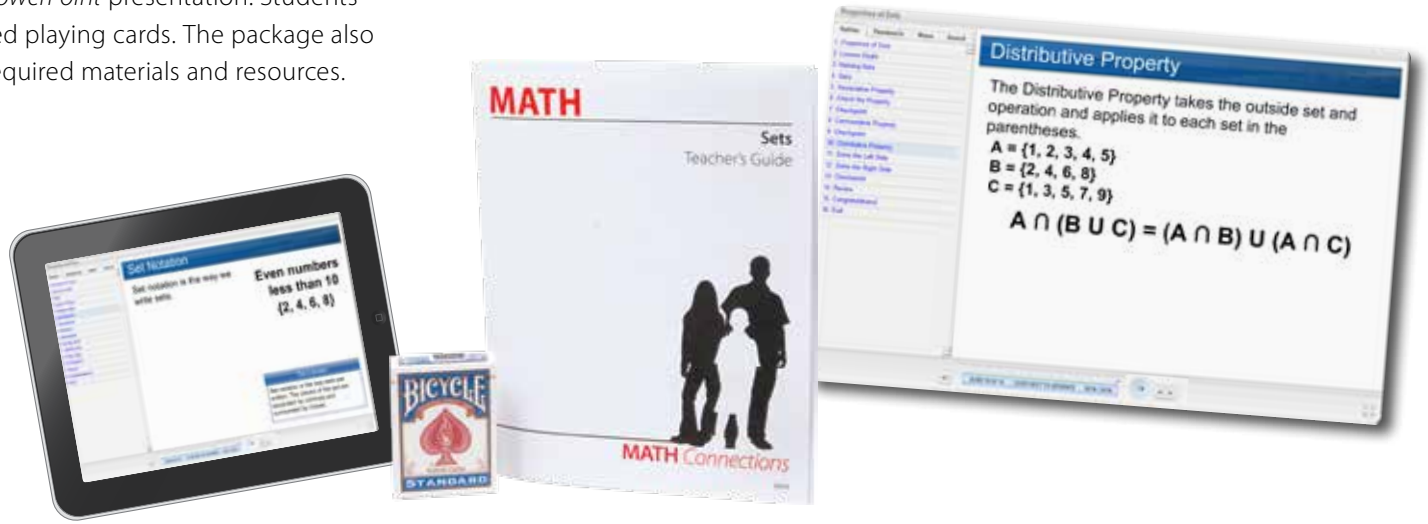
IPLS	MATH CONCEPTS
Exponential Functions	• Find ordered pairs of exponential functions. • Find the y-intercept of an exponential function. • Identify the graph of an exponential function.
Exponential Growth	• Review conversion of a percent to a decimal. • Identify and use the formula for exponential growth. • Calculate exponential growth and compound interest.
Exponential Decay	• Identify and use the formula for exponential decay. • Solve depreciation problems. • Identify and use the half-life formula.

Sets

MATH CONNECTIONS

Students are provided with practice on building sets and determining intersections and unions of sets. Included playing cards provide students with at least four different ways to organize the cards into sets (numeric, color, suit, and face cards/non-face cards) and make it unlikely for any two practice problems to be the same. A review of concepts and terms involving set notation, intersections, and unions is provided via a *PowerPoint* presentation. Students practice in pairs, using included playing cards. The package also includes an assessment and required materials and resources.

IPLS	MATH CONCEPTS
Elements and Sets	• Define sets, set notation, elements, empty sets, infinite sets, and finite sets. • Write sets using set notation.
Unions and Intersections	• Use Venn diagrams to compare and contrast sets. • Identify unions and intersections. • Define variability, normal distribution, range, and standard deviation.
Properties of Sets	• Name sets. • Define unions. • Use the Associative and Commutative Properties of sets to identify unions. • Apply the Distributive Property to sets.

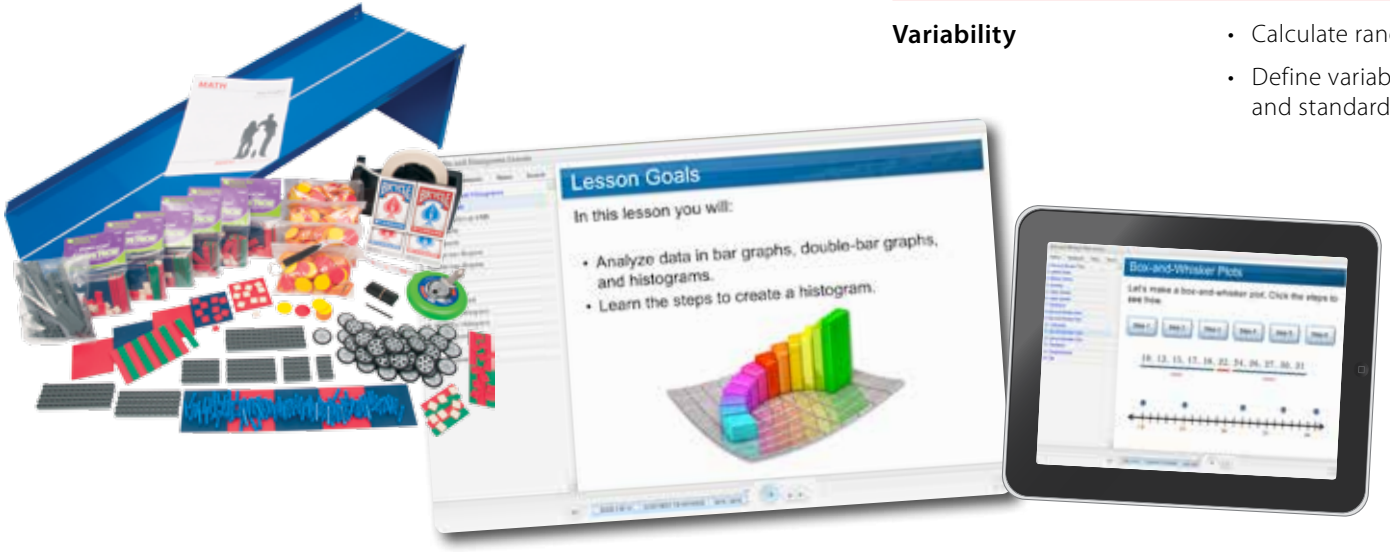


Data Graphs I

MATH CONNECTIONS

Students will complete up to five activities. Some activities include using two LEGO® cars for comparison of distance traveled. Students will create a back-to-back stem-and-leaf plot. They will also use cards and dice to create information for use in averages. Students will use colored circles, algebra tiles, and other manipulatives to create data for bar graphs and box-and-whisker plots.

IPLS	MATH CONCEPTS
Tree Diagrams, Tables, and Charts	• Learn about the different ways to organize data. • Use tree diagrams, tables, and circle graphs to organize data and find solutions.
Bar Graphs and Histograms	• Analyze data in bar graphs, double-bar graphs, and histograms. • Learn the steps to create a histogram.
Organizing Data	• Evaluate data to create stem-and-leaf plots. • Use back-to-back stem-and-leaf plots. • Create a line plot.
Central Tendency	• Calculate mean, median, mode, and range.
Box-and-Whisker Plots	• Understand quartiles. • Identify the parts of a box-and-whisker plot. • Learn how to show data in box-and-whisker plots.
Variability	• Calculate range, standard deviation, and mean. • Define variability, normal distribution, range, and standard deviation.

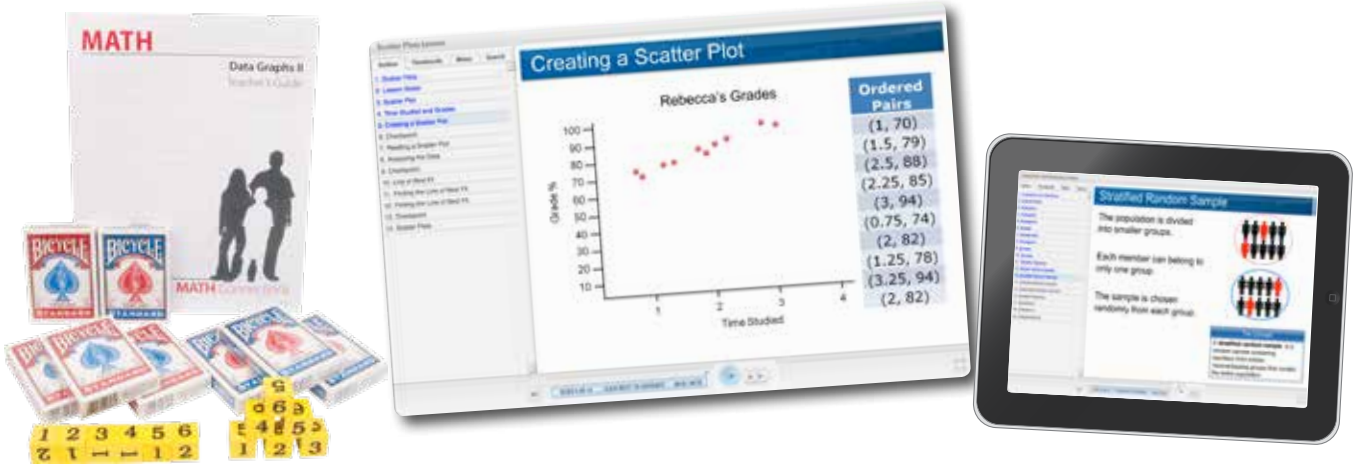


Data Graphs II

MATH CONNECTIONS

Students create simple, stratified, and systematic samples using cards and dice. They plot coordinate pairs on a scatter plot and draw a line of best fit on a graph board.

IPLS	MATH CONCEPTS
Population and Sampling	• Determine a population, sample, and sample size. • Learn about sampling techniques.
Scatter Plots	• Create scatter plots. • Analyze scatter plots to determine relationships.
Population Comparisons	• Determine mean, median, and mode. • Calculate range and standard deviation. • Identify parts of a double bar graph, double stem-and-leaf plot, and scatter plot. • Determine correlation between two sets of data using mean.

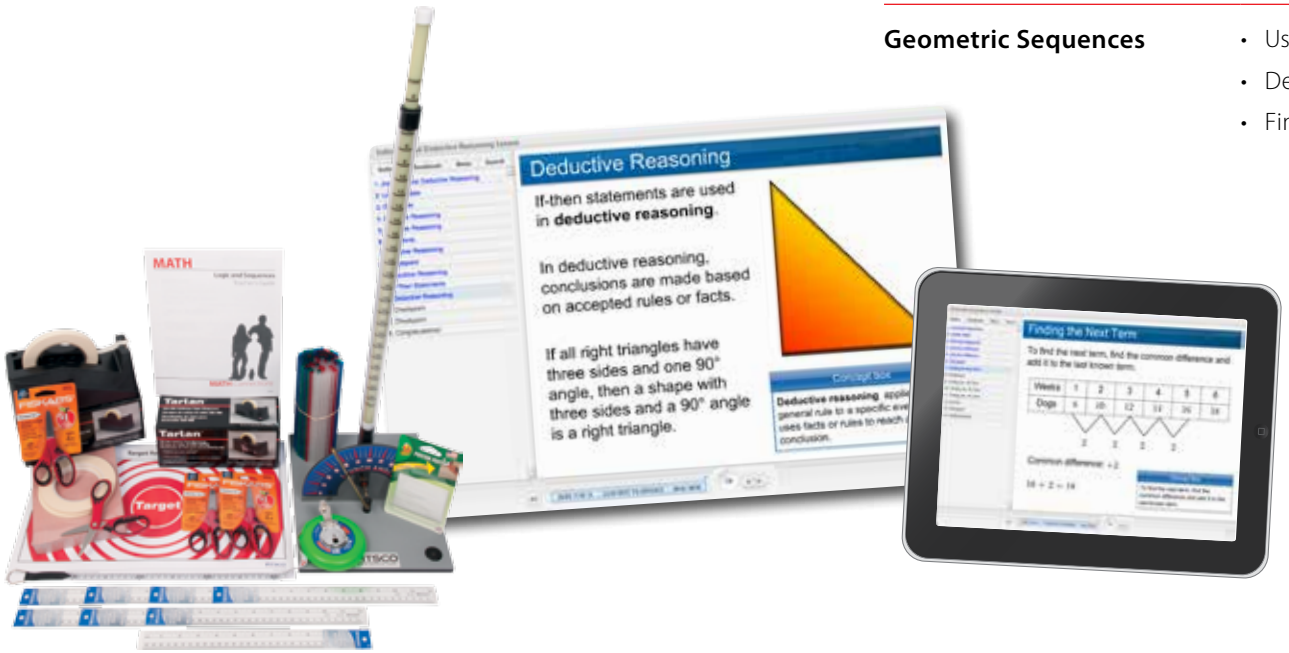


Logic and Sequences

MATH CONNECTIONS

Students use straw rockets to create data for arithmetic sequences.
Information about the components are used to create geometric sequences.

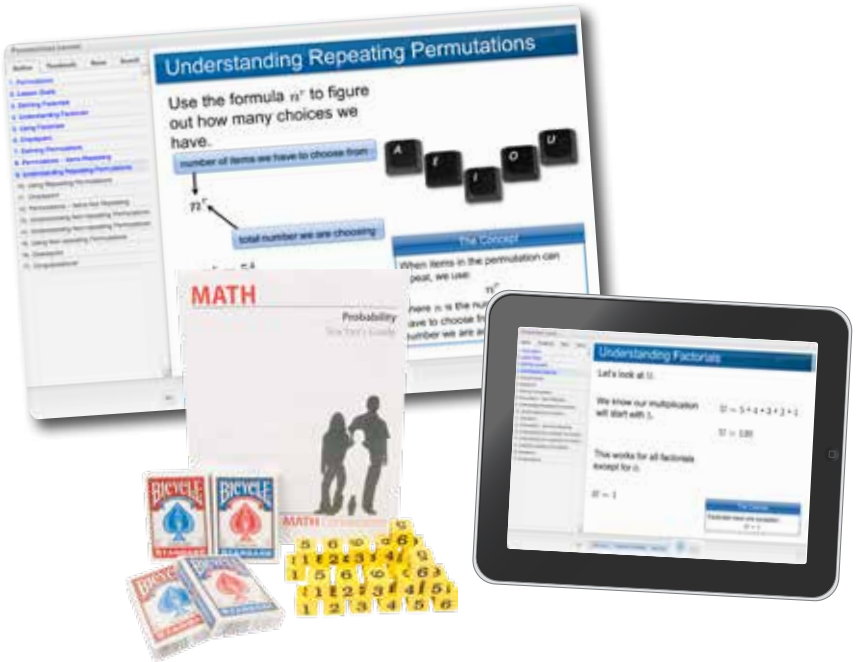
IPLS	MATH CONCEPTS
Inductive and Deductive Reasoning	• Learn the difference between inductive and deductive reasoning. • Identify examples of each type of reasoning. • Determine if a statement is true or false based on logical reasoning.
Introduction to Sequences	• View various types of sequences. • Identify terms and the order of terms. • Find the next term in a sequence. • Find the missing term in a sequence.
Arithmetic Sequences	• Recognize an arithmetic sequence. • Determine the common difference. • Find the nth term in a sequence.
Geometric Sequences	• Use geometric sequences. • Determine the common ratio. • Find the nth term in a sequence.



Probability

MATH CONNECTIONS

Students use cards, dice, and graph boards to determine outcomes for independent and dependent events, combinations, and permutations.



IPLS	MATH CONCEPTS
Fundamental Counting Principle	• Calculate the number of possible events using the Fundamental Counting Principle. • Determine if events are independent or dependent.
Probability	• Learn about probability and how likely an event is to occur. • Discover theoretical probability. • Discover experimental probability.
Probabilities of Independent & Dependent Events	• Decide if events are independent or dependent. • Solve independent events. • Solve dependent events.
Probability of Compound Events	• Decide if events are exclusive or inclusive. • Solve exclusive compound events. • Solve inclusive compound events.
Permutations	• Learn about factorials. • Solve repeating permutations. • Solve non-repeating permutations.
Combinations	• Learn the difference between permutations and combinations. • Solve repeating combinations. • Solve non-repeating combinations.

Units

MATH CONNECTIONS

Students determine and convert standard and metric measurement for length and temperature. Students measure several objects in the room and use graph boards to gather data and solve problems.

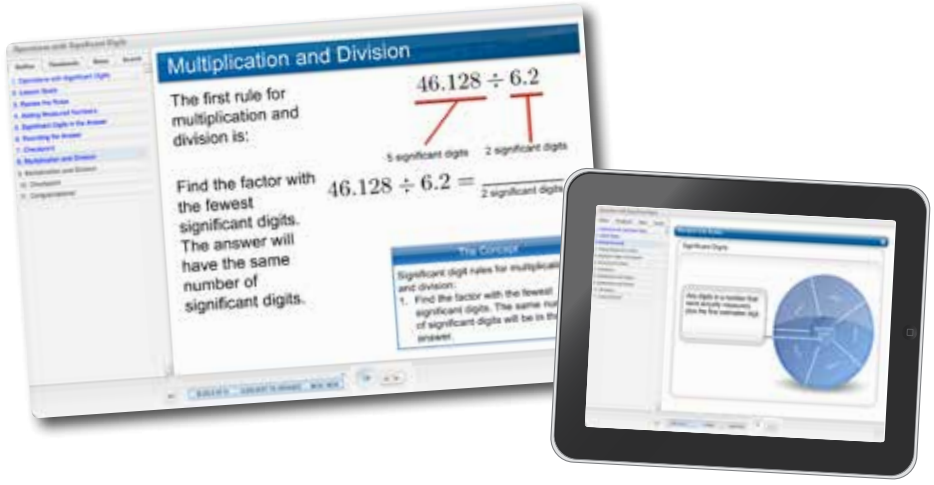
IPLS	MATH CONCEPTS
Standard Units	• Recognize the standard base units. • Identify the property each standard base unit measures. • Choose the correct unit to measure an object.
Metric Units	• Identify the common units of the metric system. • Use the basic prefixes of the metric system.
Dimensional Analysis	• Evaluate the arrangement of variables in a problem. • Convert a single unit to a different unit within a system and between systems. • Convert derived units.
Converting Fahrenheit and Celsius	• Convert from Celsius to Fahrenheit. • Convert from Fahrenheit to Celsius.

Accuracy

MATH CONNECTIONS

Students use accuracy and precision to measure the distance from their rocket to the target. They use significant digits in addition, subtraction, multiplication, and division.

IPLS	MATH CONCEPTS
Significant Digits	• Explore the rules of identifying significant digits. • Determine the significant digits in a number.
Operations with Significant Digits	• Round answers to the correct number of significant digits for addition and subtraction problems. • Round answers to the correct number of significant digits for multiplication and division problems.
Accuracy and Precision	• Define accuracy and precision. • Distinguish between accuracy and precision. • Describe accuracy using the ± symbol.



Connecting Math
Practices with Math Content

Pitsco's cloud-based *Expeditions* were developed with the Common Core State Standards Initiative and are designed to help connect mathematical practices to mathematical content. Each *Expedition* begins with an Essential Question, which sets the focus and shapes students' thinking. The overall goal is to create robust mathematical thinkers by engaging learners with the subject matter.

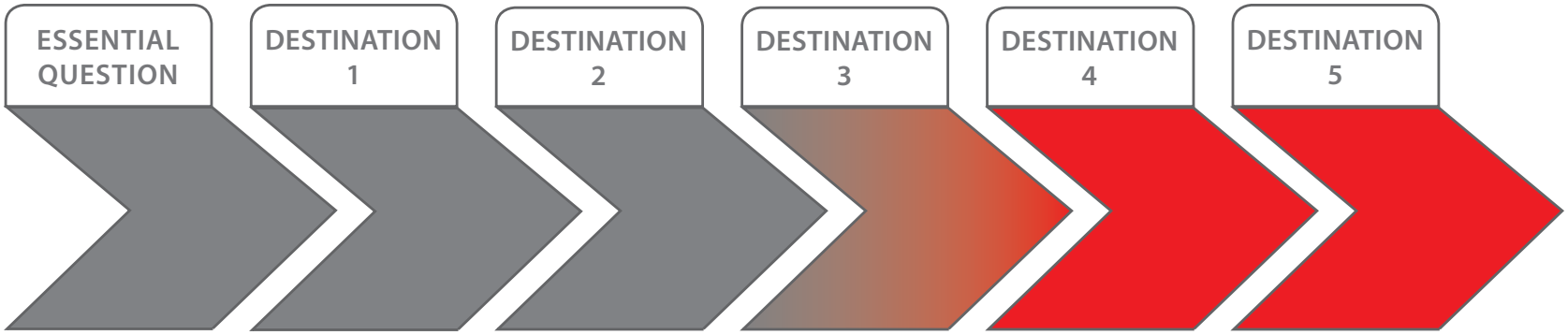
Fundamental to the *Expeditions* learning process are the 21st-century learning skills of collaboration and teamwork. Students collaborate in pairs and in teams as they seek to answer their Essential Question while recording data in logbooks and data sheets to authenticate their learning.

Expeditions are designed to be tailored to teachers and blend teacher-led instruction with student-directed, collaborative activities. These activities guide student exploration through hands-on discovery and experimentation. Activity resources are delivered in various forms including interactive content, and videos serve to give instruction, relate procedures, teach concepts, and provide opportunities for practice.

Using *Expeditions* as a vehicle, students learn the important processes and proficiencies in mathematics education. This curriculum ensures that teachers can teach and that students will develop the mathematical expertise that will benefit them in college and beyond.

- Designed to help connect mathematical practices to mathematical content
- Incorporates Essential Questions
- Blend teacher-led instruction with student-directed, collaborative activities

SAMPLE MATH *Expedition* – Running Well Thief



ESSENTIAL QUESTION

How should mathematical data be used as evidence to convict a suspect of a crime?

During this *Expedition* you will:

- Conduct experiments by analyzing data and drawing conclusions.
- Graph the results of your experiments.
- Build functions and write equations to represent your functions.

DESTINATION 1

Crime Scene Observations

Tasks/Resources:

- Create an initial theory.

DESTINATION 2

Blood Spatter Analysis

Tasks/Resources:

- Conduct a blood spatter experiment.
- Analyze blood spatter data.
- Develop blood spatter conclusion.

DESTINATION 3

Shoe Print Analysis

Tasks/Resources:

- Gather shoe length vs height data.
- Analyze shoe length data.
- Develop shoe print conclusion.

DESTINATION 4

Gathering Cooling Evidence

Tasks/Resources:

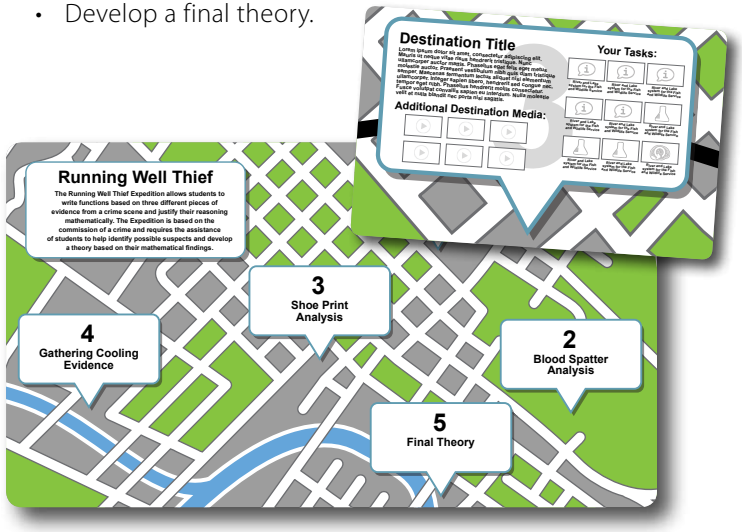
- Perform coffee-cooling experiment.
- Analyze coffee-cooling rates.
- Develop a cooling curve conclusion.

DESTINATION 5

Final Theory

Tasks/Resources:

- Develop a final theory.



Big City Growth

In *Big City Growth*, students analyze data concerning population growth and available resources for a fictional city. They create and graph functions from the data and determine points of intersection. Students use their results to evaluate a potential decision to relocate to a new city.

STANDARDS

- **HSF.LE.A.1** Distinguish between situations that can be modeled with linear functions and with exponential functions.
- **HSF.LE.A.2** Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of the relationship, or two input-output pairs (including reading these from a table).
- **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.

ESSENTIAL QUESTION

How do population growth, employment growth, and resource availability affect people's decisions in relocating to an urban setting?

Building with Patterns

In *Building with Patterns*, students examine patterns used to build and design tetrahedron and box kites. The patterns include both physical and economic models that are associated with building both styles of kites. Students build a base model and then expand the model to more complex arrangements. Using function notation, evaluating functions, interpreting functions, and recognizing sequences, the students make recommendations to a potential investor who wants to buy a kite company.

STANDARDS

- **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.
- **HSF.IF.A.3** Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. *For example, the Fibonacci sequence is defined recursively by f(0) = f(1) = 1, f(n+1) = f(n) + f(n-1) for n ≥ 1.*

ESSENTIAL QUESTION

How can functions help investors make wise decisions?

Built to Last

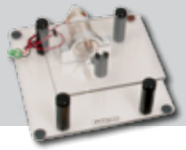
In *Built to Last*, students work as chief engineers of a high-rise construction project that is having to make adjustments to the project due to earthquake concerns. They use arithmetic and geometric sequences in table, function, and graphic forms to make projections about costs and earthquake safety. They construct tower models and test them using the myQuake test table to identify wavelengths that create resonance in the structures and then use the arithmetic and geometric sequences to propose solutions and analyze the impacts of those solutions to the budget of the project. They propose a solution and justify their choice using mathematical evidence they have collected.

STANDARDS

- **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.*
- **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).
- **HSF.LE.B.5** Interpret the parameters in a linear or exponential function in terms of a context.

ESSENTIAL QUESTION

What ways can math be used to predict how best to maintain safety while minimizing costs in building construction?



Bungee Plunge!

In *Bungee Plunge!*, students compete as designers of bungee cords using rubber band chains as their bungee cords. The students create three bungee cords: one that will allow for the fewest measurable bounces of a mass, one that will allow for the greatest number of measurable bounces of a mass, and one that will allow for a mass to come closest to the ground without any part of the mass touching the ground. To create the best design in each category, the students conduct a series of tests on several types of rubber bands. Then, they graph and analyze their data to determine any linear or exponential relationships.

STANDARDS

- **HSF.LE.A.1** Distinguish between situations that can be modeled with linear functions and with exponential functions.
- **HSF.LE.A.1.A** Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals.
- **HSF.LE.A.1.B** Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.
- **HSF-LE.A.1.C** Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.

ESSENTIAL QUESTION

What can make a regular bungee jump even more exciting?

Classroom Dragsters

In *Classroom Dragsters*, students design a competitive and fair dragster competition. Throughout the *Expedition*, students use measurement and units to guide them as they decide on rules for the competition, what kind of design specifications or constraints to place on the dragsters, how winners will be determined, and how race results will be communicated. Several experiments with the AP Mini Dragster and its launch system are conducted. Students use the data from these experiments to determine appropriate units for measurement and use dimensional analysis to convert units from one measurement system to another. Students also investigate the roles that accuracy and precision play in making the competition fair for all participants.

STANDARDS

- **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.
- **HSN.Q.A.2** Define appropriate quantities for the purpose of descriptive modeling.
- **HSN.Q.A.3** Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

ESSENTIAL QUESTION

What factors contribute to the design of a competitive, yet fair, competition?

Coaster Motion

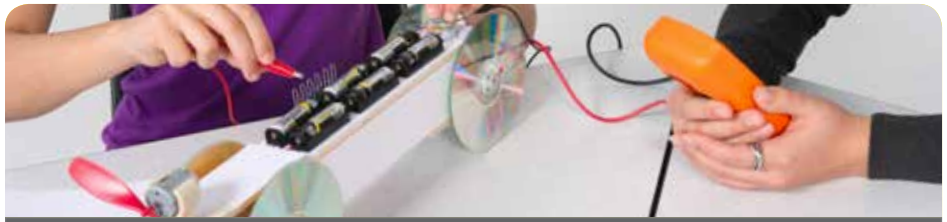
In *Coaster Motion*, students use systems of equations for various situations involving the energy of a roller coaster and the components to designing, building, and maintaining a roller coaster. Students have the opportunity to design and construct a final roller coaster model based on smaller experiments and energy calculations.

STANDARDS

- **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.
- **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.
- **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.

ESSENTIAL QUESTION

What are some important factors roller coaster engineers need to consider when designing a new roller coaster, and why are these factors important?

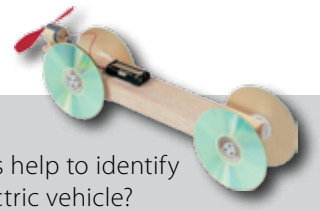


Electroprop Rally

In *Electroprop Rally*, students learn how to rearrange formulas to highlight a quantity of interest and solve the equations, explaining and justifying each step as they solve them. Students use the Ohm's law formula for resistance, current, and voltage as well as the distance formula. Students are asked to act as technicians on a racing team that uses electrical motors to power their vehicle. They are asked by members of the racing team to apply mathematical properties to rearrange the formulas that apply to a situation to examine different values of interest.

STANDARDS

- **HSA.CED.A.4** Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. *For example, rearrange Ohm's law V = IR to highlight resistance R.*
- **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.
- **HSA.REI.B.3** Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.



ESSENTIAL QUESTION

How does rearranging electrical properties formulas help to identify which variables improve the performance of an electric vehicle?

Extreme Slopes

In *Extreme Slopes,* students work as math modelers on a design team working to build a new waterslide, the Challenger Deep, for a water park. They use transformations of linear, quadratic, and exponential functions to create mathematical models using an interactive graph of the waterslide and then build and test real-world models. Finally, they use data they have collected to justify a recommendation for the final waterslide design.

STANDARDS

- **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. Include recognizing even and odd functions from their graphs and algebraic expressions for them.

ESSENTIAL QUESTION

What role does math play in designing a waterslide?

Graphic Racing

In *Graphic Racing*, students build a Fold-N-Roll vehicle and use it to compete in a bracket-style drag-racing competition. In bracket racing, students predict their E.T., or elapsed time, for completing the course, and the student who is closest to his or her prediction is declared the winner. In order to make an accurate prediction, students gather data about their vehicle by conducting experiments. The data from these experiments is analyzed by graphing equations that relate their vehicle's distance, time, velocity, and acceleration. The graphs of these equations enable students to make accurate time predictions for drag races of any length.

STANDARDS

- **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).

ESSENTIAL QUESTION

How can the motion of a vehicle be predicted?

Inventor's Workshop

In *Inventor's Workshop*, students are given the opportunity to invent a product and have their invention funded by a group of fictional investors. Using the Invention Explore-A-Pak, they are challenged to design a product that will be useful in the real world. Students perform cost analyses for materials and labor, explore projected revenue and profit options, and determine the best sales price and production schedule for their product. They present this information to their investors in a business plan. Students represent key elements of the business plan with equations and expressions as well as written explanations and descriptions.

STANDARDS

- **HSA.SSE.A.1** Interpret expressions that represent a quantity in terms of its context.
- **HSA.SSE.A.1.A** Interpret parts of an expression, such as terms, factors, and coefficients.
- **HSA.SSE.A.1.B** Interpret complicated expressions by viewing one or more of their parts as a single entity. *For example, interpret $P(1+r)^n$ as the product of P and a factor not depending on P.*
- **HSA.CED.A.1** Create equations and inequalities in one variable and use them to solve problems. *Include equations arising from linear and quadratic functions, and simple rational and exponential functions*
- **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.
- **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. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.*

ESSENTIAL QUESTION

How do costs impact the profitability of a product's design?

Package Delivery

In *Package Delivery,* students work as packaging engineers to design and build boxes for various clients. Students must consider each client's packaging needs and use a Super Boxmaker to design a box that meets those needs. After a prototype box is developed, students use functions and rates to analyze the costs of production. Production costs depend on the volume and surface area of the box, which must be calculated, as well as design factors such as the number of folds and the complexity of the box. After costs are determined, students analyze and graph linear functions to determine potential revenue and profit for each client.

STANDARDS

- **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. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.**
- **HSF.IF.B.5** Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.**
- **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.

ESSENTIAL QUESTION

What are the most important design considerations when engineering a package?

Projectile Isle

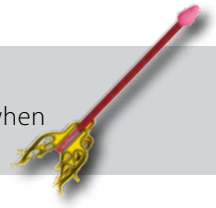
In *Projectile Isle,* students use quadratic equations to model and predict the trajectories of straw rockets. Students graph quadratic equations including the axis of symmetry and the vertex of parabolas. To win the game, students must solve quadratic equations by graphing and using the quadratic formula to correctly predict where their straw rockets will land.

STANDARDS

- **HSA.REI.B.4.B** 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.
- **HSF.IF.C.7.A** Graph linear and quadratic functions and show intercepts, maxima, and minima.

ESSENTIAL QUESTION

How can you predict the path that a projectile will follow when launched into the air?



Pulley Power

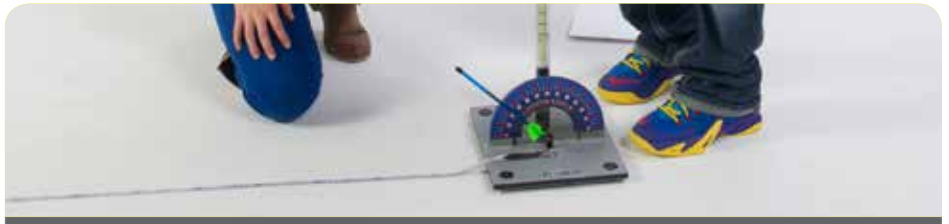
In *Pulley Power,* students experiment with pulley systems and gather data to understand relationships between the load, the effort force required to lift the load, the number of pulleys used in the system, and the mechanical advantage of the system. Students graph their experimental data and write mathematical functions that describe these relationships. For each function they create, students interpret the domain and range and evaluate each function for specific inputs of the domain. Finally, students use their functions to predict the behavior of more advanced pulley systems and then conduct experiments with those systems to prove or disprove their predictions.

STANDARDS

- **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 $y = f(x)$.
- **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.
- **HSF.BF.A.1** Write a function that describes a relationship between two quantities.*
- **HSF.IF.A.2.A** Determine an explicit expression, a recursive process, or steps for calculation from a context.

ESSENTIAL QUESTION

How do pulley systems make lifting heavy loads easier?



Rocket Explorer

In *Rocket Explorer,* students work as part of a rocket design team to analyze the accuracy and precision of the tools they use to model rocket launches. Students utilize a Straw Rocket Launcher to gather model rocket launch data and then represent that data visually with dot plots, histograms, and box plots. Students also determine statistical measures of center for their data and use these measures to compare data sets. Using their data, students explore the concepts of accuracy and precision and then recommend launch settings that prove to be the most reliable for launching a model rocket.

STANDARDS

- **HSS.ID.A.1** Represent data with plots on the real number line (dot plots, histograms, and box plots).
- **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.

ESSENTIAL QUESTION

What roles do accuracy and precision play in launching a rocket?

Running Well Thief

In *Running Well Thief*, students write functions based on three different pieces of evidence from a crime scene and justify their reasoning mathematically. This *Expedition* is based on the commission of a crime and requires the assistance of students to help identify possible suspects and develop a theory based on their mathematical findings.

STANDARDS

- **HSF.BF.A.1** Write a function that describes a relationship between two quantities.

ESSENTIAL QUESTION

How should mathematical data be used as evidence to convict a suspect of a crime?

Solar Power

In *Solar Power,* students investigate relationships of different electric characteristics in circuits. They experiment with solar panels to see which configurations work best for given situations. Collected data is used to graph square root and piecewise-defined functions in a real-world context. The students apply their learning to different scenarios and justify their decisions based on comparing data represented in different ways.

STANDARDS

- **HSF.IF.C.9** Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.*
- **HSF.IF.C.7.B** Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.

ESSENTIAL QUESTION

How can solar panels be used to power electric equipment?

The Art of Coaching

In *The Art of Coaching*, students analyze data distributions for the best techniques to use when coaching others and design a game based on data gathered from activities in different Destinations throughout the *Expedition*. Students have the opportunity to look at collected data and explain the reasoning for their decisions.

STANDARDS

- **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).

ESSENTIAL QUESTION

What is the best strategy for teaching techniques to others?

Tractor Pull

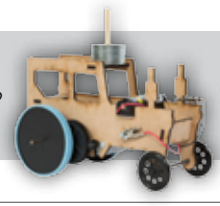
In *Tractor Pull,* students test the speed and pulling power of tractors with different gear ratios. Linear, quadratic, and exponential functions are presented in different ways by the students as they collect and analyze their data. They recommend the purchase of a tractor, predict the outcome of a pulling competition, and design the ideal tractor using data to justify their choices.

STANDARDS

- **HSF.IF.C.9** Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.*

ESSENTIAL QUESTION

How can functions be used to predict a tractor's performance?



Tuned in to Exponents

In *Tuned in to Exponents*, students learn how expressions with rational exponents can be used in the real world. Properties of exponents are discussed, practiced, and applied. Although different real-world uses will be mentioned, the focus for this *Expedition* is the use of rational exponents to calculate frequency of musical notes. Students take a journey into the lab of an instrument designer and inventor. An assistant works with the students to learn, practice, and apply properties of exponents using a basic musical instrument.

STANDARDS

- **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. *For example, we define $5^{1/3}$ to be the cube root of 5 because we want $(5^{1/3})^3 = 5^{(1/3)^3}$ to hold, so $(5^{1/3})^3$ must equal 5.*
- **HSN.RN.A.2** Rewrite expressions involving radicals and rational exponents using the properties of exponents.

ESSENTIAL QUESTION

How do exponential expressions influence music instrument development?

Water Inequality

In *Water Inequality*, students complete a mock internship with a water quality testing company. During the internship, they conduct multiple water quality tests and represent the results of the tests with mathematical inequalities. Students create inequalities in one and two variables and represent these inequalities on number lines and coordinate planes.

STANDARDS

- **HSA.CED.A.1** Create equations and inequalities in one variable and use them to solve problems. *Include equations arising from linear and quadratic functions, and simple rational and exponential functions.*
- **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.

ESSENTIAL QUESTION

How safe is the water that we use for recreation?

Sample Algebra 1 *Expedition* Progression

Expedition	Standards
Inventor's Workshop	**HSA.SSE.A.1** Interpret expressions that represent a quantity in terms of its context. **HSA.SSE.A.1.A** Interpret parts of an expression, such as terms, factors, and coefficients. **HSA.SSE.A.1.B** Interpret complicated expressions by viewing one or more of their parts as a single entity. *For example, interpret $P(1+r)^n$ as the product of P and a factor not depending on P.* **HSA.CED.A.1** Create equations and inequalities in one variable and use them to solve problems. *Include equations arising from linear and quadratic functions, and simple rational and exponential functions.* **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. **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. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.*
Electroprop Rally	**HSA.CED.A.4** Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. *For example, rearrange Ohm's law V = IR to highlight resistance R.* **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. **HSA.REI.B.3** Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.
Classroom Dragsters	**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. **HSN.Q.A.2** Define appropriate quantities for the purpose of descriptive modeling. **HSN.Q.A.3** Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
Pulley Power	**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*). **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. **HSF.BF.A.1** Write a function that describes a relationship between two quantities.* **HSF.IF.A.2.A** Determine an explicit expression, a recursive process, or steps for calculation from a context.
Building with Patterns	**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. **HSF.IF.A.3** Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. *For example, the Fibonacci sequence is defined recursively by f(0) = f(1) = 1, f(n+1) = f(n) + f(n-1) for n ≥ 1.*
Running Well Thief	**HSF.BF.A.1** Write a function that describes a relationship between two quantities.*

Modeling is best interpreted not as a collection of isolated topics but rather in relation to other standards. Making mathematical models is a Standard for Mathematical Practice, and specific modeling standards appear throughout the high school standards indicated by a star symbol (*).

Sample Algebra 1 *Expedition* Progression

Expedition	Standards
Graphic Racing	**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).
Water Inequality	**HSA.CED.A.1** Create equations and inequalities in one variable and use them to solve problems. *Include equations arising from linear and quadratic functions, and simple rational and exponential functions.* **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.
Coaster Motion	**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. **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. **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.
Tuned in to Exponents	**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. *For example, we define $5^{1/3}$ to be the cube root of 5 because we want $(5^{1/3})^3 = 5^{(1/3)3}$ to hold so $(5^{1/3})^3$ must equal 5.* **HSN.RN.A.2** Rewrite expressions involving radicals and rational exponents using the properties of exponents.
Bungee Plunge!	**HSF.LE.A.1** Distinguish between situations that can be modeled with linear functions and with exponential functions. **HSF.LE.A.1.A** Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals. **HSF.LE.A.1.B** Recognize situations in which one quantity changes at a constant rate per unit interval relative to another. **HSF.LE.A.1.C** Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.
Big City Growth	**HSF.LE.A.1** Distinguish between situations that can be modeled with linear functions and with exponential functions. **HSF.LE.A.2** Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of the relationship, or two input-output pairs (including reading these from a table). **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.

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Sample Algebra 1 *Expedition* Progression

Expedition	Standards
Built to Last	**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.* **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). **HSF.LE.B.5** Interpret the parameters in a linear or exponential function in terms of a context.
Extreme Slopes	**HSF.BF.B.3** Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $k\,f(x)$, $f(kx)$, 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. Include recognizing even and odd functions from their graphs and algebraic expressions for them.
Projectile Isle	**HSA.REI.B.4.B** 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. **HSF.IF.C.7.A** Graph linear and quadratic functions and show intercepts, maxima, and minima.
Tractor Pull	**HSF.IF.C.9** Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.*
Solar Power	**HSF.IF.C.9** Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.* **HSF.IF.C.7.B** Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.
Package Delivery	**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. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.** **HSF.IF.B.5** Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.** **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.
Rocket Explorer	**HSS.ID.A.1** Represent data with plots on the real number line (dot plots, histograms, and box plots). **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.
The Art of Coaching	**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).

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Collaborative Learning

An overarching goal of Pitsco Education's Algebra Readiness project-based curriculum is for students to become responsible learners and work cooperatively with others. The student-directed curriculum strengthens the students' ability to think and reason, communicate and interpret the mathematical concepts they encounter, and develop more powerful ways of identifying and expressing insights. The hands-on projects they share in common ultimately promote positive communication, teamwork, inquiry, learning, and social skills and more effectively develop their ability to formulate ideas and solve complex problems. Moreover, every student's unique learning style is accommodated in the project-based curriculum. The Algebra Readiness courses ensure student success through a combination of text, graphics, video instruction, and experiential learning activities. Each curriculum title has been meticulously developed to meet individual state and Common Core State Standards with a heavy emphasis on depth over breadth, giving students highly interconnected learning experiences in core mathematical concepts.

- Promotes teamwork and builds communication skills
- Accommodates multiple learning styles
- Enables student-directed learning

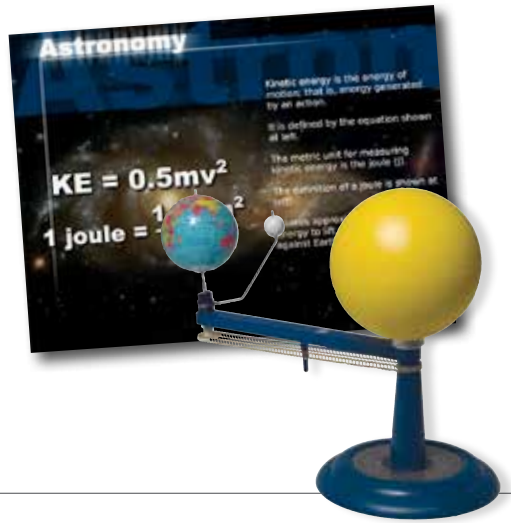
Math Concepts	Astronomy	BioEngineering	Chemical Math	Confident Consumer	Environmental Math	Forensic Math	Geometric Packing	Home Makeover	Hotel Management	Laser Geometry	Properties of Math	Statistical Analysis	Water Management	Weights & Measures
Absolute Value		•									•			
Angles and Triangles		•			•		•			•				
Area, Volume, and Geometric Shapes	•			•	•		•	•		•			•	
Coordinate Geometry						•	•			•	•			
Consumer Applications							•							
Equivalency and Congruency					•		•			•				
Exponents and Scientific Notation	•									•	•			
Fractions				•		•		•	•					•
Functions and Relations			•			•								
Inequalities			•											
Operations on Real Numbers	•			•	•	•	•	•	•	•	•		•	•
Percents, Ratios, Proportions, and Scaling	•		•	•		•	•	•	•	•				•
Probability												•		
Properties of Real Numbers	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Slope					•	•	•			•				
Solving and Graphing Linear Equations			•			•				•				
Solving Single-step and Multistep Equations			•		•	•	•		•	•	•		•	•
Square Roots and Pythagorean Theorem					•		•	•		•				
Subsets of Real Numbers				•	•						•			
Statistics and Data Representation						•						•	•	
Systems of Measurement	•					•								•
Theory of Numbers							•			•	•			
Translations, Rotations, Reflections, and Tessellations							•			•				

Astronomy

In *Astronomy*, students investigate the Sun-Moon-Earth system and their relationship to it. They use models to demonstrate day-night cycles, time zones, eclipses, seasons, tides, and Moon phases. They consider planetary motion, including elliptical orbits, gravity, and Kepler's laws. In addition, they explore the solar system, categorizing the planets by size, type, and general characteristics and creating a scale model of planetary distances. They assemble and use a small refracting telescope and calculate magnification based on focal length. Also, they learn methods for expressing the vast distances in space using scientific notation.

MATH OBJECTIVES

- Determine arcs and circumference
- Create a scale model
- Estimate using scientific notation
- Multiply decimals
- Measure angles
- Order and round decimals



BioEngineering

In *BioEngineering,* students explore topics related to kinesiology and sports performance. They measure the body angles and range of motion (ROM) of selected joints to explore the mathematics behind projectile motion. Students cover mathematical concepts including identifying and measuring angles; averaging positive and negative integers; data collection; graphing; and converting fractions, decimals, and percentages. Then, they perform flexibility tests, take digital images of the tests, and use the computer to analyze student flexibility.

MATH OBJECTIVES

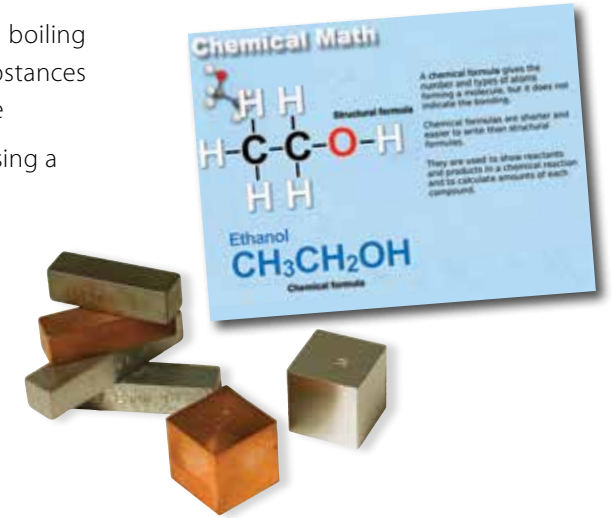
- Practice absolute value, number lines, and positive and negative numbers
- Identify characteristics and types of angles and measure angles with a protractor
- Learn and demonstrate the characteristics of projectile motion
- Measure and classify angles using a digital camera and imaging software
- Relate types of angles to body movement and athletic performance
- Gather, graph, and interpret ROM data to determine personal flexibility

Chemical Math

Chemical Math covers basic chemical concepts such as properties of matter, structure of atoms and molecules, bonding, chemical equations, and the mole concept, all from a mathematical point of view. Students learn types of mathematical expressions, how to translate word descriptions of a process into an equation, and how to solve both single-step and multistep equations. They balance chemical equations and learn to recognize and graph inequalities.

MATH OBJECTIVES

- Translate algebraic expressions from words to symbols
- Define expressions
- Solve multistep equations
- Use inverse operations
- Solve inequalities
- Locate freezing and boiling points for given substances using a number line
- Calculate density using a simple equation



Confident Consumer

In *Confident Consumer,* students use problem-solving techniques to complete activities related to consumer education. Students calculate unit prices, evaluate sales and discounts provided by vendors, calculate the most economical way to purchase food and drinks for a party of 25, evaluate products based on strength and absorbency, and much more. Percents, ratios, and proportions are used extensively throughout this curriculum title.

MATH OBJECTIVES

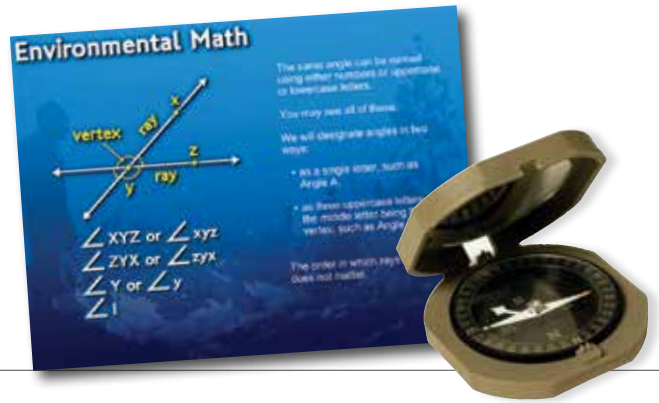
- Use ratios to solve problems
- Compute percentage rates
- Calculate area
- Compare total cost
- Calculate unit price
- Calculate the better buy
- Multiply and divide decimals

Environmental Math

In *Environmental Math,* students explore the many uses of geometry in the study and measurement of the environment. They use squares and square roots as they determine dimensions and areas of study plots and natural areas. They learn to use triangulation to measure distances, heights, and depths while exploring concepts such as types of triangles, the Pythagorean Theorem, and the Distance Formula. Students relate linear functions and slope to environmental factors such as rates of runoff and erosion.

MATH OBJECTIVES

- Estimate and calculate square roots
- Identify rational and irrational numbers
- Identify angle type and measure angles
- Identify triangles and measure the angles
- Use the Pythagorean Theorem to determine the hypotenuse
- Determine the length of a side of special right triangles
- Find the distance between two points on a coordinate plane

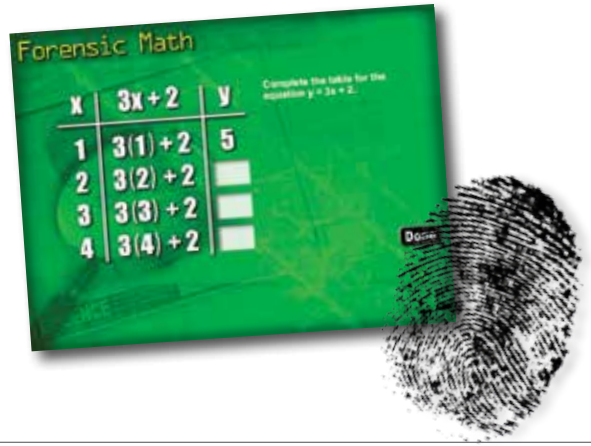


Forensic Math

In *Forensic Math,* students discover the "numbers" behind crime scene investigation. They use algebra in determining the approximate height of both suspects and victims, in calculating the turning diameter of a vehicle, and in computing the velocity of a car. Students use the concepts of slope, y-intercept, functions, and equations to complete a crime scene data analysis.

MATH OBJECTIVES

- Define a function
- Learn about polar and Cartesian coordinates
- Use the vertical line test to determine if the relation is a function
- Solve linear equations with two variables
- Graph linear equations
- Define slope and be able to find the slope of a line
- Define y-intercept

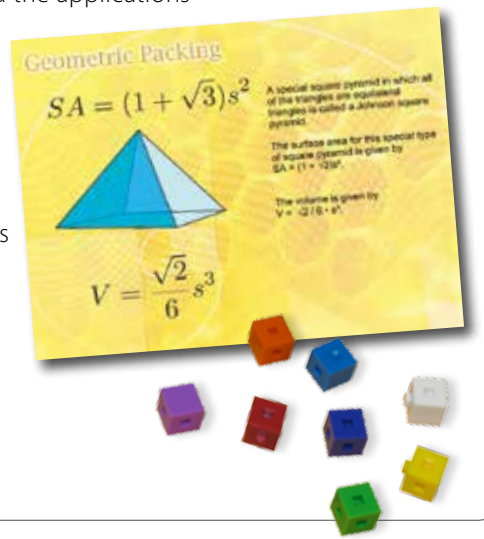


Geometric Packing

In *Geometric Packing,* students explore surface areas and volumes of various objects by packing materials. They explore spatial relationships and tessellations by transformations and the use of mathematical software. Students are introduced to the concept of slope, have tactile explorations of spherical packing, and find applications of Pascal's Triangle. They use the Fibonacci sequence to understand the greatest common divisor and the least common multiple. Finally, they investigate mathematical history by using ancient Egyptian algebra to find the golden ratio and explore the Pythagorean Theorem by building a scale replica of the Pyramid of Giza.

MATH OBJECTIVES

- Discover surface areas and volumes of three-dimensional objects
- Create tessellations by the use of rotations, reflections, and translations
- Investigate spherical packing and the applications of Pascal's Triangle in packing
- Use the golden ratio, greatest common divisor, and least common multiple to understand architecture and designs
- Utilize ancient Egyptian mathematics to explore the golden ratio and the Pythagorean Theorem



Home Makeover

When students complete *Home Makeover,* they will have an understanding of how to preplan for remodeling a home. Students design an addition to a home by calculating area, selecting materials, and computing overall costs. Students determine square feet, square yards, and the volume of a cylinder as they relate to homes and home remodeling. This curriculum title enables students to study many of the concepts used by those who remodel professionally.

MATH OBJECTIVES

- Determine the area of a rectangle, triangle, and circle
- Determine circumference, diameter, and radius
- Determine the surface area of a rectangular prism and a cylinder
- Use the Distributive Property
- Create scale drawings

Hotel Management

In *Hotel Management,* students trace the earliest types of lodging establishments in America. They explore the day-to-day responsibilities of running a hotel and examine the following hotel areas: front desk, hotel accounting, housekeeping, engineering and maintenance, and hotel security. They learn that each component is necessary to successfully run a hotel. Students utilize math skills by calculating occupancy rates, RevPAR, ADR, room rates, and room discounts. Students use percentages, decimals, ratios, and proportions.

MATH OBJECTIVES

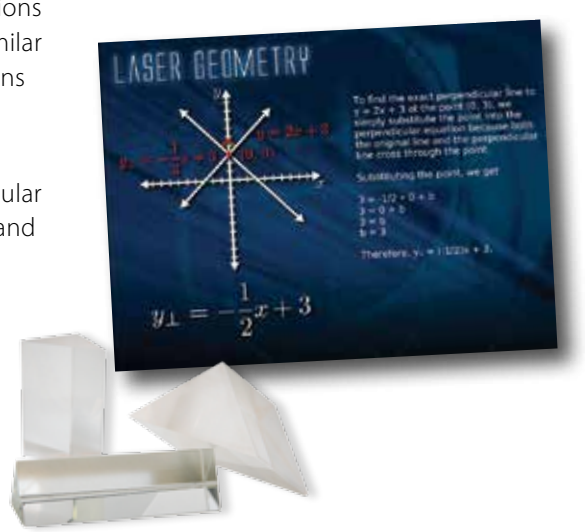
- Use and simplify ratios of costs
- Solve proportions related to room rates within a hotel
- Determine unit rate of rooms
- Convert decimals, fractions, and percentages
- Determine the discount price on room charges

Laser Geometry

In *Laser Geometry,* students use algebra and geometry to explore different mathematical concepts including exponents, scientific notation, angles, and waves. Students conduct experiments to investigate interior and exterior angles; Heisenberg's Uncertainty Principle; and transverse, longitudinal, and surface waves. Finally, they explore degrees of angles by using a game controller to create an inexpensive, interactive whiteboard and by manipulating the direction of laser beams to piggyback a radio signal to a receiver.

MATH OBJECTIVES

- Investigate types and properties of angles and triangles
- Relate angle properties to parallel and perpendicular lines
- Use exponents and scientific notation to represent numbers
- Use and solve proportions in order to discover similar and congruent polygons
- Use a compass and straightedge to create parallel and perpendicular lines, create triangles, and bisect angles

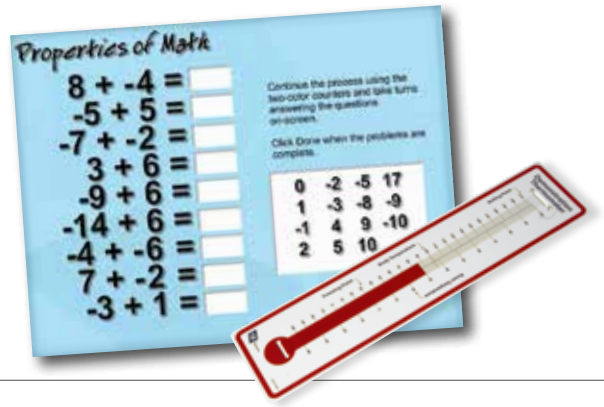


Properties of Math

In *Properties of Math,* students first build the number system from the ground up by exploring set theory and using tiles to explore the density of the real numbers. They are then introduced to the order of operations and properties and ordering of rational numbers through a series of explorations using activities on mathematical software. Students learn relationships between prime factorizations and quotients of integers while relating all ideas to the rational number system. Finally, all concepts are brought together by solving problems using multistep operations.

MATH OBJECTIVES

- Classify each subset of the complex numbers using sets and set notation
- Order integers and rational numbers and explore the density of the real numbers
- Discover operations using real numbers
- Use the greatest common divisor and the least common multiple
- Explore prime factorizations
- Use the order of operations to solve single- and multistep problems



Statistical Analysis

While engaged in *Statistical Analysis,* students create and conduct a survey and graph their data. They learn to calculate measures of central tendency and range. Students explore histograms, box-and-whisker plots, stem-and-leaf plots, bar graphs, circle graphs, and line graphs and use them to display statistical information. Students also complete probability activities ranging from tossing two-color counters and rolling dice to generating and using Pascal's Triangle to calculate experimental and theoretical probabilities. Students use their knowledge of probability to create a fair game.

MATH OBJECTIVES

- Create bar graphs
- Work with line and circle graphs
- Determine independent and dependent events
- Calculate the mean, median, and mode
- Calculate experimental and theoretical probability
- Create a histogram
- Create a stem-and-leaf plot

Water Management

In *Water Management,* students explore the hydrologic cycle, uses of water, types of water pollution, and the design and function of water treatment plants. They use a River Tank to estimate surface area and volume of water in a water body and to calculate flow rate. They use a watershed model to simulate runoff, groundwater activity, and pollution. Students calculate a water budget for a family and use a variety of graphs. They also consider methods of water conservation.

MATH OBJECTIVES

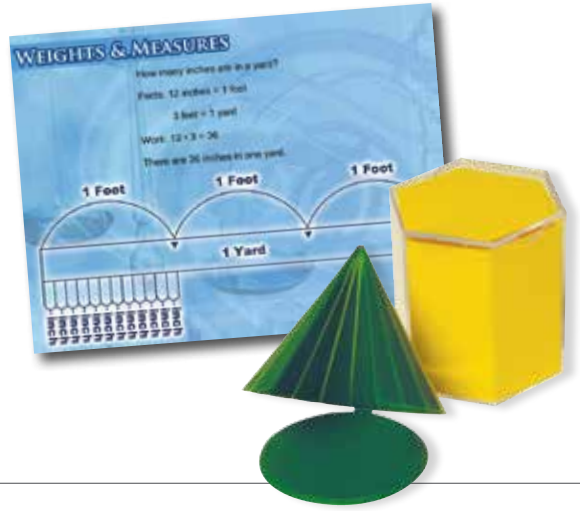
- Identify polygons and polyhedrons
- Determine surface area
- Calculate volume
- Solve equations using formulas
- Create a scatter plot and bar, circle, and line graphs

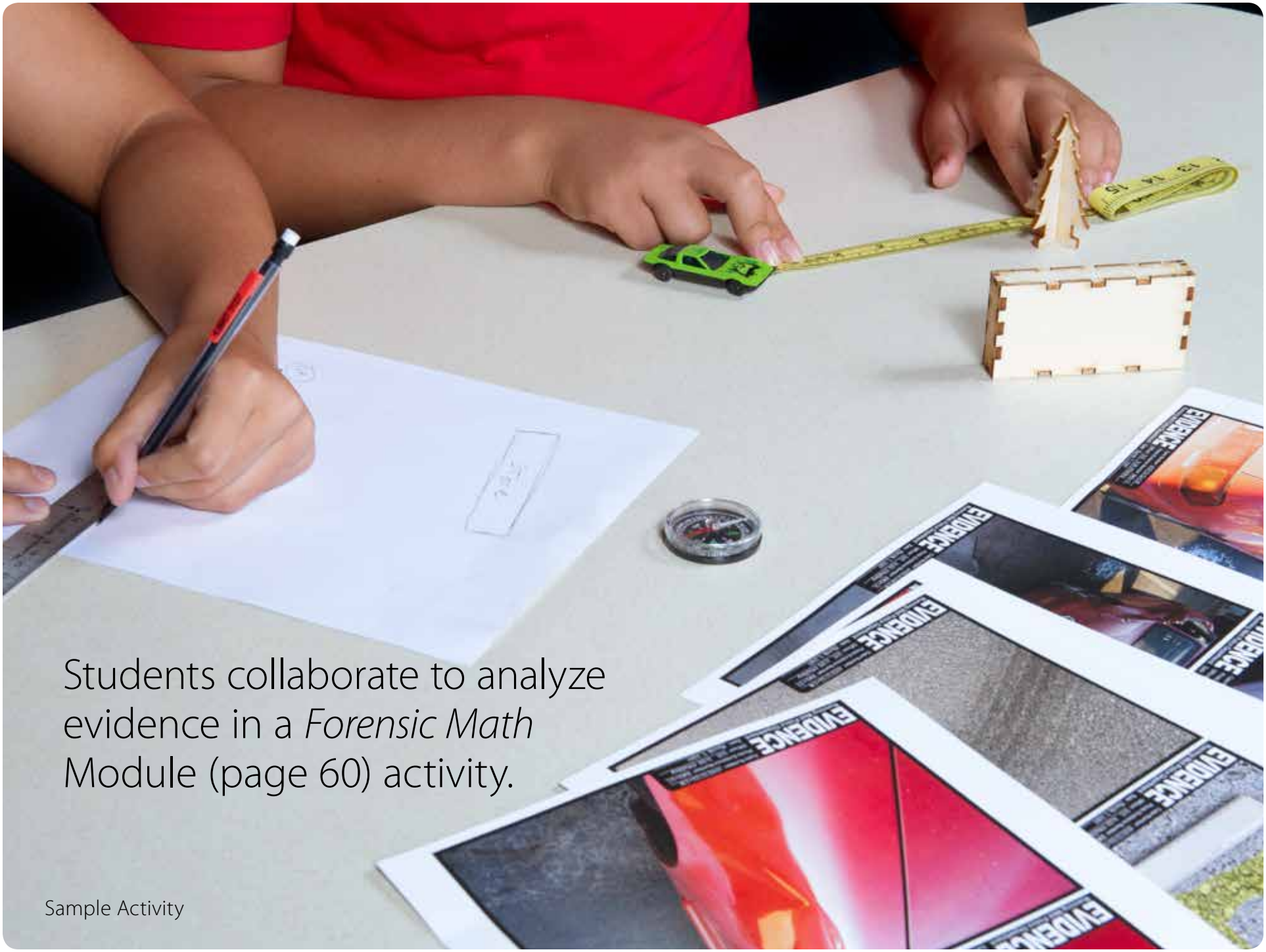
Weights & Measures

In *Weights & Measures,* students get a variety of hands-on experiences measuring and weighing items using customary and metric measurement. They practice converting measurement within a system and then learn to use dimensional analysis to convert from one measurement system to another. Using a formula, they learn to convert temperature from one system to another.

MATH OBJECTIVES

- Measure items using standard and metric measurement
- Weigh items using standard and metric measurement
- Convert standard and metric units
- Use dimensional analysis to convert metric units to customary units and vice versa





Students collaborate to analyze evidence in a *Forensic Math* Module (page 60) activity.

Sample Activity

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