

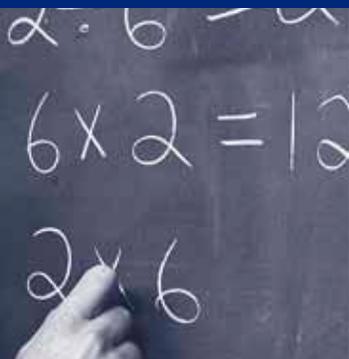
Core Knowledge Sequence

Content and Skill Guidelines for Grades K–8



Core Knowledge[®]

Teachers: Mathematics has its own vocabulary and patterns of thinking. It is a discipline with its own language and conventions. Thus, while some lessons may offer occasional opportunities for linking mathematics to other disciplines, it is critically important to attend to math as math. From the earliest years, mathematics requires incremental review and steady practice: not only the diligent effort required to master basic facts and operations, but also thoughtful and varied practice that approaches problems from a variety of angles, and gives children a variety of opportunities to apply the same concept or operation in different types of situations. While it is important to work toward the development of “higher-order problem-solving skills,” it is equally important—indeed, it is prerequisite to achieving “higher order” skills—to have a sound grasp of basic facts, and an automatic fluency with fundamental operations.



I. Numbers and Number Sense

- Read and write numbers (in digits and words) up to the trillions.
- Recognize place value up to hundred-billions.
- Integers (review):
 - Locate positive and negative integers on a number line.
 - Compare integers using $<$, $>$, $=$.
 - Know that the sum of an integer and its opposite is 0.
 - Add and subtract positive and negative integers.
- Determine whether a number is a prime number or composite number.
- Round to the nearest ten; to the nearest hundred; to the nearest thousand; to the nearest hundred thousand; to the nearest million.
- Compare and order whole numbers, mixed numbers, fractions, and decimals, using the symbols $<$, $>$, $=$.
- Determine the greatest common factor (GCF) of given numbers.
- Determine the least common multiple (LCM) of given numbers.
- Exponents:
 - Review squares and square roots.
 - Using the terms *squared* and *cubed* and *to the n th power*, read and evaluate numerical expressions with exponents.
 - Review powers of ten.
 - Write numbers in expanded notation using exponents.

Note: See Math 5: Fractions and Decimals; review these topics as needed.

II. Ratio, Percent, and Proportion

A. RATIO AND PROPORTION

- Solve proportions, including word problems involving proportions with one unknown.
- Use ratios and proportions to interpret map scales and scale drawings.
- Set up and solve proportions from similar triangles.
- Understand the justification for solving proportions by cross-multiplication.

B. PERCENT

- Convert between fractions, decimals, and percents.
- Find the given percent of a number, and find what percent a given number is of another number.
- Solve problems involving percent increase and decrease.
- Find an unknown number when a percent of the number is known.
- Use expressions with percents greater than 100% and less than 1%.

III. Computation

A. ADDITION

- Addition, commutative and associative properties: know the names and understand the properties.
Understand addition and subtraction as inverse operations.
Add and subtract with integers, fractions and decimals, both positive and negative.

B. MULTIPLICATION

- Commutative, associative, and distributive properties: know the names and understand the properties.
- Multiply multi-digit factors, with and without a calculator.
- Estimate a product.
- Multiply with integers, fractions, and decimals, both positive and negative.
- Distributive property for multiplication over addition or subtraction, that is, $A \times (B+C)$ or $A \times (B-C)$: understand its use in procedures such as multi-digit multiplication.

C. DIVISION

- Understand multiplication and division as inverse operations.
- Estimate the quotient.
- Divide multi-digit dividends by up to three-digit divisors, with and without a calculator.
- Divide with integers, fractions, or decimals, both positive and negative.

D. SOLVING PROBLEMS AND EQUATIONS

- Solve word problems with multiple steps.
- Solve problems with more than one operation, according to order of operations (with and without a calculator).

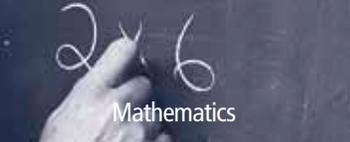
IV. Measurement

Teachers: Students should know all information regarding measurement presented in grades 4 and 5; review and reinforce as necessary.

- Solve problems requiring conversion of units within the U. S. Customary System, and within the metric system.
- Associate prefixes used in metric system with quantities:
kilo = thousand
hecto = hundred
deka = ten
deci = tenth
centi = hundredth
milli = thousandth
- Time: solve problems on elapsed time; express parts of an hour in fraction or decimal form.

V. Geometry

- Identify and use signs that mean
congruent \cong
similar \sim
parallel \parallel
perpendicular \perp
- Construct parallel lines and a parallelogram.
- Construct a perpendicular bisector.
- Know that if two lines are parallel, any line perpendicular to one is also perpendicular to the other; and, that two lines perpendicular to the same line are parallel.



- Angles:
 - Identify and measure the degrees in angles (review terms: right, acute, obtuse, straight).
 - Bisect an angle.
 - Construct an angle congruent to a given angle.
 - Construct a figure congruent to a given figure, using reflection over a line of symmetry, and identify corresponding parts.
 - Show how congruent plane figures can be made to correspond through reflection, rotation, and translation.
- Triangles:
 - Know that the sum of the measures of the angles of a triangle is 180° .
 - Construct different kinds of triangles.
 - Know terms by which we classify kinds of triangles:
 - by length of sides: equilateral, isosceles, scalene
 - by angles: right, acute, obtuse
- Identify congruent angles and sides, and axes of symmetry, in parallelograms, rhombuses, rectangles, and squares.
- Find the area (A) and perimeter (P) of plane figures, or given the area or perimeter find the missing dimension, using the following formulas:
 - rectangle
 - $A = lw$
 - $P = 2(l + w)$
 - square
 - $A = s^2$
 - $P = 4s$
 - triangle
 - $A = \frac{1}{2}bh$
 - $P = s_1 + s_2 + s_3$
 - parallelogram
 - $A = bh$
 - $P = 2(b + s)$
- Circles:
 - Identify arc, chord, radius (plural: radii), and diameter; know that radius = $\frac{1}{2}$ diameter.
 - Using a compass, draw circles with a given diameter or radius.
 - Solve problems involving application of the formulas for finding the circumference of a circle: $C = \pi d$, and $C = 2\pi r$, using 3.14 as the value of π .
 - Find the area of a circle using the formula $A = \pi r^2$
- Find volume of rectangular solids, or given the volume find a missing dimension, using the formulas $V = lwh$, or $V = bh$ (in which b = area of base).

VI. Probability and Statistics

- Find the range and measures of central tendency (mean, median, and mode) of a given set of numbers.
- Understand the differences among the measures of central tendency and when each might be used.
- Understand the use of a sample to estimate a population parameter (such as the mean), and that larger samples provide more stable estimates.
- Represent all possible outcomes of independent compound events in an organized way and determine the theoretical probability of each outcome.
- Compute the probability of any one of a set of disjoint events as the sum of their individual probabilities.
- Solve problems requiring interpretation and application of graphically displayed data.
- Given a set of data, find the mean, median, range, and mode.
- Construct a histogram; a tree diagram.

- Coordinate plane:
 - Plot points on a coordinate plane, using ordered pairs of positive and negative whole numbers.
 - Use the terms *origin* (0,0), *x-axis*, and *y-axis*.
 - Graph simple functions and solve problems involving use of a coordinate plane.

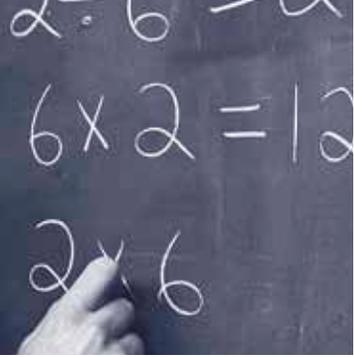
VII. Pre-Algebra

- Recognize uses of variables and solve linear equations in one variable.
- Solve word problems by assigning variables to unknown quantities, writing appropriate equations, and solving them.
- Find the value for an expression, given replacement values for the variables; for example, what is $7/x - y$ when x is 2 and y is 10?
- Simplify expressions with variables by combining like terms.
- Understand the use of the distributive property in variable expressions such as $2x(2y + 3)$.

Teachers: In learning the new concepts and procedures, students should use previously acquired mathematics to ensure that the procedures become automatic and habitual. Students should continue to master the use of measuring and drawing instruments, develop their mental arithmetic and their approximating abilities, become more familiar with deductive reasoning, and use calculators and computers in a thoughtful way.

These guidelines are representative of the mathematics typically learned in grade 7 in countries that have strong math traditions and whose students score well in international comparisons. In the United States, most teachers of middle-school mathematics follow commercial math textbooks which vary in quality. Because teachers are often selective about the parts of the textbooks they teach, the following guidelines may prove useful as an outline by which the teacher can, regardless of the textbook adopted, make sure the competencies taught in their programs are comparable to the competencies of students in the best-achieving systems.

While teaching methods may vary, it is worth keeping in mind the psychological principle that the most effective method for learning mathematics emphasizes frequent, varied practice, and encourages multiple approaches to solving varied types of problems.



I. Pre-Algebra

A. PROPERTIES OF THE REAL NUMBERS

- Know and use the associative, commutative, and distributive properties by name and in simplifying expressions involving numbers and variables.
- Understand absolute value and evaluate expressions such as $|2x - 3| + 3x$.

B. LINEAR APPLICATIONS AND PROPORTIONALITY

- Know the concept of slope.
- Translate situations of proportionality into equations of the form $y = mx$, where m is the constant of proportionality or slope; specifically know and understand $d = rt$ and $i = prt$.
- Show situations of constant proportionality as a line on the coordinate plane.
- Introduce the concept of a function and determine the equation of a linear function given its slope and intercepts in the form $y = mx + b$.
- Estimate the values of b and m from a given linear graph.

C. POLYNOMIAL ARITHMETIC

- Add, subtract, multiply, and divide monomials and polynomials (divide polynomials by monomials only).
- Factor binomials that have a common monomial factor.

D. EQUIVALENT EQUATIONS AND INEQUALITIES

- Review equality properties for equations.
- Know that addition or subtraction of the same value from both sides of an inequality maintains the inequality.
- Know that multiplying or dividing both sides of an inequality by a positive number maintains the inequality, but multiplying or dividing by a negative number reverses the inequality; be able to show why using a number line.
- Simplify and solve linear equations in one variable such as $3(2x - 5) + 4x = 12(x + 5)$.
- Simplify and graph solutions to linear inequalities in one variable such as $3(2x - 5) + 4x \leq 12(x + 5)$.

E. INTEGER EXPONENTS

- Know the meaning of an exponent n when n is positive or negative.
- Know that a non-zero number to the zero power is one.

- Understand why a negative number to an even power is positive and a negative number to odd power is negative.
- Know the multiplication properties of exponents:
Product of powers: $(a^m)(a^n) = a^{(m+n)}$
Power of a power: $(a^m)^n = a^{mn}$
Power of a product: $(ab)^m = (a^m)(b^m)$.
- Convert decimal numbers to and from scientific notation.
- Know the proper order of operations with exponents.

II. Geometry

A. THREE-DIMENSIONAL OBJECTS

- Describe and construct simple right prisms, cylinders, cones, and spheres using the concepts of parallel and perpendicular; calculate the surface areas and volumes of these objects.
- Know that the section created by the intersection of a plane and a sphere is a circle.
- Calculate the surface area of a sphere using the equation $SA = 4 \pi r^2$.
- Calculate the volume of a sphere using the equation $V = (4/3) \pi r^3$.

B. ANGLE PAIRS

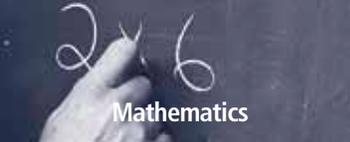
- Construct parallel lines and a transversal using a compass and straight edge.
- Understand congruent angles, vertical angles, complementary angles, supplementary angles, adjacent angles, corresponding angles, and alternate interior and alternate exterior angles.

C. TRIANGLES

- Know that a triangle is determined by its three sides or by two sides and the included angle (SSS and SAS triangle congruence) and solve problems.
- Use SSS to prove that the construction of the bisector of an angle is valid.
- Use SSS to prove that the construction of the perpendicular bisector of a segment is valid.
- Prove that the base angles of an isosceles triangle are congruent.
- Demonstrate that the sum of the interior angles of a triangle equals 180 degrees.
- Know that the shape of a triangle is determined by two (hence all three) of its angles (AA(A) triangle similarity) and solve related problems.
- Construct a circle that circumscribes a triangle using compass and straight edge.
- Know and understand the Pythagorean Theorem and its converse and use it to find the length of the missing side of a right triangle and lengths of other line segments and, in some situations, empirically verify the Pythagorean theorem by direct measurement and a calculator.
- Use the Pythagorean Theorem to determine the exact ratios of the sides in 30-60-right triangles and isosceles right triangles.
- Determine the image of a triangle under translations, rotations, and reflections.

D. MEASUREMENT

- Choose appropriate units of measure and use ratios to convert within and between measurement systems to solve problems.
- Compare weights, capacities, geometric measures, times, and temperatures within and between measurement systems (for example, miles per hour and feet per second, cubic inches to cubic centimeters).
- Use measures expressed as rates (for example, speed, density) and measures expressed as products (for example, person-days) to solve problems; check the units of the solutions; and use dimensional analysis to check the reasonableness of the answer.
- Compute the perimeter, area, and volume of common geometric objects and use the results to find measures of less common objects.
- Know how perimeter, area, and volume are affected by changes of scale.



- Estimate and compute the area of more complex or irregular two- and three-dimensional figures by breaking the figures down into more basic geometric objects.
- Relate the changes in measurement with a change of scale to the units used (for example, square inches, cubic feet) and to conversions between units (1 square foot = 144 square inches or $[1 \text{ ft}^2 = 144 \text{ in}^2]$, 1 cubic inch is approximately 16.38 cubic centimeters $[1 \text{ in}^3 = [16.36 \text{ cm}^3]$).

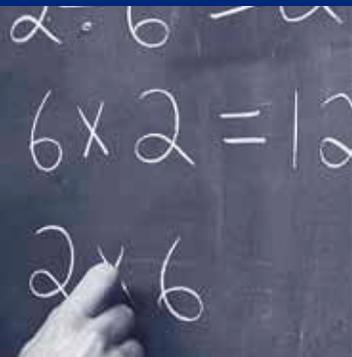
III. Probability and Statistics

- Show the relationship between two variables using a scatter-plot and describe the apparent relationship informally.
- Find the upper and lower quartiles for a data set.
- Understand that if p is the probability of an event occurring, $1 - p$ is the probability of the event not occurring.
- Understand the difference between independent and dependent events.

Teachers: These guidelines are representative of the mathematics typically learned at this grade level in countries that have strong math traditions and whose students score well in international comparisons. Concepts that were in the Grade 7 specifications are generally not repeated here but they are assumed.

In learning the new concepts and procedures, students should use previously acquired mathematics to ensure that the procedures become automatic and habitual. Students should continue to master the use of measuring and drawing instruments, develop their mental arithmetic and their approximating abilities, become more familiar with deductive reasoning, and use calculators and computers in a thoughtful way. The work in eighth grade requires some minimal use of a scientific calculator.

Appropriate preparation for algebra is critical for success in that subject and some students, particularly students who have not been in a Core Knowledge school, may simply not be ready for the content described herein. Most schools will need to spend a limited time reviewing prerequisite concepts, but those students for whom that is insufficient may well require a year in a program that is closer to the Grade 7 specifications.



I. Algebra

A. PROPERTIES OF THE REAL NUMBERS

- Be able to raise a positive number to a fractional power and simplify appropriately, including rationalizing the denominator of a simple radical expression.
- Know and use of the rules of exponents extended to fractional exponents.
- Use the definition of absolute value to solve equations such as $|2x - 3| + 3x = 4x - 2$ and understand why “extraneous solutions” are not solutions at all.

B. RELATIONS, FUNCTIONS, AND GRAPHS (TWO VARIABLES)

- Be able to plot a set of ordered pairs and surmise a reasonable graph of which the points are a part.
- Be able to make a reasonable table of ordered pairs from a given function rule, plot the points, and surmise its graph.
- Know that the points of intersections of two graphs are simultaneous solutions of the relations that define them and indicate approximate numerical solutions.

C. LINEAR EQUATIONS AND FUNCTIONS (TWO VARIABLES)

- Graph linear equations by finding the x- and y-intercepts; for example, know that $2x + 3y = 4$ is linear and graph it using its intercepts.
- Be able to convert between slope-intercept form ($y = mx + b$) and standard form ($ax + by = c$).
- Write an equation for a line given two points or one point and its slope.
- Know lines are parallel or perpendicular from their slopes.
- Find the equation of a line perpendicular to a given line that passes through a given point.
- Understand and be able to graph the solution set of a linear inequality.
- Solve a system of two linear equations in two variables algebraically and interpret the answer graphically.
- Solve a system of two linear inequalities in two variables and sketch the solution set.
- Solve word problems (including mixture, digit, and age problems) that involve linear equations.

D. ARITHMETIC OF RATIONAL EXPRESSION

- Factor second- and higher-degree polynomials when standard techniques apply, such as factoring the GCF out of all terms of a polynomial, the difference of two squares, and perfect squares trinomials.
- Add, subtract, multiply, and divide rational expressions and express in simplest form.

E. QUADRATIC EQUATIONS AND FUNCTIONS

- Solve quadratic equations in one variable by factoring or by completing the square.
- Complete the square to write a quadratic expression as the difference of two squares.
- Graph quadratic functions by completing the square to find the vertex and know that their zeros (roots) are the x-intercepts.
- Know the quadratic formula and be familiar with its proof by completing the square.
- Know how to clear fractions to solve equations that lead to linear or quadratic equations.
- Know how to use squaring to solve problems that lead to linear or quadratic equations.
- Solve word problems, including physical problems such as the motion of an object under the force of gravity, and combined rate (work) problems.

II. Geometry**A. ANALYTIC GEOMETRY**

- Reinforce the knowledge of algebra with geometry and vice versa.
- Know that the midpoint of a line segment of any slope, projected perpendicularly onto the horizontal x-axis or vertical y-axis, will be the midpoint of its projection.
- Know the similar triangles connection (AA Similarity) with slope and that this is the tangent of the angle the line makes with the x-axis.

B. INTRODUCTION TO TRIGONOMETRY

- Know that in a right triangle the cosine of an angle is the ratio of the adjacent side to the hypotenuse and the sine is the ratio of the opposite side to the hypotenuse.
- Know the values of the sine, cosine, and tangent of 0, 30, 45, 60, and 90 degrees and use a scientific calculator to determine the approximate value of any acute angle.
- Use a scientific calculator to determine the approximate value of an acute angle of a given sine, cosine, or tangent.

C. TRIANGLES AND PROOFS

- Prove that the bisector of an angle is the set of all points equidistant from both sides.
- Prove that any triangle inscribed in a circle with one side as the diameter is a right triangle.
- Prove the Pythagorean Theorem.
- Know that a line tangent to a circle is perpendicular to the radius at the point of tangency.
- Taking geometry as a model, understand the concept of a mathematical proof, as distinct from an opinion, an approximation, or a conjecture based on specific cases.
- In geometry and elsewhere, understand that a single-counter example suffices to disprove a general assertion.

| | Fourth Grade | Fifth Grade | Sixth Grade | Seventh Grade | Eighth Grade |
|------------------------------|---|--|--|--|---|
| Language Arts/English | <ul style="list-style-type: none"> I. Writing, Grammar, and Usage II. Poetry III. Fiction IV. Speeches V. Sayings and Phrases | <ul style="list-style-type: none"> I. Writing, Grammar, and Usage II. Poetry III. Fiction and Drama IV. Speeches V. Sayings and Phrases | <ul style="list-style-type: none"> I. Writing, Grammar, and Usage II. Poetry III. Fiction and Drama IV. Sayings and Phrases | <ul style="list-style-type: none"> I. Writing, Grammar, and Usage II. Poetry III. Fiction, Nonfiction, and Drama IV. Foreign Phrases Commonly Used in English | <ul style="list-style-type: none"> I. Writing, Grammar, and Usage II. Poetry III. Fiction, Nonfiction, and Drama IV. Foreign Phrases Commonly Used in English |
| History and Geography | <p>World:</p> <ul style="list-style-type: none"> I. World Geography (Spatial Sense; Mountains) II. Europe in Middle Ages III. The Spread of Islam and the "Holy Wars" IV. Early and Medieval African Kingdoms V. China: Dynasties and Conquerors <p>American</p> <ul style="list-style-type: none"> I. The American Revolution II. Making a Constitutional Government III. Early Presidents and Politics IV. Reformers V. Symbols and Figures | <p>World:</p> <ul style="list-style-type: none"> I. World Geography (Spatial Sense; Lakes) II. Early American Civilizations III. European Exploration, Trade, and the Clash of Cultures IV. The Renaissance and the Reformation V. England from the Golden Age to the Glorious Revolution VI. Russia: Early Growth and Expansion VII. Feudal Japan <p>American</p> <ul style="list-style-type: none"> I. Westward Expansion II. The Civil War: Causes, Conflicts, Consequences III. Native Americans: Cultures and Conflicts IV. U.S. Geography | <p>World:</p> <ul style="list-style-type: none"> I. World Geography (Spatial Sense; Deserts) II. Lasting Ideas from Ancient Civilizations III. The Enlightenment IV. The French Revolution V. Romanticism VI. Industrialism, Capitalism, and Socialism VII. Latin American Independence Movements <p>American</p> <ul style="list-style-type: none"> I. Immigration, Industrialization, and Urbanization II. Reform | <ul style="list-style-type: none"> I. America Becomes a World Power II. World War I: "The Great War," 1914–1918 III. Russian Revolution IV. America from the Twenties to the New Deal V. World War II VI. Geography of United States | <ul style="list-style-type: none"> I. The Decline of European Colonialism II. The Cold War III. The Civil Rights Movement IV. The Vietnam War and the Rise of Social Activism V. The Middle East and Oil Politics VI. The End of the Cold War: The Expansion of Democracy and Continuing Challenges VII. Civics: The Constitution—Principles and Structure of American Democracy VIII. Geography of Canada and Mexico |
| Visual Arts | <ul style="list-style-type: none"> I. Art of the Middle Ages in Europe II. Islamic Art and Architecture III. Art of Africa IV. Art of China V. Art of a New Nation: The United States | <ul style="list-style-type: none"> I. Art of the Renaissance II. American Art: Nineteenth-Century United States III. Art of Japan | <ul style="list-style-type: none"> I. Art History: Periods and Schools (Classical; Gothic; Renaissance; Baroque; Rococo; Neoclassical; Romantic; Realistic) | <ul style="list-style-type: none"> I. Art History: Period and Schools (Impressionism; Post-Impressionism; Expressionism and Abstraction; Modern American Painting) | <ul style="list-style-type: none"> I. Art History: Periods and Schools (Painting Since World War II; Photography; 20th-Century Sculpture) II. Architecture Since the Industrial Revolution |
| Music | <ul style="list-style-type: none"> I. Elements of Music II. Listening and Understanding (Orchestra; Vocal Ranges; Composers) III. Songs | <ul style="list-style-type: none"> I. Elements of Music II. Listening and Understanding (Composers; Connections) III. American Musical Traditions (Spirituals) IV. Songs | <ul style="list-style-type: none"> I. Elements of Music II. Classical Music: From Baroque to Romantic (Bach, Handel, Haydn, Mozart, Beethoven, Schubert, Chopin, Schumann) | <ul style="list-style-type: none"> I. Elements of Music II. Classical Music: Romantics and Nationalists (Brahms, Berlioz, Liszt, Wagner, Dvorak, Grieg, Tchaikovsky) III. American Musical Traditions (Blues and Jazz) | <ul style="list-style-type: none"> I. Elements of Music II. Non-Western Music III. Classical Music: Nationalists and Moderns IV. Vocal Music (Opera; American Musical Theater) |
| Mathematics | <ul style="list-style-type: none"> I. Numbers and Number Sense II. Fractions and Decimals III. Money IV. Computation V. Measurement VI. Geometry | <ul style="list-style-type: none"> I. Numbers and Number Sense II. Ratio and Percent III. Fractions and Decimals IV. Computation V. Measurement VI. Geometry VII. Probability and Statistics VIII. Pre-Algebra | <ul style="list-style-type: none"> I. Numbers and Number Sense II. Ratio, Percent, and Proportion III. Computation IV. Measurement V. Geometry VI. Probability and Statistics VII. Pre-Algebra | <ul style="list-style-type: none"> I. Pre-Algebra (Properties of the Real Numbers; Polynomial Arithmetic; Equivalent Equations and Inequalities; Integer Exponents) II. Geometry (Three-Dimensional Objects; Angle Pairs; Triangles; Measurement) III. Probability and Statistics | <ul style="list-style-type: none"> I. Algebra (Properties of the Real Numbers; Relations, Functions, and Graphs; Linear Equations and Functions; Arithmetic of Rational Expression; Quadratic Equations and Functions) II. Geometry (Analytic Geometry; Introduction to Trigonometry; Triangles and proofs) |
| Science | <ul style="list-style-type: none"> I. Human Body (Circulatory and Respiratory Systems) II. Chemistry: Basic Terms and Concepts III. Electricity IV. Geology: The Earth and Its Changes V. Meteorology VI. Science Biographies | <ul style="list-style-type: none"> I. Classifying Living Things II. Cells: Structures and Processes III. Plant Structures and Processes IV. Life Cycles and Reproduction V. Human Body (Endocrine and Reproductive Systems) VI. Chemistry: Matter and Change VII. Science Biographies | <ul style="list-style-type: none"> I. Plate Tectonics II. Oceans III. Astronomy: Gravity, Stars, and Galaxies IV. Energy, Heat, and Energy Transfer V. The Human Body: Lymphatic and Immune Systems VI. Science Biographies | <ul style="list-style-type: none"> I. Atomic Structure II. Chemical Bonds and Reactions III. Cell Division and Genetics IV. History of the Earth and Life Forms V. Evolution VI. Science Biographies | <ul style="list-style-type: none"> I. Physics II. Electricity and Magnetism III. Electromagnetic Radiation and Light IV. Sound Waves V. Chemistry of Food and Respiration VI. Science Biographies |

SAXON MATH[™]

Courses 1–3

Scope and Sequence

The Scope and Sequence for the *Saxon Courses 1–3* mathematics series is intended to help educators view the progression of mathematical topics throughout the series. Topics are grouped into nine strands:

1. Numbers and Operations
2. Algebra
3. Geometry
4. Measurement
5. Data Analysis and Probability
6. Problem Solving
7. Communication
8. Mathematical Reasoning
9. Connections

The locators in the Scope and Sequence identify lessons in which direct instruction of a topic is presented. Once a topic is presented, students are continually exposed to the topic in the daily problem sets that follow. Because of space considerations, the daily problem sets are not referenced in the Scope and Sequence. Consequently, student exposure to individual topics is actually stronger than indicated on the following pages.

SAXON MATH™

SCOPE AND SEQUENCE

The locators in this Scope and Sequence indicate where direct instruction on each topic can be found. Locators refer to lesson and investigation numbers.

| | Course 1 | Course 2 | Course 3 |
|---|----------------|--------------------------|------------|
| Numbers and Operations | | | |
| Numeration | | | |
| Uses digits | 12, 21 | | |
| Reads and writes whole numbers and decimals | 35, 46 | 1, 5, 31 | 12 |
| Understands place value to trillions | 12 | 5 | 12 |
| Understands place value to hundred trillions | | 5 | 12 |
| Uses a number line (integers, fractions) | 9, 14, 17, 100 | 4, 8, 29, 34, 59, 64, 68 | 1, 10 |
| Uses a number line (rational and irrational numbers) | | 78, 86 | 15, 31, 36 |
| Reads and writes numbers in expanded notation | 32, 46, 92 | 4 | |
| Uses comparison symbols ($=$, $<$, $>$) | 9 | 4, 33 | 1, 77, 94 |
| Uses comparison symbols ($=$, $<$, $>$, \leq , \geq) | | 4, 78, 93 | 62, 77, 94 |
| Compares and orders rational numbers | 9, 14, 44, 76 | 33, 86 | 1, 5, 10 |
| Compares and orders real numbers | | 100 | 16 |
| Reads and writes numbers in scientific notation | | 51, 57, 69, 83, 111 | 28, 51, 57 |
| Basic operations | | | |
| Addition | | | |
| Adds integers | 3, 5, 10, 100 | 1, 2 | 2, 31 |
| Adds decimal numbers | 1, 37 | 1 | 24 |
| Adds fractions and mixed numbers | 24, 26, 59, 61 | 9 | 13 |
| Adds algebraic terms | | | 31 |
| Adds polynomials | | | 80 |
| Adds radical expressions | | | 96 |
| Solves addition problems with regrouping | 1 | 2 | 2, 13, 31 |
| Subtraction | | | |
| Subtracts integers | 3, 5, 100 | 1, 2 | 2, 33 |
| Subtracts decimal numbers | 1, 37 | 1 | 25 |
| Subtracts fractions and mixed numbers | 24, 26, 36 | 9, 23 | 13 |
| Subtracts algebraic terms | | | 31 |
| Subtracts polynomials | | | 80 |
| Solves subtraction problems with regrouping | 1, 36, 48, 63 | 23 | 13, 31, 33 |
| Multiplication | | | |
| Multiplies integers | 2, 5, 10, 112 | 1, 2 | 2, 36 |
| Multiplies decimal numbers | 39, 46 | 1 | 25, 46 |
| Multiplies fractions and mixed numbers | 29, 66, 70 | 9, 26 | 22, 23 |

| | Course 1 | Course 2 | Course 3 |
|---|------------------|----------------------|------------------------|
| Numbers and Operations, continued | | | |
| Basic Operations, continued | | | |
| <i>Multiplication, continued</i> | | | |
| Multiplies algebraic terms | | | 15, 21, 27, 36 |
| Multiplies radical expressions | | | 96, 120 |
| Multiplies binomials | | | 92 |
| Solves multiplication problems with regrouping | 2 | 2 | 2 |
| Understands multiplication notations: $a \times b$, $a \cdot b$, $a(b)$ | 2 | 1 | |
| <i>Division</i> | | | |
| Understands division notations: division box, division sign, and division bar | 2 | 1 | |
| Divides integers | 5, 112 | 1, 2 | 2, 36 |
| Solves division problems with remainders | 2, 11 | 10, 42, 44 | |
| Divides decimal numbers | 45 | 1 | 25, 46 |
| Divides fractions and mixed numbers | 50, 54, 68 | 25, 26 | 22, 23 |
| Divides algebraic terms | | | 27, 36 |
| Properties of numbers and operation | | | |
| Identifies even and odd integers | 10, 19 | 4 | 1 |
| Identifies factors | 2, 19, 21 | 6, 118 | 9 |
| Identifies multiples | 25 | | |
| Understands divisibility | 21 | 6 | 9 |
| Identifies prime and composite numbers | 19 | 21 | 9 |
| Finds the greatest common factor (GCF) | 20 | 6, 21, 24 | 9, 10 |
| Finds the least common multiple (LCM) | 30 | 27, 30 | 13 |
| Uses divisibility tests (2, 3, 5, 9, 10) | 21 | 6 | 9 |
| Uses divisibility tests (4, 6, 8) | | 6 | 9 |
| Finds the prime factorization of whole numbers | 65, 73 | 21, 24, 30, 103, 115 | 9, 10, 15 |
| Uses positive exponents with whole numbers, decimals, fractions | 73, 92 | 20, 83 | 15, 27, 46 |
| Uses positive exponents with integers | | 47, 103 | 27, 36, 46 |
| Uses negative exponents with whole numbers | | 57 | 51, 57 |
| Uses negative exponents with rational numbers | | | 51, 57, 68 |
| Finds square roots | 38 | 20, 100, 103, 106 | 15, 36, 74 |
| Finds cube roots | | 106 | 15 |
| Follows the order of operations | 5, 84, 92 | 2, 52, 63, 85 | 31, 33 |
| Uses inverse operations | 1, 2, 4, 87, 106 | 2, 9, 106 | 38 |
| Estimation | | | |
| Rounds whole numbers, decimals, mixed numbers | 16, 51 | 29, 33 | 17, 117 |
| Estimates sums, differences, products, quotients | 16 | 29 | 17 |
| Estimates squares and square roots | 89 | 29, 100 | 16, 118 |
| Determines the reasonableness of a solution | | 29 | 17 |
| Finds approximate irrational numbers | | 29, 100 | 16; Investigation 2 |

Algebra**Ratio and proportional reasoning**

| | | | |
|--|--------------------------|----------------------------|---|
| Finds a fractional part of a whole, group, set, or number | 6, 22, 77, 117 | 8, 14, 22, 60, 71, 74 | |
| Writes equivalent fractions | 26, 29, 55, 56 | 15, 24, 27, 48 | |
| Converts between fractions, terminating decimals, and percents | 33, 35, 73, 74, 75, 99 | 8, 43, 48; Investigation 1 | 11, 12, 71, 119 |
| Converts between fractions, repeating decimals, and percents | | 43, 48 | 30, 63, 71, 110 |
| Finds the reciprocals of numbers | 30, 50 | 9, 25 | 22 |
| Simplifies complex fractions involving one term in numerator/denominator | | 25, 76 | 119 |
| Simplifies complex fractions involving two terms in numerator/denominator | | | 119 |
| Finds a percent of a whole, group, set, or number | 94, 105, 119 | 8, 14, 77 | 11, 48, 58, 63, 109 |
| Works with percents greater than 100% | 94 | 8 | 67, 71 |
| Solves percent of change problems | | 92 | 67, 71 |
| Solves proportions with an unknown in one term | 83, 85, 101 | 39, 81 | 34, 35, 45, 87 |
| Finds unit rates and ratios in proportional relationships | 88 | 36, 46, 53 | 7, 29, 34, 38, 44, 49, 105 |
| Applies proportional relationships such as similarity, scaling, and rates | 23, 80; Investigation 11 | 46, 54, 98 | 26, 49, 70; Investigation 12 |
| Estimates and solves application problems involving percent | 105, 119 | 81, 110 | 48, 58, 67, 71; Investigation 10 |
| Estimates and solves application problems involving proportional relationships such as similarity and rate | | 46, 54, 98 | 7, 35, 45, 49, 64, 70; Investigation 10 |
| Compares and contrasts proportional and non-proportional linear relationships (direct and inverse variation) | | | 34, 41, 47, 69, 98 |

Patterns, relations, and functions

| | | | |
|--|------------|-------------------------------|---------------------------------------|
| Generates an alternate representation of data | | 56, 116, 120; Investigation 9 | 69 |
| Uses, describes, and extends arithmetic sequences (with a constant rate of change) | 10 | 4 | 61, 73 |
| Completes input/output tables | 10, 82, 96 | 16, 56 | 41, 47, 97, 99 |
| Analyzes a pattern to verbalize a rule | 10, 82, 96 | 4 | 61, 73 |
| Analyzes a pattern to write an algebraic expression | | 56, 87 | 61, 97 |
| Evaluates an algebraic expression to extend a pattern | | 4, 56 | 61, 73, 97 |
| Compares and contrasts linear and nonlinear functions | | 120 | 41, 88, 98, 99; Investigations 10, 11 |

Variables, expressions, equations, and inequalities

| | | | |
|---|----------|---------------------|---|
| Solves equations using concrete and pictorial models | 114, 116 | 87; Investigation 7 | |
| Formulates a problem situation for a given equation with one unknown variable | | 11, 12, 13, 14 | 3 |

| | Course 1 | Course 2 | Course 3 |
|--|------------------------|------------------------|----------------------------|
| Algebra, continued | | | |
| Variables, expressions, equations, and inequalities, continued | | | |
| Formulates an equation with one unknown variable given a problem situation | 11, 15, 87, 105 | 11, 12, 13, 14, 101 | 3, 4 |
| Formulates an inequality with one unknown variable given a problem situation | | | 62, 77 |
| Solves one-step equations with whole numbers | 87 | 41; Investigation 7 | 2, 3, 14, 38 |
| Solves two-step equations with whole numbers | 106, 116 | 93, 102, 108, 109 | 19, 50, 79 |
| Solves one-step equations with fractions and decimals | | 90; Investigation 7 | 3, 4, 14, 38 |
| Solves two-step equations with fractions and decimals | | 93, 108, 110 | 50, 79 |
| Solves equations with exponents | | | 93 |
| Solves systems of equations with two unknowns by graphing | | | 56, 82, 89 |
| Graphs an inequality on a number line | | 78, 86 | 62, 77 |
| Graphs pairs of inequalities on a number line | | | 94 |
| Solves inequalities with one unknown | | 93 | 62, 77 |
| Validates an equation solution using mathematical properties | | 102, 106, 109 | 19, 90; Investigation 8 |
| Geometry | | | |
| Basic terms | | | |
| Describes and names points | 7 | 7, 117 | 18 |
| Describes, identifies, and draws segments | 7 | 7, 117 | 18 |
| Describes, identifies, and draws rays | 7 | 7, 117 | 18 |
| Describes, identifies, and draws lines | 7 | 7, 117 | 18, 44, 54 |
| Describes, identifies, and names angles | 28, 69 | 7, 117 | 18, 54 |
| Describes planes | 28, 69 | 7, 117 | 18; Investigation 1 |
| Properties and relationships of lines | | | |
| Describes, identifies, and draws parallel, perpendicular, and intersecting lines | 28, 71, 97 | 7, 61, 117 | 18, 54; Investigation 1 |
| Describes, identifies, and draws horizontal, vertical, and oblique lines | 18; Investigation 7 | 117 | 44; Investigation 1 |
| Finds and uses the slope of a line | | 107, 116, 117 | 44 |
| Properties and relationships of angles | | | |
| Describes, identifies, and draws acute, obtuse, and right angles | 28; Investigation 3 | 7, 62 | 18, 54; Investigation 3 |
| Describes, identifies, and draws straight angles | | 7 | 18, 54 |
| Identifies complementary and supplementary angles | 69, 71, 97 | 40 | 54 |
| Identifies and finds the measures of angles formed by transversals | 97 | 102 | 54 |
| Constructs an angle bisector | Investigation 8 | Investigation 10 | |
| Identifies vertical angles | | 40 | 54 |

Geometry, continued**Properties and relationships of angles, continued**

| | | | |
|---|------------|----------|-------------------------------------|
| Identifies adjacent angles | | 40 | 54 |
| Calculates to find unknown angle measures | 71, 97, 98 | 101, 102 | 20, 54, 81, 115; Investigation 3 |

Properties and relationships of polygons

| | | | |
|---|----------------------------|-------------------------|--|
| Identifies and describes regular polygons | 2, 60 | 18 | 19 |
| Identifies and describes interior and exterior angles | 97, 98 | 61, 89 | |
| Finds and uses the sum of angle measures | 98 | 40 | 20, 115 |
| Identifies and draws diagonals | | 89 | 66, 74 |
| Understands the effects of scaling on area | | Investigation 11 | 8, 26, 71, 91, 108; Investigation 5 |
| Understands the effects of scaling on volume | | 98; Investigation 11 | 35, 71, 76, 91, 106, 108 |
| Understands and applies similarity and congruence | 68, 79, 108, 109 | 18, 97 | 19 |
| Classifies triangles | 93 | 62 | 20, 35 |
| Classifies quadrilaterals | 60, 64; Investigation 6 | 75; Investigation 6 | Investigation 3 |

Use Pythagorean theorem to solve problems

| | | | |
|--|--|---------|------------------------------------|
| Uses the Pythagorean theorem to solve problems involving whole numbers | | 99, 112 | 74; Investigation 2 |
| Uses the Pythagorean theorem to solve problems involving radicals | | | 66, 74, 78, 96; Investigation 2 |
| Uses trigonometric ratios | | | 112, 118 |

3-Dimensional figures

| | | | |
|--|----------------------|-------------------------|-----------------|
| Represents three-dimensional figures in two-dimensional world using nets | Investigations 6, 12 | 67; Investigation 12 | 55, 95, 100 |
| Draws three-dimensional figures | Investigation 6 | 67 | Investigation 4 |

Coordinate geometry

| | | | |
|---|-----------------|------------------------|------------------------------------|
| Names and graphs ordered pairs | Investigation 7 | 56; Investigation 3 | 41, 89; Investigations 1, 5, 11 |
| Identifies intercepts of a line | | 116 | 56, 82 |
| Determines slope from the graph of line | | 116, 117 | 44, 56, 113; Investigation 8 |
| Identifies reflections, translations, rotations, and symmetry | 108 | 58, 80 | 26; Investigation 3 |
| Graphs reflections across the horizontal or vertical axes | 108 | 80 | 26; Investigation 5 |
| Graphs translations | | 80 | Investigation 5 |
| Graphs rotations | | | Investigation 5 |
| Graphs dilations | | | 60, 71; Investigation 5 |
| Graphs linear equations | | 56; Investigation 9 | 41, 47, 56, 82 |

| | Course 1 | Course 2 | Course 3 |
|--|-----------------------|----------------------|-----------------------------|
| Measurement | | | |
| Measuring physical attributes | | | |
| Uses customary units of length, area, volume, weight, capacity | 7, 31, 78, 82, 102 | 16, 70, 79, 82 | 6, 31, 42 |
| Uses metric units of length, area, volume, weight, capacity | 7, 8, 82 | 32, 70, 79, 82, 114 | 6, 8, 42, 104 |
| Uses temperature scales: Fahrenheit, Celsius | 10, 32 | 16, 32 | 31 |
| Uses units of time | 13, 32 | 49 | 80 |
| Systems of measurement | | | |
| Converts units of measure in the U.S. Customary System | 78, 81, 114 | 16, 49, 50 | 6, 52, 72 |
| Converts units of measure in the metric system | 7, 114 | 50, 114 | 6, 104 |
| Converts between systems | 7 | 50 | 6 |
| Uses unit multipliers | 95, 114 | 50, 88 | 52, 64, 72 |
| Solving measurement problems | | | |
| Finds the perimeter of polygons, circles, and complex figures | 8, 47, 60, 71, 103 | 19, 65 | 8, 31, 39, 60 |
| Finds the area of triangles, rectangles, and parallelograms | 31, 71, 79 | 20, 37 | 8, 20, 37, 60, 66, 92, 96 |
| Finds the area of trapezoids | | 75 | 75 |
| Finds the area of circles | 86 | 82 | 40, 101, 114 |
| Finds the area of semicircles and sectors | | 104 | 40 |
| Finds the area of complex figures | 107 | 75 | 37 |
| Finds the surface area of right prisms and cylinders | Investigation 12 | 105 | 43, 44, 85 |
| Finds the surface area of spheres | | 105 | 111 |
| Finds the surface area of cones and pyramids | | | 100, 114 |
| Estimates area | 86, 118 | 79 | 37, 40, 43; Investigation 1 |
| Finds the volume of right prisms, cylinders, pyramids, and cones | 120; Investigation 12 | 95, 113, 117, 119 | 42, 76, 104, 117 |
| Find the volume of spheres | | 113, 119 | 111 |
| Estimates volume | 78 | 117, 119 | 42, 76, 104, 117 |
| Solving problems of similarity | | | |
| Solves problems involving scale factors | 83; Investigation 11 | 98; Investigation 11 | 26, 35, 87, 91 |
| Solves problems involving similar triangles | | 97 | 35, 115; Investigation 12 |
| Solves problems involving indirect measurement | | 97 | 65, 118 |
| Solves problems involving scale drawings: two-dimensional | Investigation 11 | 98 | 35, 60 |
| Solves problems involving scale drawings: three-dimensional | | | 91 |

Measurement, continued**Use appropriate measurement instruments**

| | | | |
|---|------------------------|-------------------------|----|
| Uses rulers (U.S. Customary and metric) | 7, 17 | 8; Investigation 10 | |
| Uses a compass | 27; Investigation 8 | Investigations 2, 10 | 39 |
| Uses a protractor | Investigation 3 | 17, 96 | 18 |
| Uses a thermometer | 10, 100 | 32 | |

Data Analysis and Probability**Data collection and representation**

| | | | |
|--|---------------------------|-------------------------|--------------------------------|
| Collects and displays data | Investigations 1, 4, 5 | 38; Investigation 5 | 53; Investigation 6 |
| Makes and interprets tables and charts | Investigation 5 | 110; Investigation 9 | Investigations 8, 11 |
| Makes and interprets frequency tables | Investigations 1, 9 | 38 | Investigation 6 |
| Makes and interprets pictographs | Investigation 5 | 38 | |
| Makes and interprets line graphs | 18 | 38; Investigation 5 | |
| Makes and interprets histograms | Investigation 1 | Investigation 5 | 53; Investigation 6 |
| Makes and interprets bar graphs | Investigation 4 | 38; Investigation 5 | 53; Investigation 6 |
| Makes and interprets circle graphs | 40; Investigation 5 | 38; Investigation 5 | Investigation 6 |
| Makes and interprets Venn diagrams | | 86 | 90; Investigation 3 |
| Makes and interprets scatterplots | | | 113; Investigation 8 |
| Makes and interprets line plots | Investigations 4, 5 | 56 | 53, 109 |
| Makes and interprets stem-and-leaf plots | Investigation 5 | Investigation 4 | |
| Makes and interprets box-and-whisker plots | | Investigation 4 | 103 |
| Chooses an appropriate graph | Investigation 5 | 38 | 103; Investigations 6, 9 |
| Identifies bias in data collection | | 38 | Investigation 6 |
| Analyzes bias in data collection | | | Investigations 6, 9 |
| Draws and compares different representations | 40; Investigation 5 | 38; Investigation 5 | 16 |

Data set characteristics

| | | | |
|--|------------------------|----------------------------|-----------------|
| Finds mean, median, mode, and range | 18; Investigation 5 | 28; Investigation 4 | 7, 53, 103, 105 |
| Selects the best measure of central tendency for a given situation | | 77, 79; Investigation 4 | 7, 53 |

| | Course 1 | Course 2 | Course 3 |
|--|----------------------------|----------------------------|------------------------|
| Data Analysis and Probability, continued | | | |
| Data set characteristics, continued | | | |
| Determines trends from data | | 38 | 53, 98, 113 |
| Makes predictions from graphs | | Investigation 5 | 98, 113 |
| Recognizes misuses of graphical or numerical information | | 38; Investigation 5 | 53 |
| Evaluates predictions and conclusions based on data analysis | | 38 | 53 |
| Probability | | | |
| Calculates experimental probability | Investigations 9, 10 | Investigation 8 | 32, 59 |
| Makes predictions based on experiments | Investigations 9, 10 | Investigation 8 | 32, 59 |
| Evaluates accuracy of predictions in experiments | Investigation 9 | Investigation 8 | 59 |
| Calculates theoretical probability | Investigation 9 | Investigation 8 | 32, 59, 110 |
| Identifies sample spaces | 58 | 36 | 32, 68, 83 |
| Calculates simple probability | 58, 77; Investigation 9 | 14 | 32, 59 |
| Calculates the probability of compound events | Investigation 10 | Investigation 8 | 32, 68 |
| Calculates the probability of the complement of an event | 77; Investigation 10 | 14 | 32 |
| Calculates the probability of independent events | Investigations 9, 10 | 94; Investigation 8 | 32, 83 |
| Calculates the probability of dependent events | | 94 | 83 |
| Selects and uses different models to simulate an event | | | 59 |
| Problem Solving | | | |
| Problem-solving strategies | | | |
| Acts it out or make a model | 10, 30, 34 | 34, 50, 54 | 1, 6, 11 |
| Draws a picture or diagram | 1, 14, 17 | 14, 17, 20 | 1, 9, 23 |
| Finds a pattern | 1, 4, 11 | 1, 2, 4 | 5, 10, 16 |
| Guesses and checks | 5, 6, 25 | 5, 18, 19 | 8, 12, 35 |
| Makes an organized list | 2, 26, 32 | 8, 26, 27 | 10, 62, 64 |
| Makes it simpler | 4, 12, 31 | 2, 4, 6 | 4, 7, 13 |
| Makes or uses a table, chart, or graph | 11, 14, 59 | 18, 21, 38 | 17, 18, 21 |
| Uses logical reasoning | 3, 5, 6 | 3, 5, 7 | 12, 15, 17 |
| Works backwards | 15, 55, 56 | 6, 15, 35 | 2, 14, 30 |
| Writes a number sentence or equation | 3, 17, 22 | 3, 7, 9 | 3, 31, 32 |
| Communication | | | |
| Questions and responds | 2, 3, 4 | 2, 4, 6 | 12, 13, 14 |
| Works with partners or in groups | Investigations 2, 4, 9 | Investigations 1, 3, 8 | Investigations 1, 4, 9 |
| Communicates mathematical ideas through objects, words, pictures, numbers, technology, and symbols | 1, 2; Investigation 2 | 5, 7, 8 | 5, 6, 8 |
| Writes about math | 4, 6; Investigation 1 | 11, 12; Investigation 1 | 3, 4, 5 |

| | Course 1 | Course 2 | Course 3 |
|---------------------------------|--|---|---|
| Mathematical Reasoning | | | |
| Uses algebraic reasoning | 10, 11, 82, 87, 96 | 4, 11, 16, 41, 56, 87 | 3, 41, 61, 62, 73, 97 |
| Uses spatial reasoning | 28, 60, 64, 71, 97, 108, 109; Investigations 6, 12 | 7, 18, 40, 67, 75, 80, 99, 102, 117; Investigation 11 | 18, 19, 26, 44, 54, 55, 60, 71, 74, 91, 108, 112; Investigations 2, 3, 4, 5 |
| Classifies and sorts | 60, 64, 93; Investigation 6 | 7, 18, 62, 67; Investigation 6 | 19, 20; Investigations 3, 4 |
| Explains an answer | 1, 2, 3 | 2, 4, 5 | 2, 9, 10 |
| Makes generalizations | 1, 2, 9 | 3, 4, 5 | 2, 3, 7 |
| Justifies conclusions | 13, 19; Investigation 1 | 1, 2, 3 | 2, 4, 5 |
| Connections | | | |
| Connects math to architecture | 61, 98 | 107, 109; Investigation 11 | 35, 42; Investigation 3 |
| Connects math to art | 63, 67, 112 | 30, 56, 94 | 31, 33; Investigation 3 |
| Connects math to geography | 14, 16; Investigation 1 | 13, 18, 20 | 6, 17, 28 |
| Connects math to history | 10, 13, 13 | 12, 13, 14 | 3, 7, 14 |
| Connects math to science | 7, 10, 11 | 9, 14, 19 | 16, 18, 28 |
| Connects math to social studies | | 28, 29, 62 | 53 |
| Connects math to sports | 4, 7, 8 | 7, 11, 18 | 3, 4, 6 |