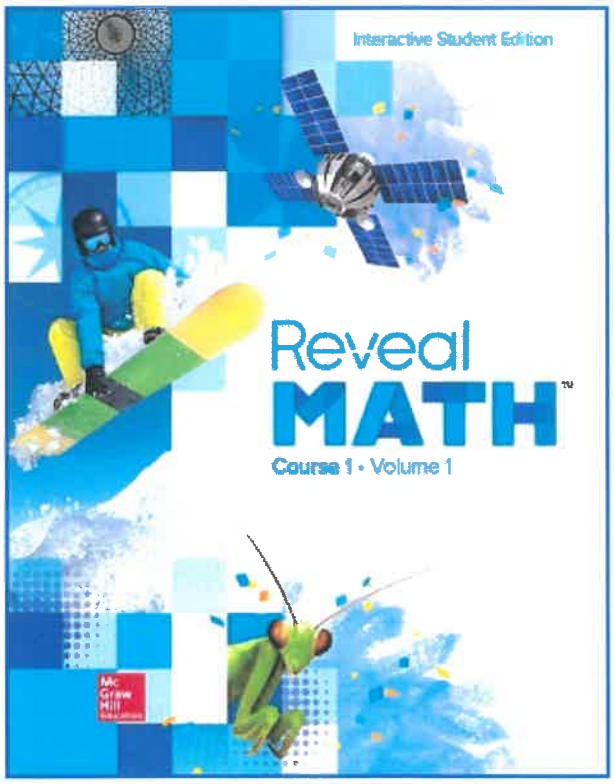
Learning Standards
Mathematics Grade 6

Ohio | Department of Education



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STANDARDS	LESSON(S)

Standards for Mathematical Practice

The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students. These practices rest on important "processes and proficiencies" with longstanding importance in mathematics education. The first of these are the NCTM process standards of problem solving, reasoning and proof, communication, representation, and connections. The second are the strands of mathematical proficiency specified in the National Research Council's report Adding It Up: adaptive reasoning, strategic competence, conceptual understanding (comprehension of mathematical concepts, operations and relations), procedural fluency (skill in carrying out procedures flexibly, accurately, efficiently, and appropriately), and productive disposition (habitual inclination to see mathematics as sensible, useful, and worthwhile, coupled with a belief in diligence and one's own efficacy).

STANDARDS	LESSON(S)
1. Make sense of problems and persevere in solving them. Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, "Does this make sense?" They can understand the approaches of others to solving more complicated problems and identify correspondences between different approaches.	A strong problem-solving strand is present throughout the program with an emphasis on having students explain to themselves and others the meanings of problems and plan their solution strategies. Look for the **Apply** problems and exercises labeled as **Persevere with Problems.** In the Teacher Edition, look for the **Teaching the Mathematical Practices** tips labeled as this mathematical practice. *Throughout the program, for example:* *Interactive Student Edition and Teacher Edition:* • Lesson 3-1, Practice Exercise 15 • Lesson 8-1, Apply • Lesson 9-1, Apply
2. Reason abstractly and quantitatively. Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to *decontextualize*—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to *contextualize*, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.	Students are routinely asked to make sense of quantities and their relationships, and attend to the meaning of quantities as opposed to just computing with them. Look for the exercises labeled as **Reason Abstractly.** Many ***Talk About It!*** question prompts ask students to reason about relationships between quantities. In the Teacher Edition, look for the **Teaching the Mathematical Practices** tips labeled as this mathematical practice. *Throughout the program, for example:* *Interactive Student Edition and Teacher Edition:* • Lesson 1-6, Example 1 • Lesson 1-7, Example 1 • Lesson 7-1, Example 2 • Lesson 7-3, Learn *Write an Equation from a Graph*

STANDARDS	LESSON(S)
3. Construct viable arguments and critique the reasoning of others. Understand and use stated assumptions, definitions, and previously established results in constructing arguments. Make conjectures and build a logical progression of statements to explore the truth of their conjectures. Justify conclusions and communicate them to others. Respond to the arguments of others by listening, asking clarifying questions, and critiquing the reasoning of others.	Students are required to justify their reasoning and to find the errors in another student's reasoning or work. Look for the **Apply** problems (Step 4) and the exercises labeled as **Make a Conjecture**, **Find the Error**, **Use a Counterexample**, **Make an Argument**, or **Justify Conclusions.** Many ***Talk About It!*** question prompts ask students to justify conclusions and/or critique another student's reasoning. In the Teacher Edition, look for the **Teaching the Mathematical Practices** tips labeled as this mathematical practice. *Throughout the program, for example:* *Interactive Student Edition and Teacher Edition:* • Lesson 2-3, Practice Exercises 16-17 • Lesson 8-2, Practice Exercises 11, 14 • Lesson 9-1, Practice Exercise 9 • Lesson 9-4, Example 2, *Talk About It!*
4. Model with mathematics. Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts, and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.	Students apply the mathematics they know to solve real-world problems by using mathematical modeling. For example, students write equations to model real-world situations. Look for the exercises labeled as **Model with Mathematics.** In the Teacher Edition, look for the **Teaching the Mathematical Practices** tips labeled as this mathematical practice. *Throughout the program, for example:* *Interactive Student Edition and Teacher Edition:* • Lesson 6-2, Example 1 • Lesson 7-2, Examples 1-2 • Lesson 7-3, Example 2 • Lesson 7-4, Example 1

STANDARDS	LESSON(S)
5. Use appropriate tools strategically. Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.	In addition to traditional tools such as estimation, mental math, or measurement tools, students are encouraged to use digital tools, such as Web Sketchpad, eTools, etc. to help solve problems. Look for the exercises labeled as **Use Math Tools.** Many **Explore** activities ask students to select and use appropriate tools as they progress through the activities. In the Teacher Edition, look for the **Teaching the Mathematical Practices** tips labeled as this mathematical practice. *Throughout the program, for example:* *Interactive Student Edition and Teacher Edition:* • Lesson 3-3, Examples 4-5 • Lesson 4-1, Explore activity *Represent Integers* • Lesson 5-3, Explore activity *Write Algebraic Expressions* • Lesson 6-6, Example 2

STANDARDS	LESSON(S)
6. Attend to precision. Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently and express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.	Students are routinely required to communicate precisely to partners, the teacher, or the entire class by using precise definitions and mathematical vocabulary. Look for the exercises labeled as **Be Precise.** Many ***Talk About It!*** question prompts ask students to clearly and precisely explain their reasoning. In the Teacher Edition, look for the **Teaching the Mathematical Practices** tips labeled as this mathematical practice. *Throughout the program, for example:* *Interactive Student Edition and Teacher Edition:* • Lesson 3-1, Learn *Divide Multi-Digit Numbers* • Lesson 4-4, Learn *Absolute Value of Rational Numbers, Talk About It!* • Lesson 6-2, Learn *Write Addition Equations, Talk About It!* • Lesson 10-4, Learn *Measures of Variation, Talk About It!*
7. Look for and make use of structure. Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see 7×8 equals the well remembered $7 \times 5 + 7 \times 3$, in preparation for learning about the distributive property. In the expression $x^2 + 9x + 14$, older students can see the 14 as 2×7 and the 9 as $2 + 7$. They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complex things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see $5 - 3(x - y)^2$ as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers x and y.	Students are routinely encouraged to look for patterns or structure present in problem situations. For example, students look for structure present in algebraic expressions and use the structure of three-dimensional figures to create nets. Look for the exercises labeled as **Identify Structure.** Many ***Talk About It!*** question prompts ask students to study the structure of expressions and figures. In the Teacher Edition, look for the **Teaching the Mathematical Practices** tips labeled as this mathematical practice. *Throughout the program, for example:* *Interactive Student Edition and Teacher Edition:* • Lesson 4-6, Example 1, *Talk About It!* • Lesson 4-7, Learn *Find Vertical Distance, Talk About It!* • Lesson 5-3, Learn *Structure of Algebraic Equations, Talk About It!* • Lesson 5-3, Example 1 • Lesson 6-1, Learn *Equations, Talk About It!* • Lesson 9-2, Learn *Make a Net to Represent a Rectangular Prism, Talk About It!* • Lesson 9-3, Example 2

STANDARDS	LESSON(S)
8. Look for and express regularity in repeated reasoning. Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through (1, 2) with slope 3, students might abstract the equation $(y-2)/(x-1) = 3$. Noticing the regularity in the way terms cancel when expanding $(x-1)(x+1)$, $(x-1)(x^2+x+1)$, and $(x-1)(x^3+x^2+x+1)$ might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.	Students are encouraged to look for repeated calculations that lead them to sound mathematical conclusions. For example, students notice that division ends when a remainder is zero. Look for the exercises labeled as **Identify Repeated Reasoning.** Several ***Talk About It!*** question prompts ask students to look for repeated calculations. In the Teacher Edition, look for the **Teaching the Mathematical Practices** tips labeled as this mathematical practice. *Throughout the program, for example:* *Interactive Student Edition and Teacher Edition:* • Lesson 3-1, Example 2, *Talk About It!* • Lesson 4-2, Example 3 • Lesson 6-2, Explore activity *One-Step Addition Equations*
RATIOS AND PROPORTIONAL RELATIONSHIPS **6.RP** Understand ratio concepts and use ratio reasoning to solve problems.	
6.RP.1 Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. For example, *"The ratio of wings to beaks in the bird house at the zoo was 2:1, because for every 2 wings there was 1 beak." "For every vote candidate A received, candidate C received nearly three votes."*	**Lesson(s)** **1-1,** *1-5, 1-6, 10-7*
6.RP.2 Understand the concept of a unit rate a/b associated with a ratio $a:b$ with $b \neq 0$, and use rate language in the context of a ratio relationship. For example, *"This recipe has a ratio of 3 cups of flour to 4 cups of sugar, so the rate is ¾ cup of flour for each cup of sugar." "We paid $75 for 15 hamburgers, which is a rate of $5 per hamburger."*	**Lesson(s)** **1-7, 1-8**
6.RP.3 Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams[G], double number line diagrams[G], or equations.	**Lesson(s)** **1-2, 1-3, 1-4, 1-5, 1-6, 1-7, 1-8, 2-4, 2-5, 2-6,** *10-7*

STANDARDS	LESSON(S)
a. Make tables of equivalent ratios relating quantities with whole-number measurements, find missing values in the tables, and plot the pairs of values on the coordinate plane. Use tables to compare ratios.	**Lesson(s)** **1-2, 1-3, 1-4, 1-7,** *7-3, 7-4*
b. Solve unit rate problems including those involving unit pricing and constant speed. *For example, if it took 7 hours to mow 4 lawns, then at that rate, how many lawns could be mowed in 35 hours? At what rate were lawns being mowed?*	**Lesson(s)** **1-7, 1-8**
c. Find a percent of a quantity as a rate per 100, e.g., 30% of a quantity means $^{30}/_{100}$ times the quantity; solve problems involving finding the whole, given a part and the percent.	**Lesson(s)** **2-4, 2-5, 2-6**
d. Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities.	**Lesson(s)** **1-6**
THE NUMBER SYSTEM **6.NS** Apply and extend previous understandings of multiplication and division of whole numbers to divide fractions by fractions.	
Standard 6.NS.1 Interpret and compute quotients of fractions, and solve word problems involving division of fractions by fractions, e.g., by using visual fraction models[G] and equations to represent the problem. *For example, create a story context for $(^2/_3) \div (^3/_4)$ and use a visual fraction model to show the quotient; use the relationship between multiplication and division to explain that $(^2/_3) \div (^3/_4) = {}^8/_9$ because $^3/_4$ of $^8/_9$ is $^2/_3$. (In general, $(^a/_b) \div (^c/_d) = {}^{ad}/_{bc}$.) How much chocolate will each person get if 3 people share $^1/_2$ pound of chocolate equally? How many $^3/_4$ cup servings are in $^2/_3$ of a cup of yogurt? How wide is a rectangular strip of land with length $^3/_4$ mi and area $^1/_2$ square mi?*	**Lesson(s)** **3-3, 3-4, 3-5**

STANDARDS	LESSON(S)
Compute fluently with multi-digit numbers and find common factors and multiples.	
6.NS.2 Fluently[G] divide multi-digit numbers using the standard algorithm[G].	**Lesson(s)** **3-1**
6.NS.3 Fluently add, subtract, multiply, and divide multi-digit decimals using s standard algorithm for each operation.	**Lesson(s)** **3-2**
6.NS.4 Find the greatest common factor of two whole numbers less than or equal to 100 and the least common multiple of two whole numbers less than or equal to 12. Use the distributive property to express a sum of two whole numbers 1–100 with a common factor as a multiple of a sum of two whole numbers with no common factor. *For example, express 36 + 8 as 4 (9 + 2).*	**Lesson(s)** **5-5, 5-6**
Apply and extend previous understandings of numbers to the system of rational numbers.	
6.NS.5 Understand that positive and negative numbers are used together to describe quantities having opposite directions or values e.g., temperature above/below zero, elevation above/below sea level, credits/debits, positive/negative electric charge; use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation.	**Lesson(s)** **4-1, 4-2**
6.NS.6 Understand a rational number as a point on the number line. Extend number line diagrams and coordinate axes familiar from previous grades to represent points on the line and in the plane with negative number coordinates.	**Lesson(s)** **4-1, 4-2,** *4-3,* **4-4, 4-5, 4-6,** *4-7*
a. Recognize opposite signs of numbers as indicating locations on opposite sides of 0 on the number line; recognize that the opposite of the opposite of a number is the number itself, e.g., *-(-3) = 3, and zero is its own opposite.*	**Lesson(s)** **4-2,** *4-6*
b. Understand signs of numbers in ordered pairs as indicating locations in quadrants of the coordinate plane; recognize that when two ordered pairs differ only by signs, the locations of the points are related by reflections across one or both axes.	**Lesson(s)** **4-5, 4-6**

STANDARDS	LESSON(S)
c. Find and position integers and other rational numbers on a horizontal or vertical number line diagram; find and position pairs of integers and other rational numbers on a coordinate plane.	**Lesson(s)** **4-1,** *4-3,* **4-4, 4-5, 4-6,** *6-6, 7-3, 7-4*
6.NS.7 Understand ordering and absolute value of rational numbers.	**Lesson(s)** **4-2, 4-3, 4-4**
a. Interpret statements of inequality as statements about the relative position of two numbers on a number line diagram. *For example, interpret –3 > –7 as a statement that –3 is located to the right of –7 on a number line oriented from left to right.*	**Lesson(s)** **4-3, 4-4**
b. Write, interpret, and explain statements of order for rational numbers in real-world contexts. *For example, write –3 °C > –7 °C to express the fact that –3 °C is warmer than –7 °C.*	**Lesson(s)** **4-3,** *4-4*
c. Understand the absolute value of a rational number as its distance from 0 on the number line; interpret absolute value as magnitude for a positive or negative quantity in a real-world context. *For example, for an account balance of –30 dollars, write |–30| = 30 to describe the size of the debt in dollars.*	**Lesson(s)** **4-2, 4-3, 4-4,** *4-7*
d. Distinguish comparisons of absolute value from statements about order. *For example, recognize that an account balance less than –30 dollars represents a debt greater than 30 dollars.*	**Lesson(s)** **4-3**
6.NS.8 Solve real-world and mathematical problems by graphing points in all four quadrants of the coordinate plane. Include use of coordinates and absolute value to find distances between points with the same first coordinate or the same second coordinate.	**Lesson(s)** **4-5, 4-6, 4-7**
EXPRESSIONS AND EQUATIONS **6.EE** Apply and extend previous understandings of arithmetic to algebraic expressions.	
6.EE.1 Write and evaluate numerical expressions involving whole number exponents.	**Lesson(s)** **5-1, 5-2**
6.EE.2 Write, read, and evaluate expressions in which letters stand for numbers.	**Lesson(s)** **5-3, 5-4,** *5-7,* **8-1, 8-2, 8-3**

STANDARDS	LESSON(S)
a. Write expressions that record operations with numbers and with letters representing numbers. *For example, express the calculation "Subtract y from 5" as 5 – y.*	**Lesson(s)** **5-3**
b. Identify parts of an expression using mathematical terms (sum, term, product, factor, quotient, coefficient); view one or more parts of an expression as a single entity. *For example, describe the expression 2(8 + 7) as a product of two factors; view (8 + 7) as both a single entity and a sum of two terms.*	**Lesson(s)** **5-3**, *5-6*
c. Evaluate expressions at specific values of their variables. Include expressions that arise from formulas used in real-world problems. Perform arithmetic operations, including those involving whole-number exponents, using the algebraic order of operations when there are no parentheses to specify a particular order. *For example, use the formulas $V = s^3$ and $A = 6s^2$ to find the volume and surface area of a cube with sides of length s = 1/2.*	**Lesson(s)** *5-2*, **5-4**, *7-1*, **8-1, 8-2, 8-3**
6.EE.3 Apply the properties of operations to generate equivalent expressions. *For example, apply the distributive property to the expression 3(2 + x) to produce the equivalent expression 6 + 3x; apply the distributive property to the expression 24x + 18y to produce the equivalent expression 6(4x + 3y); apply properties of operations to y + y + y to produce the equivalent expression 3y.*	**Lesson(s)** **5-6, 5-7**
6.EE.4 Identify when two expressions are equivalent, i.e., when the two expressions name the same number regardless of which value is substituted into them. *For example, the expressions y + y + y and 3y are equivalent because they name the same number, regardless of which number y stands for.*	**Lesson(s)** **5-7**
Reason about and solve one-variable equations and inequalities.	
6.EE.5 Understand solving an equation or inequality as a process of answering a question: which values from a specified set, if any, make the equation or inequality true? Use substitution to determine whether a given number in a specified set makes an equation or inequality true.	**Lesson(s)** **6-1, 6-6**

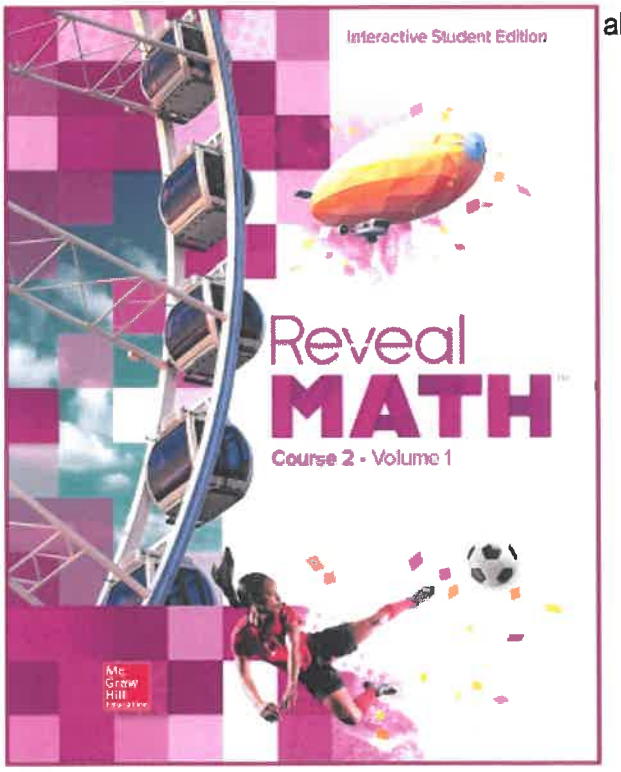
STANDARDS	LESSON(S)
6.EE.6 Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set.	**Lesson(s)** **5-3, 5-4,** *6-1,* **6-2, 6-3, 6-4, 6-5,** *6-6, 7-2, 7-3, 7-4, 9-1, 10-3*
6.EE.7 Solve real-world and mathematical problems by writing and solving equations of the form $x + p = q$ and $px = q$ for cases in which p, q and x are all nonnegative rational numbers.	**Lesson(s)** **6-2, 6-3, 6-4, 6-5,** *7-2, 7-3, 7-4*
6.EE.8 Write an inequality of the form $x > c$ or $x < c$ to represent a constraint or condition in a real-world or mathematical problem. Recognize that inequalities of the form $x > c$ or $x < c$ have infinitely many solutions; represent solutions of such inequalities on number line diagrams.	**Lesson(s)** **6-6**
Represent and analyze quantitative relationships between dependent and independent variables.	
6.EE.9 Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation. *For example, in a problem involving motion at constant speed, list and graph ordered pairs of distances and times, and write the equation $d = 65t$ to represent the relationship between distance and time.*	**Lesson(s)** **7-1, 7-2, 7-3, 7-4**
GEOMETRY **6.G** Solve real-world and mathematical problems involving area, surface area, and volume.	
6.G.1 Through composition into rectangles or decomposition into triangles, find the area of right triangles, other triangles, special quadrilaterals, and polygons; apply these techniques in the context of solving real-world and mathematical problems.	**Lesson(s)** **8-1, 8-2, 8-3, 8-4,** *8-5*

STANDARDS	LESSON(S)
6.G.2 Find the volume of a right rectangular prism with fractional edge lengths by packing it with unit cubes of the appropriate unit fraction edge lengths, and show that the volume is the same as would be found by multiplying the edge lengths of the prism. Apply the formulas $V = l\ w\ h$ and $V = B\ h$ to find volumes of right rectangular prisms with fractional edge lengths in the context of solving real-world and mathematical problems.	**Lesson(s)** **9-1**
6.G.3 Draw polygons in the coordinate plane given coordinates for the vertices; use coordinates to find the length of a side joining points with the same first coordinate or the same second coordinate. Apply these techniques in the context of solving real-world and mathematical problems.	**Lesson(s)** **8-5**
6.G.4 Represent three-dimensional figures using nets made up of rectangles and triangles, and use the nets to find the surface area of these figures. Apply these techniques in the context of solving real-world and mathematical problems.	**Lesson(s)** **9-2, 9-3, 9-4**
STATISTICS AND PROBABILITY **6.SP** Develop understanding of statistical problem solving.	
6.SP.1 Develop statistical reasoning by using the GAISE model:	**Lesson(s)** **10-1, 10-2, 10-7**
a. Formulate Questions: Recognize and formulate a statistical question as one that anticipates variability and can be answered with quantitative data. *For example, "How old am I?" is not a statistical question, but "How old are the students in my school?" is a statistical question because of the variability in students' ages.* (GAISE Model, step 1)	**Lesson(s)** **10-1**
b. Collect Data: Design and use a plan to collect appropriate data to answer a statistical question. (GAISE Model, step 2)	**Lesson(s)** **10-1**
c. Analyze Data: Select appropriate graphical methods and numerical measures to analyze data by displaying variability within a group, comparing individual to individual, and comparing individual to group. (GAISE Model, step 3)	**Lesson(s)** **10-2, 10-3, 10-4, 10-6, 10-7**

STANDARDS	LESSON(S)
d. Interpret Results: Draw logical conclusions from the data based on the original question. (GAISE Model, step 4)	**Lesson(s)** **10-1, 10-2, 10-7**
6.SP.2 Understand that a set of data collected to answer a statistical question has a distribution that can be described by its center, spread, and overall shape.	**Lesson(s)** **10-4, 10-7**
6.SP.3 Recognize that a measure of center for a numerical data set summarizes all of its values with a single number, while a measure of variation describes how its values vary with a single number.	**Lesson(s)** **10-3, 10-4, 10-5, 10-6, 10-7**
Summarize and describe distributions.	
6.SP.4 Display numerical data in plots on a number line, including dot plots[G] (line plots), histograms, and box plots[G]. (GAISE Model, step 3)	**Lesson(s)** **10-2, 10-3, 10-4, 10-6, 10-7**
6.SP.5 Summarize numerical data sets in relation to their context.	**Lesson(s)** **10-2, 10-3, 10-4, 10-5, 10-6, 10-7**
a. Report the number of observations.	**Lesson(s)** *10-1,* **10-2, 10-3, 10-5, 10-7**
b. Describe the nature of the attribute under investigation, including how it was measured and its units of measurement.	**Lesson(s)** **10-3, 10-5, 10-7**
c. Find the quantitative measures of center (median and/or mean) for a numerical data set and recognize that this value summarizes the data set with a single number. Interpret mean as an equal or fair share. Find measures of variability (range and interquartile range[G]) as well as informally describe the shape and the presence of clusters, gaps, peaks, and outliers in a distribution.	**Lesson(s)** **10-3, 10-4, 10-5, 10-6, 10-7**
d. Choose the measures of center and variability, based on the shape of the data distribution and the context in which the data were gathered.	**Lesson(s)** **10-6, 10-7**

Learning Standards
Mathematics Grade 7

Ohio | Department of Education



about 17 to check...thanks!

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STANDARDS	LESSON(S)
Strand: MATHEMATICAL PRACTICES (7.MP) The Standards for Mathematical Practice in Seventh Grade describe mathematical habits of mind that teachers should seek to develop in their students. Students become mathematically proficient in engaging with mathematical content and concepts as they learn, experience, and apply these skills and attitudes **(Standards 7.MP.1–8).**	
Standard 7.MP.1 **Make sense of problems and persevere in solving them.** Explain the meaning of a problem and look for entry points to its solution. Analyze givens, constraints, relationships, and goals. Make conjectures about the form and meaning of the solution, plan a solution pathway, and continually monitor progress asking, "Does this make sense?"	A strong problem-solving strand is present throughout the program with an emphasis on having students explain to themselves and others the meanings of problems and plan their solution strategies. Look for the **Apply** problems and exercises labeled as **Persevere with Problems**. In the Teacher Edition, look for the **Teaching the Mathematical Practices** tips labeled as this mathematical practice.

Primary references are bold. *Supporting references are italicized.*

STANDARDS	LESSON(S)
Continued from previous cell... Consider analogous problems, make connections between multiple representations, identify the correspondence between different approaches, look for trends, and transform algebraic expressions to highlight meaningful mathematics. Check answers to problems using a different method.	***Continued from previous cell...*** *Throughout the program, for example:* *Interactive Student Edition and Teacher Edition:* • Lesson 2-5, Example 4, Apply • Lesson 2-6, Apply • Lesson 5-2, Apply • Lesson 9-3, Apply
Standard 7.MP.2 **Reason abstractly and quantitatively.** Make sense of the quantities and their relationships in problem situations. Translate between context and algebraic representations by contextualizing and decontextualizing quantitative relationships. This includes the ability to decontextualize a given situation, representing it algebraically and manipulating symbols fluently as well as the ability to contextualize algebraic representations to make sense of the problem.	Students are routinely asked to make sense of quantities and their relationships, and attend to the meaning of quantities as opposed to just computing with them. Look for the exercises labeled as **Reason Abstractly**. Many ***Talk About It!*** question prompts ask students to reason about relationships between quantities. In the Teacher Edition, look for the **Teaching the Mathematical Practices** tips labeled as this mathematical practice. *Throughout the program, for example:* *Interactive Student Edition and Teacher Edition:* • Lesson 1-1, Examples 1-2 • Lesson 1-4, Example 4 • Lesson 2-2, Example 1 • Lesson 9-1, Learn *Circumference of Circles* • Lesson 9-4, Example 5

STANDARDS	LESSON(S)
Standard 7.MP.3 **Construct viable arguments and critique the reasoning of others.** Understand and use stated assumptions, definitions, and previously established results in constructing arguments. Make conjectures and build a logical progression of statements to explore the truth of their conjectures. Justify conclusions and communicate them to others. Respond to the arguments of others by listening, asking clarifying questions, and critiquing the reasoning of others.	Students are required to justify their reasoning and to find the errors in another student's reasoning or work. Look for the **Apply** problems (Step 4) and the exercises labeled as **Make a Conjecture**, **Find the Error**, **Use a Counterexample**, **Make and Argument**, or **Justify Conclusions.** Many ***Talk About It!*** question prompts ask students to justify conclusions and/or critique another student's reasoning. In the Teacher Edition, look for the **Teaching the Mathematical Practices** tips labeled as this mathematical practice. *Throughout the program, for example:* *Interactive Student Edition and Teacher Edition:* • Lesson 1-1, Practice Exercise 14 • Lesson 2-4, Example 1, *Talk About It!* • Lesson 4-2, Practice Exercises 20 and 21 • Lesson 8-3, Learn *Classify Triangles*, *Talk About It!* • Lesson 8-5, Example 3, *Talk About It!* • Lesson 9-6, Example 2
Standard 7.MP.4 **Model with mathematics.** Apply mathematics to solve problems arising in everyday life, society, and the workplace. Make assumptions and approximations, identifying important quantities to construct a mathematical model. Routinely interpret mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.	Students apply the mathematics they know to solve real-world problems by using mathematical modeling. For example, students write equations to model real-world situations. Look for the exercises labeled as **Model with Mathematics.** In the Teacher Edition, look for the **Teaching the Mathematical Practices** tips labeled as this mathematical practice. *Throughout the program, for example:* *Interactive Student Edition and Teacher Edition:* • Lesson 6-3, Examples 1-2 • Lesson 6-5, Examples 1-2 • Lesson 7-2, Examples 1-2 • Lesson 7-5, Examples 1-2

STANDARDS	LESSON(S)
Standard 7.MP.5 **Use appropriate tools strategically.** Consider the available tools and be sufficiently familiar with them to make sound decisions about when each tool might be helpful, recognizing both the insight to be gained as well as the limitations. Identify relevant external mathematical resources and use them to pose or solve problems. Use tools to explore and deepen their understanding of concepts.	In addition to traditional tools such as estimation, mental math, or measurement tools, students are encouraged to use digital tools, such as Web Sketchpad, eTools, etc. to help solve problems. Look for the exercises labeled as **Use Math Tools.** Many **Explore** activities ask students to select and use appropriate tools as they progress through the activities. In the Teacher Edition, look for the **Teaching the Mathematical Practices** tips labeled as this mathematical practice. *Throughout the program, for example:* *Interactive Student Edition and Teacher Edition:* • Lesson 5-2, Example 1 • Lesson 6-2, Explore activities *Solve Two-Step Equations Using Bar Diagrams* and *Solve Two-Step Equations Using Algebra Tiles* • Lesson 6-4, Explore activities *Solve Two-Step Equations Using Bar Diagrams* and *Solve Two-Step Equations Using Algebra Tiles* • Lesson 8-3, online Explore activity *Create Triangles* • Lesson 8-3, Learn *Draw Triangles Using Tools*, Examples 2-3
Standard 7.MP.6 **Attend to precision.** Communicate precisely to others. Use explicit definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose. Specify units of measure and label axes to clarify the correspondence with quantities in a problem. Calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context.	Students are routinely required to communicate precisely to partners, the teacher, or the entire class by using precise definitions and mathematical vocabulary. Look for the exercises labeled as **Be Precise.** Many ***Talk About It!*** question prompts ask students to clearly and precisely explain their reasoning. In the Teacher Edition, look for the **Teaching the Mathematical Practices** tips labeled as this mathematical practice. *Throughout the program, for example:* *Interactive Student Edition and Teacher Edition:* • Lesson 1-4, Example 4 • Lesson 4-3, Example 1 • Lesson 8-3, Example 1 • Lesson 9-4, Example 5

STANDARDS	LESSON(S)
Standard 7.MP.7 **Look for and make use of structure.** Look closely at mathematical relationships to identify the underlying structure by recognizing a simple structure within a more complicated structure. See complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. *For example, see $5 – 3(x – y)^2$ as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers x and y.*	Students are routinely encouraged to look for patterns or structure present in problem situations. Look for the exercises labeled as **Identify Structure.** Many ***Talk About It!*** question prompts ask students to study the structure of expressions and figures. In the Teacher Edition, look for the **Teaching the Mathematical Practices** tips labeled as this mathematical practice. *Throughout the program, for example:* *Interactive Student Edition and Teacher Edition:* • Lesson 9-3, Examples 1-2 • Lesson 9-4, Example 5 • Lesson 9-5, Example 2 • Lesson 9-6, Example 1, Learn *Surface Area of Composite Figures*, Example 2
Standard 7.MP.8 **Look for and express regularity in repeated reasoning.** Notice if reasoning is repeated, and look for both generalizations and shortcuts. Evaluate the reasonableness of intermediate results by maintaining oversight of the process while attending to the details.	Students are encouraged to look for repeated calculations that lead them to sound mathematical conclusions. Look for the exercises labeled as **Identify Repeated Reasoning.** Several ***Talk About It!*** question prompts ask students to look for repeated calculations. In the Teacher Edition, look for the **Teaching the Mathematical Practices** tips labeled as this mathematical practice. *Throughout the program, for example:* *Interactive Student Edition and Teacher Edition:* • Lesson 3-3, Learn *Multiply Integers with the Same Sign* • Lesson 4-1, Examples 1-2 • Lesson 5-3, Learn *Additive Inverses of Expressions* • Lesson 5-3, Example 2
RATIOS AND PROPORTIONAL RELATIONSHIPS **7.RP** Analyze proportional relationships and use them to solve real-world and mathematical problems.	
7.RP.1 Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units. *For example, if a person walks ½ mile in each ¼ hour, compute the unit rate as the complex fraction[6] ½/¼ miles per hour, equivalently 2 miles per hour.*	**1-1**

STANDARDS	LESSON(S)
Standard 7.RP.2 Recognize and represent proportional relationships between quantities.	**1-2, 1-3, 1-4, 1-5, 1-6,** *8-4, 11-2, 11-3*
a. Decide whether two quantities are in a proportional relationship, e.g., by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin.	**1-3, 1-4**
b. Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.	**1-3, 1-4, 1-5,** *8-4*
c. Represent proportional relationships by equations. *For example, if total cost t is proportional to the number* n *of items purchased at a constant price p, the relationship between the total cost and the number of items can be expressed as t = pn.*	**1-5**
d. Explain what a point *(x, y)* on the graph of a proportional relationship means in terms of the situation, with special attention to the points (0, 0) and (1, *r*) where *r* is the unit rate.	**1-4**
7.RP.3 Use proportional relationships to solve multi-step ratio and percent problems. *Examples: simple interest, tax, markups and markdowns, gratuities and commissions, fees, percent increase and decrease, percent error.*	**1-6, 2-1, 2-2, 2-3, 2-4, 2-5, 2-6, 2-7,** *8-4, 11-2*
THE NUMBER SYSTEM **7.NS** Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers.	
7.NS.1 Apply and extend previous understandings of addition and subtraction to add and subtract rational numbers; represent addition and subtraction on a horizontal or vertical number line diagram.	**3-1, 3-2, 3-5, 4-2, 4-3, 4-6**
a. Describe situations in which opposite quantities combine to make 0. *For example, a hydrogen atom has 0 charge because its two constituents are oppositely charged.*	**3-1, 4-2**
b. Understand $p + q$ as the number located a distance $\|q\|$ from p in the positive or negative direction, depending on whether q is positive or negative. Show that a number and its opposite have a sum of 0 (are additive inverses). Interpret sums of rational numbers by describing real-world contexts.	**3-1, 4-2**

STANDARDS	LESSON(S)
c. Understand subtraction of rational numbers as adding the additive inverse, $p - q = p + (-q)$. Show that the distance between two rational numbers on the number line is the absolute value of their difference, and apply this principle in real-world contexts.	**3-2, 4-3**
d. Apply properties of operations as strategies to add and subtract rational numbers.	**3-1, 3-2,** *3-4,* **3-5, 4-2, 4-3,** *4-4, 4-5,* **4-6**
7.NS.2 Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers.	**3-3, 3-4, 3-5, 4-1, 4-4, 4-5, 4-6**
a. Understand that multiplication is extended from fractions to rational numbers by requiring that operations continue to satisfy the properties of operations, particularly the distributive property, leading to products such as $(-1)(-1) = 1$ and the rules for multiplying signed numbers. Interpret products of rational numbers by describing real-world contexts.	**3-3, 4-4,** *4-5*
b. Understand that integers can be divided, provided the divisor is not zero, and that every quotient of integers (with non-zero divisor) is a rational number. If p and q are integers, then $-(p/q) = (-p)/q = p/(-q)$. Interpret quotients of rational numbers by describing real-world contexts.	**3-4, 4-1, 4-5**
c. Apply properties of operations as strategies to multiply and divide rational numbers.	**3-3, 3-4, 3-5, 4-4, 4-5, 4-6**
d. Convert a rational number to a decimal using long division; know that the decimal form of a rational number terminates in 0s or eventually repeats.	**4-1**
7.NS.3 Solve real-world and mathematical problems involving the four operations with rational numbers. Computations with rational numbers extend the rules for manipulating fractions to complex fractions.	*3-1, 3-2, 3-3, 3-4,* **3-5,** *4-1, 4-2,* **4-4, 4-5, 4-6, 6-1,** *8-4, 9-1, 9-2, 9-3, 9-4, 9-5, 9-6*
EXPRESSIONS AND EQUATIONS · **7.EE** Use properties of operations to generate equivalent expressions.	
7.EE.1 Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.	**5-1, 5-2, 5-3, 5-4, 5-5**

STANDARDS	LESSON(S)

7.EE.2 In a problem context, understand that rewriting an expression in an equivalent form can reveal and explain properties of the quantities represented by the expression and can reveal how those quantities are related. *For example, a discount of 15% (represented by $p - 0.15p$) is equivalent to $(1 - 0.15)p$, which is equivalent to $0.85p$ or finding 85% of the original price.*	**2-2, 2-3, 2-4, 2-6,** *4-6,* **5-1**
Solve real-life and mathematical problems using numerical and algebraic expressions and equations.	
Standard 7.EE.3 Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. *For example: If a woman making $25 an hour gets a 10% raise, she will make an additional 1/10 of her salary an hour, or $2.50, for a new salary of $27.50. If you want to place a towel bar 9 3/4 inches long in the center of a door that is 27 1/2 inches wide, you will need to place the bar about 9 inches from each edge; this estimate can be used as a check on the exact computation.*	*2-1, 2-2, 2-3, 2-4, 2-5, 2-6, 2-7,* **3-1,** *3-2,* **3-3,** *3-4,* **3-5,** *4-1,* **4-2, 4-3,** *4-4, 4-5, 4-6, 6-1, 6-2, 6-3, 6-4, 6-5, 7-1, 7-2, 7-3, 7-4, 7-5, 7-6, 8-1, 8-2, 8-4*
7.EE.4 Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities.	**6-1, 6-2, 6-3, 6-4, 6-5, 7-1, 7-2, 7-3, 7-4, 7-5, 7-6,** *9-1, 9-2, 9-3, 9-4*
a. Solve word problems leading to equations of the form $px + q = r$ and $p(x + q) = r$, where p, q, and r are specific rational numbers. Solve equations of these forms fluently. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach. *For example, the perimeter of a rectangle is 54 cm. Its length is 6 cm. What is its width?*	**6-1, 6-2, 6-3, 6-4, 6-5,** *8-1, 8-2, 9-1, 9-2, 9-3, 9-4*

b. Solve word problems leading to inequalities of the form $px + q > r$ or $px + q < r$, where p, q, and r are specific rational numbers. Graph the solution set of the inequality and interpret it in the context of the problem. *For example: As a salesperson, you are paid $50 per week plus $3 per sale. This week you want your pay to be at least $100. Write an inequality for the number of sales you need to make, and describe the solutions.*	**7-1, 7-2, 7-3, 7-4, 7-5, 7-6**
Strand: GEOMETRY **7.G** Draw, construct, and describe geometrical figures, and describe the relationships between them.	
7.G.1 Solve problems involving similar figures with right triangles, other triangles, and special quadrilaterals.	**8-4**
a. Compute actual lengths and areas from a scale drawing and reproduce a scale drawing at a different scale.	**8-4**
b. Represent proportional relationships within and between similar figures.	**8-4**
7.G.2 Draw (freehand, with ruler and protractor, and with technology) geometric shapes with given conditions.	**8-3**
a. Focus on constructing triangles from three measures of angles or sides, noticing when the conditions determine a unique triangle, more than one triangle, or no triangle.	**8-3**
b. Focus on constructing quadrilaterals with given conditions noticing types and properties of resulting quadrilaterals and whether it is possible to construct different quadrilaterals using the same conditions.	**This is beyond the scope of this course.**
7.G.3 Describe the two-dimensional figures that result from slicing three-dimensional figures, as in plane sections of right rectangular prisms and right rectangular pyramids.	**8-5**
Solve real-life and mathematical problems involving angle measure, circles, area, surface area, and volume.	
7.G.4 Work with circles.	**9-1, 9-2,** *9-3*

a. Explore and understand the relationships among the circumference, diameter, area, and radius of a circle.	9-1, 9-2, *9-3*
b. Know and use the formulas for the area and circumference of a circle and use them to solve real-world and mathematical problems.	Please check and change.. - good 9-1, 9-2, *9-3*
7.G.5 Use facts about supplementary, complementary, vertical, and adjacent angles in a multi-step problem to write, and solve simple equations for an unknown angle in a figure.	8-1, 8-2
7.G.6 Solve real-world and mathematical problems involving area, volume and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms.	9-3, 9-4, 9-5, 9-6
STATISTICS AND PROBABILITY 7.SP Use random sampling to draw inferences about a population.	
7.SP.1 Understand that statistics can be used to gain information about a population by examining a sample of the population.	11-1
a. Differentiate between a sample and a population.	11-1
b. Understand that conclusions and generalizations about a population are valid only if the sample is representative of that population. Develop an informal understanding of bias.	11-1
Broaden understanding of statistical problem solving.	
7.SP.2 Broaden statistical reasoning by using the GAISE model:	Check these… good 11-1, 11-2, 11-3
a. Formulate Questions: Recognize and formulate a statistical question as one that anticipates variability and can be answered with quantitative data. *For example, "How do the heights of seventh graders compare to the heights of eighth graders?"* (GAISE Model, step 1)	11-2
b. Collect Data: Design and use a plan to collect appropriate data to answer a statistical question. (GAISE Model, step 2)	11-2, 11-3

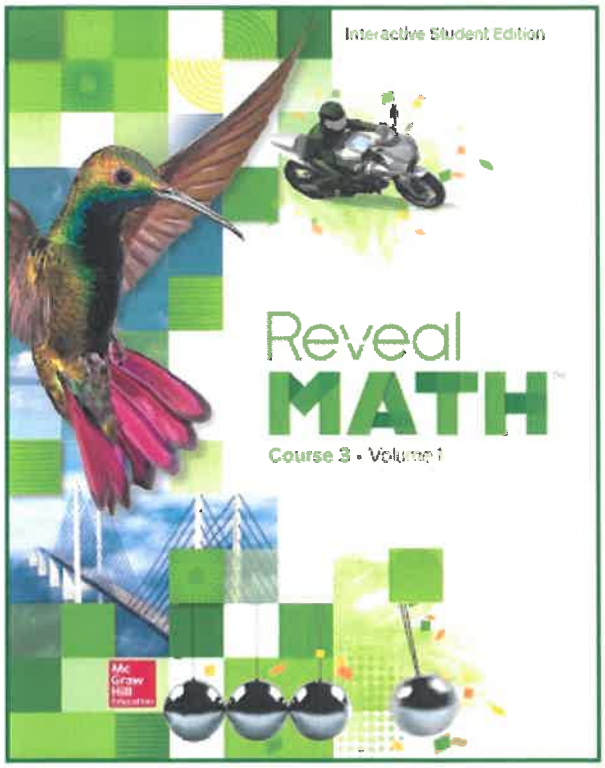
c. Analyze Data: Select appropriate graphical methods and numerical measures to analyze data by displaying variability within a group, comparing individual to individual, and comparing individual to group. (GAISE Model, step 3)	**11-5**
d. Interpret Results: Draw logical conclusions and make generalizations from the data based on the original question. (GAISE Model, step 4)	**11-2**
Summarize and describe distributions representing one population and draw informal comparisons between two populations.	
7.SP.3 Describe and analyze distributions.	**Please check yes** **11-5**
a. Summarize quantitative data sets in relation to their context by using mean absolute deviation[G] (MAD), interpreting mean as a balance point.	**11-4**
b. Informally assess the degree of visual overlap of two numerical data distributions with similar variabilities, measuring the difference between the centers by expressing it as a multiple of a measure of variability. *For example, the mean height of players on the basketball team is 10 cm greater than the mean height of players on the soccer team, approximately twice the variability (mean absolute deviation) on either team; on a dot plot[G], the separation between the two distributions of heights is noticeable.*	**Please check yes** **11-5**
7.SP.4 [Deleted standard]	
Investigate chance processes and develop, use, and evaluate probability models.	
7.SP.5 Understand that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of the event occurring. Larger numbers indicate greater likelihood. A probability near 0 indicates an unlikely event, a probability around ½ indicates an event that is neither unlikely nor likely, and a probability near 1 indicates a likely event.	**10-1**

7.SP.6 Approximate the probability of a chance event by collecting data on the chance process that produces it and observing its long-run relative frequency, and predict the approximate relative frequency given the probability. *For example, when rolling a number cube 600 times, predict that a 3 or 6 would be rolled roughly 200 times, but probably not exactly 200 times.*	**10-2, 10-4**
Standard 7.SP.7 Develop a probability model[G] and use it to find probabilities of events. Compare probabilities from a model to observed frequencies; if the agreement is not good, explain possible sources of the discrepancy.	**10-2, 10-3, 10-4**
a. Develop a uniform probability model[G] by assigning equal probability to all outcomes, and use the model to determine probabilities of events. *For example, if a student is selected at random from a class, find the probability that Jane will be selected and the probability that a girl will be selected.*	**10-3, 10-4**
b. Develop a probability model (which may not be uniform) by observing frequencies in data generated from a chance process. *For example, find the approximate probability that a spinning penny will land heads up or that a tossed paper cup will land open-end down. Do the outcomes for the spinning penny appear to be equally likely based on the observed frequencies?*	**10-2, 10-4**
Standard 7.SP.8 Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation.	**10-5, 10-6**
a. Understand that, just as with simple events, the probability of a compound event is the fraction of outcomes in the sample space[G] for which the compound event occurs.	**10-5**
b. Represent sample spaces for compound events using methods such as organized lists, tables and tree diagrams. For an event described in everyday language (e.g., "rolling double sixes"), identify the outcomes in the sample space which compose the event.	**10-5**
c. Design and use a simulation to generate frequencies for compound events. *For example, use random digits as a simulation tool to approximate the answer to the question: If 40% of donors have type A blood, what is the probability that it will take at least 4 donors to find one with type A blood?*	**10-6**

Mc Graw Hill Education

Learning Standards
Mathematics Grade 8

Ohio | Department of Education



Reveal MATH

STANDARDS	LESSON(S)
Strand: MATHEMATICAL PRACTICES (8.MP) The Standards for Mathematical Practice in Eighth Grade describe mathematical habits of mind that teachers should seek to develop in their students. Students become mathematically proficient in engaging with mathematical content and concepts as they learn, experience, and apply these skills and attitudes **(Standards 8.MP.1–8).**	
Standard 8.MP.1 Make sense of problems and persevere in solving them. Explain the meaning of a problem and look for entry points to its solution. Analyze givens, constraints, relationships, and goals. Make conjectures about the form and meaning of the solution, plan a solution pathway, and continually monitor progress asking, "Does this make sense?"	A strong problem-solving strand is present throughout the program with an emphasis on having students explain to themselves and others the meanings of problems and plan their solution strategies. Look for the **Apply** problems and exercises labeled as **Persevere with Problems.** In the Teacher Edition, look for the **Teaching the Mathematical Practices** tips labeled as this mathematical practice.

STANDARDS	LESSON(S)
Continued from previous cell... Consider analogous problems, make connections between multiple representations, identify the correspondence between different approaches, look for trends, and transform algebraic expressions to highlight meaningful mathematics. Check answers to problems using a different method.	***Continued from previous cell...*** *Throughout the program, for example:* *Interactive Student Edition and Teacher Edition:* • Lesson 4-5, Apply • Lesson 5-4, Apply • Lesson 7-3, Practice Exercise 7 • Lesson 8-1, Practice Exercises 7-8 • Lesson 10-1, Apply
Standard 8.MP.2 Reason abstractly and quantitatively. Make sense of the quantities and their relationships in problem situations. Translate between context and algebraic representations by contextualizing and decontextualizing quantitative relationships. This includes the ability to decontextualize a given situation, representing it algebraically and manipulating symbols fluently as well as the ability to contextualize algebraic representations to make sense of the problem.	Students are routinely asked to make sense of quantities and their relationships, and attend to the meaning of quantities as opposed to just computing with them. Look for the exercises labeled as **Reason Abstractly**. Many ***Talk About It!*** question prompts ask students to reason about relationships between quantities. In the Teacher Edition, look for the **Teaching the Mathematical Practices** tips labeled as this mathematical practice. *Throughout the program, for example:* *Interactive Student Edition and Teacher Edition:* • Lesson 1-2, Learn *Quotient of Powers*, *Talk About It!* • Lesson 2-4, Example 4 *Talk About It!* • Lesson 5-2, Example 3 • Lesson 6-3, Example 4 • Lesson 9-1, Explore activity *Congruence and Transformations*

STANDARDS	LESSON(S)
Standard 8.MP.3 Construct viable arguments and critique the reasoning of others. Understand and use stated assumptions, definitions, and previously established results in constructing arguments. Make conjectures and build a logical progression of statements to explore the truth of their conjectures. Justify conclusions and communicate them to others. Respond to the arguments of others by listening, asking clarifying questions, and critiquing the reasoning of others.	Students are required to justify their reasoning and to find the errors in another student's reasoning or work. Look for the **Apply** problems (Step 4) and the exercises labeled as **Make a Conjecture**, **Find the Error**, **Use a Counterexample**, **Make an Argument**, or **Justify Conclusions.** Many ***Talk About It!*** question prompts ask students to justify conclusions and/or critique another student's reasoning. In the Teacher Edition, look for the **Teaching the Mathematical Practices** tips labeled as this mathematical practice. *Throughout the program, for example:* *Interactive Student Edition and Teacher Edition:* • Lesson 1-4, Explore activity *Exponents of Zero* • Lesson 2-1, Practice Exercise 16 • Lesson 2-4, Practice Exercises 14 and 17 • Lesson 4-3, Learn *Similar Triangles and Slope, Talk About It!* • Lesson 7-2, Explore activity *Angles of Triangles* • Lesson 8-2, Practice Exercise 9
Standard 8.MP.4 Model with mathematics. Apply mathematics to solve problems arising in everyday life, society, and the workplace. Make assumptions and approximations, identifying important quantities to construct a mathematical model. Routinely interpret mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.	Students apply the mathematics they know to solve real-world problems by using mathematical modeling. For example, students write equations to model real-world situations. Look for the exercises labeled as **Model with Mathematics.** In the Teacher Edition, look for the **Teaching the Mathematical Practices** tips labeled as this mathematical practice. *Throughout the program, for example:* *Interactive Student Edition and Teacher Edition:* • Lesson 3-2, Example 2 • Lesson 4-4, Example 1 • Lesson 5-3, Example 1 • Lesson 6-1, Explore activity *Systems of Equations* • Lesson 6-5, Example 2

STANDARDS	LESSON(S)
Standard 8.MP.5 Use appropriate tools strategically. Consider the available tools and be sufficiently familiar with them to make sound decisions about when each tool might be helpful, recognizing both the insight to be gained as well as the limitations. Identify relevant external mathematical resources and use them to pose or solve problems. Use tools to explore and deepen their understanding of concepts.	In addition to traditional tools such as estimation, mental math, or measurement tools, students are encouraged to use digital tools, such as Web Sketchpad, eTools, etc. to help solve problems. Look for the exercises labeled as **Use Math Tools.** Many **Explore** activities ask students to select and use appropriate tools as they progress through the activities. In the Teacher Edition, look for the **Teaching the Mathematical Practices** tips labeled as this mathematical practice. *Throughout the program, for example:* *Interactive Student Edition and Teacher Edition:* • Lesson 2-3, Practice Exercise 15 • Lesson 4-2, Explore activity *Develop Concepts of Slope* • Lesson 6-1, Explore activity *Systems of Equations* • Lesson 7-3, Explore activity *Right Triangle Relationships* • Lesson 8-3, Example 2 *Talk About It!*
Standard 8.MP.6 Attend to precision. Communicate precisely to others. Use explicit definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose. Specify units of measure and label axes to clarify the correspondence with quantities in a problem. Calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context.	Students are routinely required to communicate precisely to partners, the teacher, or the entire class by using precise definitions and mathematical vocabulary. Look for the exercises labeled as **Be Precise.** Many ***Talk About It!*** question prompts ask students to clearly and precisely explain their reasoning. In the Teacher Edition, look for the **Teaching the Mathematical Practices** tips labeled as this mathematical practice. *Throughout the program, for example:* *Interactive Student Edition and Teacher Edition:* • Lesson 1-5, Practice Exercise 14 • Lesson 2-1, Example 1 • Lesson 2-2, Example 4, *Talk About It!* • Lesson 3-5, Example 3, *Talk About It!* • Lesson 4-1, Learn *Unit Rate and Slope*, *Talk About It!*

STANDARDS	LESSON(S)
Standard 8.MP.7 Look for and make use of structure. Look closely at mathematical relationships to identify the underlying structure by recognizing a simple structure within a more complicated structure. See complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. *For example, see $5 - 3(x - y)^2$ as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers x and y.*	Students are routinely encouraged to look for patterns or structure present in problem situations. Look for the exercises labeled as **Identify Structure.** Many ***Talk About It!*** question prompts ask students to study the structure of expressions and figures. In the Teacher Edition, look for the **Teaching the Mathematical Practices** tips labeled as this mathematical practice. *Throughout the program, for example:* *Interactive Student Edition and Teacher Edition:* • Lesson 1-1, Practice Exercise 12 • Lesson 3-5, Learn *Number of Solutions*, *Talk About It!* • Lesson 6-1, Example 3 • Lesson 6-2, Practice Exercise 13 • Lesson 6-3, Example 4 and *Talk About It!* • Lesson 7-5, Example 1, *Talk About It!*
Standard 8.MP.8 Look for and express regularity in repeated reasoning. Notice if reasoning is repeated, and look for both generalizations and shortcuts. Evaluate the reasonableness of intermediate results by maintaining oversight of the process while attending to the details.	Students are encouraged to look for repeated calculations that lead them to sound mathematical conclusions. Look for the exercises labeled as **Identify Repeated Reasoning.** Several ***Talk About It!*** question prompts ask students to look for repeated calculations. In the Teacher Edition, look for the **Teaching the Mathematical Practices** tips labeled as this mathematical practice. *Throughout the program, for example:* *Interactive Student Edition and Teacher Edition:* • Lesson 1-2, Practice Exercise 14 • Lesson 2-1, Examples 1 and 2 • Lesson 2-2, Explore activity *Find Square Roots Using a Square Model* • Lesson 2-2, Practice Exercise 16 • Lesson 4-2, Explore activity *Slope of Horizontal and Vertical Lines*

STANDARDS	LESSON(S)
NUMBER SYSTEM **8.NS** Know that there are numbers that are not rational, and approximate them by rational numbers.	
8.NS.1 Know that real numbers are either rational or irrational. Understand informally that every number has a decimal expansion which is repeating, terminating, or is non-repeating and non-terminating.	**Please check these good** **2-1, 2-3, 2-5**
8.NS.2 Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions (e.g., π^2). *For example, by truncating the decimal expansion of $\sqrt{2}$, show that $\sqrt{2}$ is between 1 and 2, then between 1.4 and 1.5, and explain how to continue on to get better approximations.*	**2-4, 2-5**
EXPRESSIONS AND EQUATIONS **8.EE** Work with radicals and integers exponents.	
8.EE.1 Understand, explain, and apply the properties of integer exponents to generate equivalent numerical expressions. For example, $3^2 \times 3^{-5} = 3^{-3} = 1/3^3 = 1/27$.	**1-2, 1-3, 1-4,** *1-6*
8.EE.2 Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$, where p is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that $\sqrt{2}$ is irrational	**2-2, 2-3,** *2-4, 7-3, 10-4*
8.EE.3 Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other. *For example, estimate the population of the United States as 3 times 10^8 and the population of the world as 7 times 10^9, and determine that the world population is more than 20 times larger.*	**1-5, 1-6**

8.EE.4 Perform operations with numbers expressed in scientific notation, including problems where both decimal notation and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities (e.g., use millimeters per year for seafloor spreading). Interpret scientific notation that has been generated by technology.	**1-5, 1-6**
Understand the connections between proportional relationships, lines, and linear equations.	
8.EE.5 Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. *For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.*	**4-1,** *4-4*
8.EE.6 Use similar triangles to explain why the slope m is the same between any two distinct points on a non-vertical line in the coordinate plane; derive the equation $y = mx$ for a line through the origin and the equation $y = mx + b$ for a line intercepting the vertical axis at b.	**4-3, 4-4, 4-5**
Analyze and solve linear equations and pairs of simultaneous linear equations.	
8.EE.7 Solve linear equations in one variable.	**Please doublecheck these good** **3-1, 3-2, 3-3, 3-4, 3-5**
a. Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form $x = a$, $a = a$, or $a = b$ results (where a and b are different numbers).	*3-2, 3-4,* **3-5**

STANDARDS	LESSON(S)
b. Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.	**Please doublecheck these good** **3-1, 3-2, 3-3, 3-4**
Analyze and solve linear equations and pairs of simultaneous linear equations.	
8.EE.8 Analyze and solve pairs of simultaneous linear equations.	**6-1, 6-2, 6-3, 6-4, 6-5**
a. Understand that the solution to a pair of linear equations in two variables corresponds to the point(s) of intersection of their graphs, because the point(s) of intersection satisfy both equations simultaneously.	**6-1, 6-2,** *6-5*
b. Use graphs to find or estimate the solution to a pair of two simultaneous linear equations in two variables. Equations should include all three solution types: one solution, no solution, and infinitely many solutions. Solve simple cases by inspection. *For example, 3x + 2y = 5 and 3x + 2y = 6 have no solution because 3x + 2y cannot simultaneously be 5 and 6.*	**Please doublecheck these adjusted** **6-1, 6-2, 6-5**
c. Solve real-world and mathematical problems leading to pairs of linear equations in two variables. *For example, given coordinates for two pairs of points, determine whether the line through the first pair of points intersects the line through the second pair.* (Limit solutions to those that can be addressed by graphing.)	**6-1, 6-2, 6-3, 6-4, 6-5**
FUNCTIONS **8.F** Define, evaluate, and compare functions.	
8.F.1 Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output. Function notation is not required in grade 8.	**5-1, 5-2**
8.F.2 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greater rate of change.*	**5-4**
STANDARDS	LESSON(S)

8.F.3 Interpret the equation $y = mx + b$ as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. *For example, the function $A = s^2$ giving the area of a square as a function of its side length is not linear because its graph contains the points (1,1), (2,4) and (3,9), which are not on a straight line.*	**5-5**
Use functions to model relationships between quantities.	
8.F.4 Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values.	**5-3,** *11-3*
8.F.5 Describe qualitatively the functional relationship between two quantities by analyzing a graph e.g., where the function is increasing or decreasing, linear or nonlinear. Sketch a graph that exhibits the qualitative features of a function that has been described verbally.	**5-6**
GEOMETRY **8.G** Understand congruence and similarity using physical models, transparencies, or geometry software.	
8.G.1 Verify experimentally the properties of rotations, reflections, and translations (include examples both with and without coordinates).	**8-1, 8-2, 8-3, 9-1, 9-2**
a. Lines are taken to lines, and line segments are taken to line segments of the same length.	**8-1, 8-2, 8-3, 9-1, 9-2**
b. Angles are taken to angles of the same measure.	**9-1, 9-2**
c. Parallel lines are taken to parallel lines.	**9-1**
8.G.2 Understand that a two-dimensional figure is congruent[G] to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them. (Include examples both with and without coordinates.)	**9-1**

STANDARDS	LESSON(S)
8.G.3 Describe the effect of dilations[G], translations, rotations, and reflections on two-dimensional figures using coordinates.	**8-1, 8-2, 8-3, 8-4**
8.G.4 Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them. (Include examples both with and without coordinates.)	**9-3, 9-4, 9-5**
8.G.5 Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles. *For example, arrange three copies of the same triangle so that the sum of the three angles appears to form a line, and give an argument in terms of transversals why this is so.*	**7-1, 7-2, 9-4, 9-5**
Understand and apply the Pythagorean Theorem.	
8.G.6 Analyze and justify an informal proof of the Pythagorean Theorem and its converse.	**7-3, 7-4**
8.G.7 Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.	**7-3**
8.G.8 Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.	**7-5**
Solve real-world and mathematical problems involving volume of cylinders, cones, and spheres.	
8.G.9 Solve real-world and mathematical problems involving volumes of cones, cylinders, and spheres.	**10-1, 10-2, 10-3, 10-4, 10-5**
STATISTICS AND PROBABILITY **8.SP** Investigate patterns of association in bivariate data.	
8.SP.1 Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association. (GAISE Model, steps 3 and 4)	**11-1**

8.SP.2 Understand that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line. (GAISE Model, steps 3 and 4)	**11-2**
8.SP.3 Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept. *For example, in a linear model for a biology experiment, interpret a slope of 1.5 cm/hr as meaning that an additional hour of sunlight each day is associated with an additional 1.5 cm in mature plant height.* (GAISE Model, steps 3 and 4)	**11-3**
8.SP.4 Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible association between the two variables. *For example, collect data from students in your class on whether or not they have a curfew on school nights and whether or not they have assigned chores at home. Is there evidence that those who have a curfew also tend to have chores?*	**11-4, 11-5**