EUREKA MATH™ TIPS FOR PARENTS

KEY CONCEPT OVERVIEW

Welcome to Grade 8! In the first topic of Module 1, students will be learning about operations (mathematical processes such as addition and subtraction) with terms that have **exponents.** They will learn how to use definitions and properties, often referred to as the laws of exponents, to perform these operations. Students will start by investigating the properties of exponents using only positive exponents (e.g., 8^2 or $(-7)^4$), and then they will extend their knowledge to exponents of zero (e.g., 8^0) and **negative exponents** (e.g., 5^{-2} or $(-3)^{-4}$).

You can expect to see homework that asks your child to do the following:

- Write a **repeated multiplication representation** using exponents.
- Recognize when standard numbers are showing an exponential pattern. For example, 2, 4, 8, 16, and 32 are equal to 2^1, 2^2, 2^3, 2^4, and 2^5, respectively.
- Change a given number to an **exponential expression** with a given **base**. For example, 25 to 5^2.
- Determine whether an exponential expression is positive or negative.
- Simplify expressions using the properties/laws of exponents, including the **zeroth power** and negative powers.
- Explain his work, and prove that two expressions are equivalent by referencing the definition or property/law used.

SAMPLE PROBLEM *(From Lesson 6)*

$(5^{-3})^4 = \left(\frac{1}{5^3}\right)^4$ By definition of negative exponents

$= \left(\frac{1}{5^3}\right) \times \left(\frac{1}{5^3}\right) \times \left(\frac{1}{5^3}\right) \times \left(\frac{1}{5^3}\right)$ By definition of exponential notation

$= \frac{1}{5^{3+3+3+3}}$ By 1st law of exponents

$= \frac{1}{5^{12}}$

$= 5^{-12}$ By definition of negative exponents

Properties of Exponents/Laws of Exponents

For any numbers x, y and all integers (0, and positive and negative numbers that are not fractions) a, b, the following rules apply:		
Name of Rule	General Example	Another Example
1st Law of Exponents	$x^a \cdot x^b = x^{a+b}$	$3^6 \times 3^8 = 3^{6+8} = 3^{14}$
2nd Law of Exponents-Power to a Power	$(x^a)^b = x^{ab}$	$((-6)^4)^2 = (-6)^{4 \cdot 2} = (-6)^8$
3rd Law of Exponents	$(xy)^a = x^a y^a$	$(5g)^3 = 5^3 \cdot g^3$
Division of Exponents; Consequence of 1st Law for Division	$\frac{x^a}{x^b} = x^{a-b}$	$\frac{x^{10}}{x^2} = x^{10-2} = x^8$
Fraction to a Power; Consequence of 3rd Law for Division	$\left(\frac{x}{y}\right)^a = \frac{x^a}{y^a}$	$\left(\frac{2}{3}\right)^4 = \frac{2^4}{3^4}$
For any positive number x, and all integers b, the following rule applies:		
Definition of Negative Exponents	$x^{-b} = \frac{1}{x^b}$	$5^{-2} = \frac{1}{5^2}$

Additional sample problems with detailed answer steps are found in the *Eureka Math Homework Helpers* books. Learn more at GreatMinds.org.

EUREKA MATH™ TIPS FOR PARENTS

KEY CONCEPT OVERVIEW

In Topic B, students are introduced to **scientific notation,** which is a convenient way to write numbers that are very large or very small. Students learn to convert standard numbers to scientific notation and perform operations on numbers in many forms. Finally, students compare numbers written in various forms to put them in order or to determine which number has the greatest or least value.

After your child has completed Lesson 11, LEARN MORE by viewing a video called "Powers of Ten," which demonstrates positive and negative powers of 10. Visit: eurmath.link/powers-of-ten.

You can expect to see homework that asks your child to do the following:

- Use the **order of magnitude** of a number to determine the next greatest **power of ten,** and put numbers in order according to their value. The larger the magnitude, the larger the number's value.
- Solve real-life problems using numbers written in scientific notation.
- Convert numbers written in standard form to scientific notation, and vice versa. Represent those numbers on a calculator.
- Determine whether a number represented in scientific notation is very large or very small in value.
- Perform calculations on numbers represented in scientific notation.
- Change a given unit of measure to a different unit of measure.

SAMPLE PROBLEMS *(From Lessons 9 and 10)*

The table below shows the debt of the three most populous states and three least populous states.

State	Debt (in dollars)	Population (2012)
California	407, 000, 000, 000	38, 000, 000
New York	337, 000, 000, 000	19, 000, 000
Texas	276, 000, 000, 000	26, 000, 000
North Dakota	4, 000, 000, 000	690, 000
Vermont	4, 000, 000, 000	626, 000
Wyoming	2, 000, 000, 000	576, 000

How much larger is the combined debt of the three most populous states than that of the three least populous states? Express your answer in scientific notation.

$$\begin{aligned}(1.02 \times 10^{12}) - (1 \times 10^{10}) &= (1.02 \times 10^2 \times 10^{10}) - (1 \times 10^{10})\\ &= (102 \times 10^{10}) - (1 \times 10^{10})\\ &= (102 - 1) \times 10^{10}\\ &= 101 \times 10^{10}\\ &= (1.01 \times 10^2) \times 10^{10}\\ &= 1.01 \times 10^{12}\end{aligned}$$

EUREKA MATH™ TIPS FOR PARENTS

KEY CONCEPT OVERVIEW

This module is all about geometry. Until now, students may have thought of two objects as being congruent if they were the same shape and the same size. In Topic A, we will lay the groundwork for arriving at a more precise mathematical definition of congruence. Students will be doing hands-on work as they **transform** (slide, turn, or flip) points, segments**,** lines and shapes.

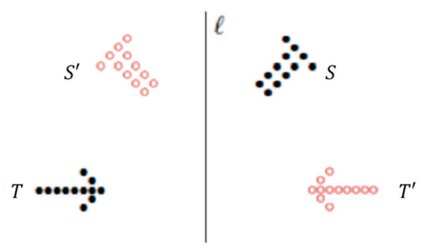
To LEARN MORE about transformations, visit:
eurmath.link/translation, eurmath.link/reflection, eurmath.link/rotatecw, and eurmath.link/rotateccw. The videos were developed by Sunil Koswatta.

You can expect to see homework that asks your child to do the following:

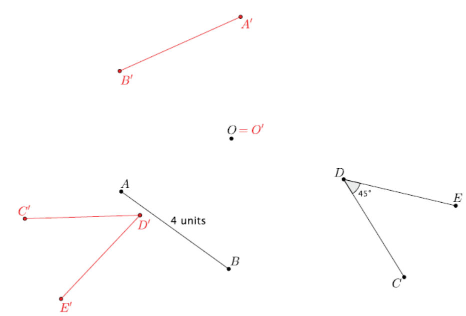
- Identify transformations (**translation, rotation, reflection**) that have been performed on shapes.
- Translate (slide), rotate (turn), and reflect (flip) objects using given criteria.
- Use accurate labeling and precise language when performing transformations.
- Determine lengths of segments and measures of angles (e.g., 45°, 90°) after a transformation has been performed.
- Understand the special consequences of rotations of 180°.

SAMPLE PROBLEMS *(From Lessons 4 and 5)*

The original images are in black, and the reflected (flipped) images are in red.



Let $\overline{AB}$ be a segment of length 4 units and $\angle CDE$ be 45°. Let there be a rotation by d degrees, where $d < 0$, about O. Find the images of the given figures.



Verify that students have rotated around center O in the clockwise direction.

Additional sample problems with detailed answer steps are found in the *Eureka Math Homework Helpers* books. Learn more at GreatMinds.org.

EUREKA MATH™ TIPS FOR PARENTS

KEY CONCEPT OVERVIEW

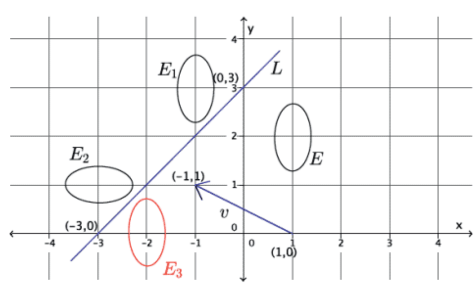
Now that students have learned to perform single transformations, they will begin sequencing transformations, or performing more than one type of transformation on the same shape. Students will investigate to determine whether performing multiple transformations changes the properties—measurements, for instance—of a shape that stayed the same during a single transformation. Precise language is essential in Topic B because students must accurately explain which object is being transformed and what each transformation requires.

You can expect to see homework that asks your child to do the following:

- Using given criteria, perform the appropriate sequence of rigid motions (translate, rotate, and reflect) on objects.
- Use accurate labeling and precise language when performing a **sequence of transformations**.
- Determine lengths of segments and measures of angles after a sequence of transformations has been performed.
- Determine whether the order in which a sequence of transformations is performed will affect the final location of the image.

SAMPLE PROBLEM *(From Lesson 10)*

This image shows a sequence of transformations performed on Object E.



To create Object E_1, translate (slide) Object E along the vector from point $(1, 0)$ on the coordinate plane/grid to point $(-1, 1)$. (NOTE: Students can also explain this translation on the coordinate plane as 1 up and 2 left.)

To create Object E_2, rotate (turn) Object E_1 around point $(-1, 1)$ 90°. Notice that the rotation is in the counterclockwise direction.

To create Object E_3, reflect (flip) Object E_2 across line L.

Additional sample problems with detailed answer steps are found in the *Eureka Math Homework Helpers* books. Learn more at GreatMinds.org.

EUREKA MATH™ TIPS FOR PARENTS

KEY CONCEPT OVERVIEW

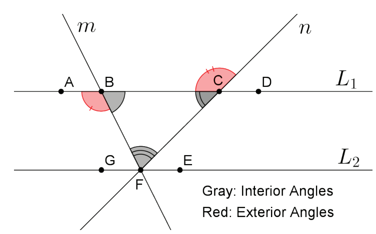
In Topic C, students discover and apply a precise definition for **congruence**. They examine the angles formed when a **transversal** crosses **parallel lines**; they also examine the angles inside and outside of a triangle. To pull all of these relationships together, students begin examining diagrams in which two or more transversals cross parallel lines, creating triangles.

You can expect to see homework that asks your child to do the following:

- Use sequences of transformations to determine whether two figures are congruent.
- Use precise language to describe the congruence by describing the sequence of transformations that was performed.
- Determine the relationships between angles and missing angle measurements in a diagram in which parallel lines are cut by a transversal. Describe these relationships using precise language with transformations.
- Determine the measures of missing angles in diagrams with triangles.
- Determine whether two lines are parallel given the measure of the angles in the diagram.

SAMPLE PROBLEM *(From Lesson 13)*

The figure below shows parallel lines L_1 and L_2. Let m and n be transversals that intersect L_1 at points B and C, respectively, and L_2 at point F, as shown. Let A be a point on L_1 to the left of B, D be a point on L_1 to the right of C, G be a point on L_2 to the left of F, and E be a point on L_2 to the right of F.



a. Name a triangle in the figure. ***$\triangle BCF$***

b. Name a straight angle that will be useful in proving that the sum of the measures of the interior angles of the triangle is 180°. ***$\angle GFE$***

c. Our goal is to show that the sum of the measures of the interior angles of the triangle is equal to the measure of the straight angle. Show that the measures of the interior angles of a triangle have a sum of 180°. Write your proof below.

The straight angle $\angle GFE$ comprises $\angle GFB$, $\angle BFC$, and $\angle EFC$.
Alternate interior angles of parallel lines are equal in measure.
For that reason, $m\angle BCF = m\angle EFC$ and $m\angle CBF = m\angle GFB$.
Since $\angle GFE$ is a straight angle, its measure is equal to 180°.
Then, $m\angle GFE = m\angle GFB + m\angle BFC + m\angle EFC = 180^\circ$.
By substitution, $m\angle GFE = m\angle CBF + m\angle BFC + m\angle BCF = 180^\circ$.
Therefore, the sum of the measures of the interior angles of a triangle is 180° (angle sum of triangles).

Additional sample problems with detailed answer steps are found in the *Eureka Math Homework Helpers* books. Learn more at GreatMinds.org.

EUREKA MATH™ TIPS FOR PARENTS

KEY CONCEPT OVERVIEW

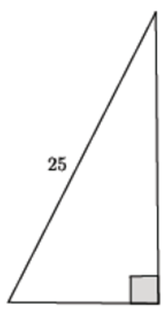
In Topic D, students are introduced to the **Pythagorean theorem**, $a^2 + b^2 = c^2$, a rule about right triangles. Students will perform the basic rigid motions and apply what they have learned about congruence to prove the Pythagorean theorem (i.e., to verify it). After proving the theorem, students will use it to find the length of one side of a right triangle, given the lengths of the other two sides.

You can expect to see homework that asks your child to apply the Pythagorean theorem to do the following:

- Determine the missing length of the **hypotenuse of a right triangle**.
- Determine the missing length of a **leg of a right triangle**.
- Determine the lengths of segments in a graph as well as in real-life situations (e.g., the length of a ladder leaning against a wall that creates a right triangle with the wall and the floor).

SAMPLE PROBLEMS *(From Lesson 16)*

Use the Pythagorean theorem to find the missing length of the leg in the right triangle.

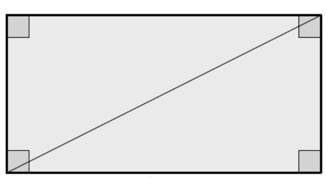


Let b represent the missing leg length.

$$\begin{aligned} 15^2 + b^2 &= 25^2 \\ 15^2 - 15^2 + b^2 &= 25^2 - 15^2 \\ b^2 &= 625 - 225 \\ b^2 &= 400 \\ b &= 20 \end{aligned}$$

The length of the leg is 20 units.

Given a rectangle with dimensions 5 cm and 10 cm, as shown, find the length of the diagonal, if possible.



Let c represent the length of the diagonal, in centimeters.

$$\begin{aligned} c^2 &= 5^2 + 10^2 \\ c^2 &= 25 + 100 \\ c^2 &= 125 \end{aligned}$$

The length of the diagonal in centimeters is the positive number c that satisfies $c^2 = 125$.

Additional sample problems with detailed answer steps are found in the *Eureka Math Homework Helpers* books. Learn more at GreatMinds.org.

EUREKA MATH™ TIPS FOR PARENTS

KEY CONCEPT OVERVIEW

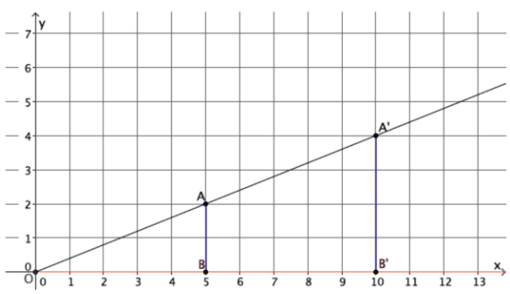
In Module 3, students are introduced to a new transformation called a **dilation**, which results in an image that is the same shape but a different size than the original. Because a dilation **magnifies (enlarges)** or **shrinks (reduces)** the original shape, it is not a rigid motion. Students will use a rule called the **fundamental theorem of similarity**, or FTS, to examine the effect of dilations on **coordinates**. Through this work, students will develop a precise **definition of dilation**. During this module, your child will be asked to use a ruler, a compass, and a calculator. Making these tools available at home will help your child complete his work.

You can expect to see homework that asks your child to do the following:

- Use side lengths to calculate the **scale factor** of a dilation and classify it as an enlargement or a reduction.
- Use the definition of dilation to solve for the length of an unknown side in the original shape or dilated shape, as well as calculate the scale factor used in the dilation.
- Create images by dilating an original figure using the given **center of dilation** and scale factor. Students will dilate objects with straight or curved sides.
- Determine the sequence of transformations used on an original object to create an image.
- Calculate the scale factor used to return an image back to the original figure.
- Use the fundamental theorem of similarity to solve for segment lengths and coordinates of points and to find congruent angles and parallel lines.

SAMPLE PROBLEMS *(From Lesson 5)*

1. Find the length of segment $A'B'$ using the diagram. Explain.



If the points A and B are both dilated by a scale factor of 2, the segments AB and A′B′ will be parallel, with the length of segment A′B′ (4) equal to twice the length of segment AB (2). Therefore, $|A'B'| = 2|AB|$***, and*** $4 = 2 \cdot 2$.

2. Point D (0, 11) is dilated from the origin by scale factor $r = 4$. What are the coordinates of point D'?

$$D'(4 \cdot 0, 4 \cdot 11) = D'(0, 44)$$

3. Point $E(-2, -5)$ is dilated from the origin by scale factor $r = \frac{3}{2}$. What are the coordinates of point E'?

$$E'\left(\frac{3}{2} \cdot (-2), \frac{3}{2} \cdot (-5)\right) = E'\left(-3, -\frac{15}{2}\right)$$

Additional sample problems with detailed answer steps are found in the *Eureka Math Homework Helpers* books. Learn more at GreatMinds.org.

EUREKA MATH™ TIPS FOR PARENTS

KEY CONCEPT OVERVIEW

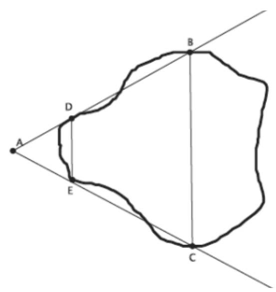
In Topic B, students formally define **similarity** and investigate the properties of similar objects. Looking specifically at triangles, students learn to tell whether two triangles are similar using techniques other than dilation or the basic rigid motions. After determining that two triangles are similar, students use equivalent ratios to find the unknown side lengths of a triangle. Finally, students apply their knowledge of similarity to real-world tasks, such as finding heights of buildings and determining distances that are too large to measure with a typical measuring tool.

You can expect to see homework that asks your child to do the following:

- Describe a dilation followed by a sequence of rigid motions that would map one shape onto another.
- Determine whether two objects are similar using **angle-angle criterion** or **proportional** side relationships.
- Use dilation and rigid motion to prove that similarity is **symmetric** and **transitive**.
- Given that two triangles are similar, solve for the unknown side length.
- Use similar triangle relationships to solve problems with real-world contexts.

SAMPLE PROBLEM *(From Lesson 12)*

A geologist wants to determine the distance across the widest part of a nearby lake. The geologist marked off specific points around the lake so that the line containing segment DE would be parallel to the line containing segment BC. Segment BC is selected specifically because it is the widest part of the lake. Segment DE is selected specifically because it is a short enough distance to measure easily. The geologist sketched the situation, as shown below.



a. Has the geologist done enough so far to use similar triangles to help measure the widest part of the lake? Explain your answer.

Yes, based on the sketch, the geologist found a center of dilation at point A. The geologist marked points around the lake that, when connected, make parallel lines. The triangles are similar by the angle-angle (AA) criterion. Corresponding angles of parallel lines are equal in measure, and the measure of $\angle DAE$ is equal to itself. Since there are two pairs of corresponding angles that are equal, $\triangle DAE \sim \triangle BAC$.

b. The geologist made the following measurements: $|DE| = 5$ feet, $|AE| = 7$ feet, and $|EC| = 15$ feet. Does she have enough information to complete the task? If so, determine the length across the widest part of the lake. If not, state what additional information is needed.

Yes, there is enough information about the similar triangles to determine the distance across the widest part of the lake using the AA criterion.

Let x represent the length of segment BC; then, $\frac{x}{5} = \frac{22}{7}$.

We are looking for the value of x that makes the fractions equivalent. Therefore, $7x = 110$ and $x \approx 15.7$. The distance across the widest part of the lake is approximately 15.7 feet.

Additional sample problems with detailed answer steps are found in the *Eureka Math Homework Helpers* books. Learn more at GreatMinds.org.

EUREKA MATH™ TIPS FOR PARENTS

KEY CONCEPT OVERVIEW

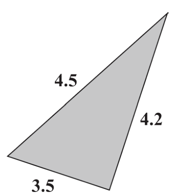
In Topic C, we return to the **Pythagorean theorem**. In this exposure to the theorem, students are presented with a proof that involves similar triangles and the angle-angle criterion. Once again, students apply the Pythagorean theorem to find the measures of unknown side lengths in right triangles.

You can expect to see homework that asks your child to do the following:

- Use the Pythagorean theorem to solve for the measure of an unknown side length in a right triangle.
- Use the properties of **perfect squares** to apply to perfect square decimals. For example, if $c^2 = 121$, then $c = 11$. Likewise, if $c^2 = 1.21$, then $c = 1.1$.
- Determine whether a triangle is a right triangle by using the **converse of the Pythagorean theorem**.

SAMPLE PROBLEM *(From Lesson 14)*

The numbers in the diagram below indicate the lengths of the sides of the triangle. Is the triangle shown below a right triangle? Show your work, and answer in a complete sentence.



If this were a right triangle, the side measuring 4.5 would be the longest side and would therefore be the hypotenuse. We need to check whether $3.5^2 + 4.2^2 = 4.5^2$ is a true statement. The left side of the equation is equal to 29.89. The right side of the equation is equal to 20.25. That means $3.5^2 + 4.2^2 = 4.5^2$ is not true, so the triangle shown is not a right triangle.

Additional sample problems with detailed answer steps are found in the *Eureka Math Homework Helpers* books. Learn more at GreatMinds.org.

HOW YOU CAN HELP AT HOME

You can help at home in many ways. Here are some tips to help you get started.

- Do you have a tall tree or a flagpole in your yard? Use the shadow activity found in Lesson 12 Problem Set 1. On a sunny day, position yourself such that the end of your shadow and the end of the tree's shadow match up. Ask your child to measure the following: your distance from the tree, your height, and the length of your shadow. Ensure that the measurements are all in one unit (e.g., 3 feet 6 inches should either be 42 inches or 3.5 feet). Then, challenge your child to use that data with equivalent ratios to determine the height of the tree. Next, your child can use the Pythagorean theorem and the data gathered so far to determine the **hypotenuse** lengths of the two triangles formed by you, the tree, and your shadows.
- Right angles are all around you. Continue to point out right angles (or what appear to be right angles) in your environment. Discuss with your child ways to determine whether an angle is actually a right angle.
- Work with your child to remember the perfect squares. Your child should be able to identify the first fifteen perfect squares and know what number squared results in each perfect square (See Terms).

EUREKA MATH™ TIPS FOR PARENTS

KEY CONCEPT OVERVIEW

In Module 4 Topic A, students begin to make connections between proportional relationships and **linear expressions** and equations. They transcribe the information from word problems into expressions and equations and then evaluate or solve. Students learn that an equation may have one **solution**, no solution, or many solutions.

You can expect to see homework that asks your child to do the following:

- Write statements using symbolic language. For example, twice a number less 4 is transcribed as $2x - 4$, where x represents a number.
- Determine whether an expression or equation is linear or nonlinear.
- Solve linear equations, explain the **properties of equality** used to find the solutions, and check those solutions.
- Write and solve equations to find the measures of angles in triangles.
- Determine whether an equation has a unique (one) solution, no solution, or infinitely many solutions.

SAMPLE PROBLEMS *(From Lessons 7 and 9)*

1. Solve the linear equation $x - 9 = \frac{3}{5}x$. State the property that justifies each of your steps.

The left side of the equation, $x - 9$, and the right side of the equation, $\frac{3}{5}x$, are transformed as much as possible.

$$x - 9 = \frac{3}{5}x$$

$$x - x - 9 = \frac{3}{5}x - x \quad \textit{Subtraction property of equality}$$

$$(1-1)x - 9 = \left(\frac{3}{5} - 1\right)x \quad \textit{Distributive property}$$

$$-9 = -\frac{2}{5}x$$

$$-\frac{5}{2}(-9) = -\frac{5}{2}\left(-\frac{2}{5}x\right) \quad \textit{Multiplicative property of equality}$$

$$\frac{45}{2} = x$$

2. Give a brief explanation as to what kind of solution(s) you expect the following linear equation to have. Transform the equation into a simpler form if necessary.

$$11x - 2x + 15 = 8 + 7 + 9x$$

$$11x - 2x + 15 = 8 + 7 + 9x$$

$$(11 - 2)x + 15 = (8 + 7) + 9x$$

$$9x + 15 = 15 + 9x$$

I notice that the coefficients of the x are the same, specifically 9, and that the constants, 15, are also the same. Therefore, this equation has infinitely many solutions.

Additional sample problems with detailed answer steps are found in the *Eureka Math Homework Helpers* books. Learn more at GreatMinds.org.

HOW YOU CAN HELP AT HOME

You can help at home in many ways. Here are some tips to help you get started.

- Ask your child to transform each side of an equation from class using the **commutative**, **associative**, and/or **distributive** properties. Then have your child solve the *new* equation using the properties of equality.
- Place equations from both Lessons 2 and 3 on index cards. Have your child organize the cards into linear and nonlinear equations.

EUREKA MATH™ TIPS FOR PARENTS

KEY CONCEPT OVERVIEW

In Topic B, students write linear equations to represent **constant rate** problems. The lessons in this topic introduce students to the standard form of an equation in two variables and ask students to write, interpret, and graph information from various situations.

You can expect to see homework that asks your child to do the following:

- Write and solve problems with **proportional relationships** involving speed, distance, time, and other constant rates.
- Write a **linear equation in two variables**.
- Given the value of one variable, solve a two-variable linear equation to determine the value of the other variable.
- Compute information for a constant rate problem, or a linear equation, and graph the data in the **coordinate plane**.
- Given data in a coordinate plane, determine whether the data represent a given linear equation.
- Find solutions to an equation, and plot the solutions as points on a coordinate plane.
- Graph linear equations on the coordinate plane.

SAMPLE PROBLEM *(From Lesson 11)*

Juan types at a constant rate. He can type a full page of text in $3\frac{1}{2}$ minutes. How many pages, p, can Juan type in t minutes?

a. Write a linear equation representing the number of pages Juan can type in any given time period.

Let C represent the constant rate that Juan types in pages per minute. Then, $\frac{1}{3.5} = C$ and $\frac{p}{t} = C$; therefore, $\frac{1}{3.5} = \frac{p}{t}$.

$$\frac{1}{3.5} = \frac{p}{t}$$

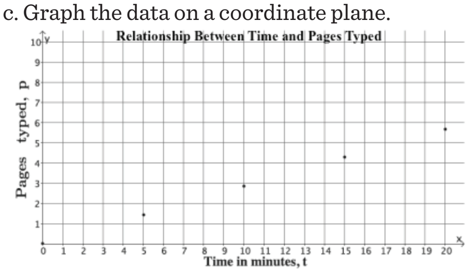
$$(t)\frac{1}{3.5} = \frac{p}{t}(t)$$

$$\frac{1}{3.5}t = p$$

b. Complete the table below. Use a calculator, and round your answers to the tenths place.

t (time in minutes)	Linear Equation: $p = \frac{1}{3.5}t$	p (pages typed)
0	$p = \frac{1}{3.5}(0)$	0
5	$p = \frac{1}{3.5}(5)$	$\frac{5}{3.5} \approx 1.4$
10	$p = \frac{1}{3.5}(10)$	$\frac{10}{3.5} \approx 2.9$
15	$p = \frac{1}{3.5}(15)$	$\frac{15}{3.5} \approx 4.3$
20	$p = \frac{1}{3.5}(20)$	$\frac{20}{3.5} \approx 5.7$

c. Graph the data on a coordinate plane.



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EUREKA MATH™ TIPS FOR PARENTS

KEY CONCEPT OVERVIEW

Topic C extends students' work with constant rate as it applies to the **slope** of a line. Students determine the slope by using any two points from the graph of a line. Students then apply the slope of the line to the **slope-intercept form** to find the equation of that line. For example, if the slope is 3, the slope-intercept form of the line could be $y = 3x + 8$. Last, students compare various proportional relationships represented in graphs, tables, equations, and descriptions.

You can expect to see homework that asks your child to do the following:

- Determine whether the slope of a line is positive or negative, and then find the exact value of the slope or ***y*-intercept point**. The data used may be given in graphs, tables, equations, or descriptions.
- Confirm that the slope of a line stays the same when using two different points on the line to determine the slope.
- Using the properties of equality, transform an equation from **standard form** to slope-intercept form and vice versa.
- Given points on a line—or the graph, table, equation, or description of the line—determine one or more of the other representations (i.e., points, graph, table, equation, or description) of the line.
- Determine whether two equations result in the same line when graphed.
- Find and graph various solutions to an equation.

SAMPLE PROBLEMS *(From Lesson 22)*

A faucet leaks at a constant rate of 7 gallons per hour. Suppose y gallons leak in x hours. Express the situation as a linear equation in two variables.

$\frac{y}{x} = 7$ ***or*** $y = 7x$

Another faucet leaks at a constant rate, and the table below shows the number of gallons, y, that leak in x hours.

Number of Hours (x)	Number of Gallons (y)
2	13
4	26
7	45.5
10	65

Determine the rate at which the second faucet leaks.

Let m represent the rate at which this faucet leaks in gallons per hour.

$$m = \frac{(26 - 13)}{(4 - 2)}$$

$$m = \frac{13}{2}$$

$$m = 6.5$$

The second faucet leaks at a rate of 6.5 gallons per hour.

Which faucet has the worse leak? That is, which faucet leaks more water over a given time interval?

The first faucet has the worse leak because the rate is greater: 7 gallons per hour compared to 6.5 gallons per hour.

Additional sample problems with detailed answer steps are found in the *Eureka Math Homework Helpers* books. Learn more at GreatMinds.org.

EUREKA MATH™ TIPS FOR PARENTS

KEY CONCEPT OVERVIEW

In Topic D, students continue their work with linear equations by exploring **simultaneous equations (systems of equations)** using graphs, as well as multiple algebraic methods. Students discover that, as with linear equations in one variable, a system can have a unique solution, no solution, or infinitely many solutions. Topic E extends systems of equations to an application of the **Pythagorean theorem**.

You can expect to see homework that asks your child to do the following:

- Write a system of equations for situations involving constant rate.
- Graph a system of equations and interpret the point where the lines intersect as the solution to the system.
- Substitute numbers for specific variables to verify the solution for simultaneous equations.
- Determine whether a system has a unique solution, no solution, or infinitely many solutions.
- Solve simultaneous equations by using the computational methods of elimination and substitution. (See Sample Problem.)
- Apply techniques for solving systems of equations to real-life situations, including finding **Pythagorean triples**.

SAMPLE PROBLEM *(From Lesson 28)*

Determine the solution to the system of equations by eliminating one of the variables. Verify the solution using the graph of the system.
$$\begin{cases} x-4y=7 \\ 5x+9y=6 \end{cases}$$

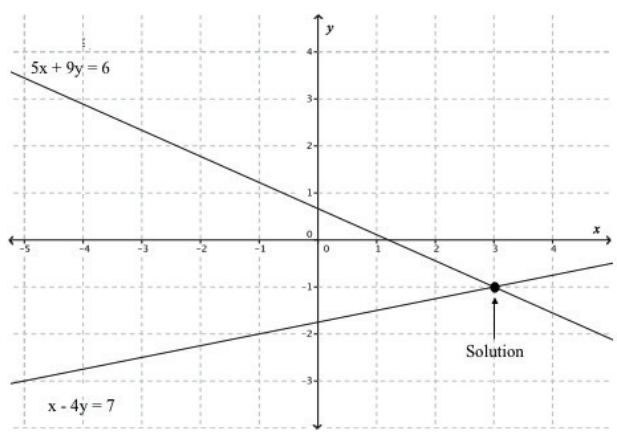
Transform one of the equations to create inverses that will cancel or eliminate one of the variables.

$$-5(x-4y)=-5(7)$$
$$-5x+20y=-35$$

Now there is a new system where one of the variables will eliminate.

$$\begin{cases} -5x+20y=-35 \\ 5x+9y=6 \end{cases}$$
$$-5x+20y+5x+9y=-35+6$$
$$29y=-29$$
$$y=-1$$
$$x-4y=7$$
$$x-4(-1)=7$$
$$x+4=7$$
$$x=3$$

***The solution is* (3, −1).**



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EUREKA MATH™ TIPS FOR PARENTS

KEY CONCEPT OVERVIEW

In this topic, students learn the concept of a **function**, its formal definition, and how it works as an input–output machine. For example, if the function is *multiply by 5*, the output will always equal the input times 5. Students learn that the equation $y = mx + b$ defines a **linear function** whose graph is a straight line, and that a **nonlinear function** is a set of ordered pairs that graph as something other than a straight line. Students begin comparing two functions represented in different ways. For example, students are presented with an equation, a word problem, the **graph of a function**, and the **table of values** that represent a function and are asked to determine which function has the greatest **rate of change**.

You can expect to see homework that asks your child to do the following:

- Interpret the graph of a function to identify key features, including whether the function is linear or nonlinear.
- Find the **average rate of change**.
- Determine whether a given representation represents a function, and create representations of real-world functions. For example, the water flowing from a faucet into a bathtub is a linear function with relation to time if the flow of water is constant.
- Create a rule (an equation) that represents a function.
- Identify whether a function is **discrete** or **not discrete**.
- Determine **restrictions on the variables**.
- Compare functions and determine which has the greater rate of change.

SAMPLE PROBLEMS *(From Lesson 5)*

The distance that Giselle runs is a function of the amount of time she spends running. Giselle runs 3 miles in 21 minutes. Assume she runs at a constant rate.

a. Write an equation in two variables that represents the distance she ran, y, as a function of the time she spent running, x.

$$\frac{3}{21} = \frac{y}{x}$$
$$y = \frac{1}{7}x$$

b. Use the equation you wrote in part (a) to determine how many miles Giselle can run in 28 minutes.

$$y = \frac{1}{7}(28)$$
$$y = 4$$

Giselle can run 4 miles in 28 minutes.

c. Is the function discrete?

The function is not discrete because we can find the distance Giselle runs for any given amount of time she spends running (e.g., 10.2 minutes).

Additional sample problems with detailed answer steps are found in the *Eureka Math Homework Helpers* books. Learn more at GreatMinds.org.

EUREKA MATH™ TIPS FOR PARENTS

KEY CONCEPT OVERVIEW

In this topic, students begin to think of **volume** as the area of two or more two-dimensional shapes stacked on one another. They develop the general **formulas for the volume** of cones, cylinders, and spheres. Students explore how cones, cylinders, and spheres are related and discover that the volume of a cone is one-third the volume of a cylinder with the same dimensions. They also discover that the volume of a sphere is two-thirds the volume of the cylinder that fits tightly around it. Students use these new formulas to solve real-world and mathematical problems related to volume. Please note that in this topic the terms *cylinder* and *cone* generally refer to a right circular cylinder and a right circular cone.

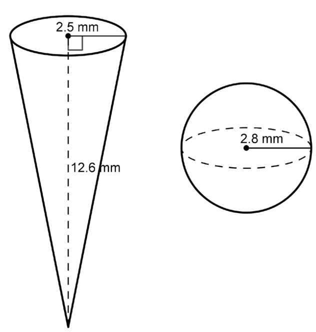
To LEARN MORE by viewing videos about comparing volumes, visit eurmath.link/volume-sphere and eurmath.link/volume-cone.

You can expect to see homework that asks your child to do the following:

- Find the area of two-dimensional figures, including those composed of many shapes.
- Find the volume of three-dimensional figures, including those composed of many **solids**.
- Determine how many of one solid it will take to fill another.
- Identify which solid has a greater volume.

SAMPLE PROBLEMS *(From Lesson 11)*

Use the diagram to answer the problems.



a. Predict which of the figures has the greater volume. Explain.

Student answers will vary. Students will probably say the cone has a greater volume because it looks larger.

b. Find the volume of each figure and determine which has the greater volume.

$V = \frac{1}{3}\pi r^2 h$

$V = \frac{1}{3}\pi (2.5)^2 (12.6)$

$V = 26.25\pi$

The volume of the cone is 26.25π **mm³**.

$V = \frac{4}{3}\pi r^3$

$V = \frac{4}{3}\pi (2.8)^3$

$V = 29.\overline{269}\pi$

The volume of the sphere is about 29.27π **mm³**.

The volume of the sphere is greater than the volume of the cone.

Additional sample problems with detailed answer steps are found in the *Eureka Math Homework Helpers* books. Learn more at GreatMinds.org.

EUREKA MATH™ TIPS FOR PARENTS

KEY CONCEPT OVERVIEW

In this topic, students continue to investigate **functions** by connecting a context (word problem) to a set of ordered pairs that model the function at certain inputs. These ordered pairs are then organized in tables and graphs that visually represent the functions. Students discover the relationship between **slope** and rate of change as well as between the y-intercept point and the **initial value** of linear functions. Further investigation leads to determining whether a function represents an **increasing**, **decreasing**, or **constant** relationship. Students close this topic by using graphs and verbal descriptions to explore nonlinear functions.

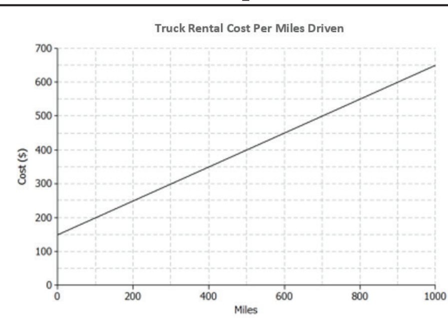
To LEARN MORE by viewing a video about graphing functions, visit eurmath.link/graph-functions.

You can expect to see homework that asks your child to do the following:

- Construct or interpret a table of values, a graph, or an equation that models a linear function.
- Interpret the meaning of values from equations, tables, or graphs in the context of a verbal description.
- Identify which function has a faster rate, steeper slope, or better value.
- Determine the **rate of change** and initial value of a function based on a variety of representations.
- Determine whether a function represents an increasing, decreasing, or constant relationship.
- Explore nonlinear functions by using graphs and verbal descriptions.

SAMPLE PROBLEM *(From Lesson 3)*

Based on the verbal description, create a table, a graph, and an equation.

<table>
<tr><th>Verbal Description</th><th>Table of Values</th><th>Graph</th><th>Equation</th></tr>
<tr>
<td>A truck rental company charges a $150 rental fee in addition to a charge of $0.50 per mile driven. Allow C to represent the total cost of the rental in dollars and m the number of miles driven.</td>
<td>
<table>
<tr><th>Miles Driven</th><th>Total Cost, in dollars</th></tr>
<tr><td>0</td><td>150</td></tr>
<tr><td>200</td><td>250</td></tr>
<tr><td>400</td><td>350</td></tr>
<tr><td>600</td><td>450</td></tr>
<tr><td>800</td><td>550</td></tr>
<tr><td>1000</td><td>650</td></tr>
</table>
</td>
<td>
</td>
<td>$C = 150 + 0.50m$</td>
</tr>
</table>

Additional sample problems with detailed answer steps are found in the *Eureka Math Homework Helpers* books. Learn more at GreatMinds.org.

EUREKA MATH™ TIPS FOR PARENTS

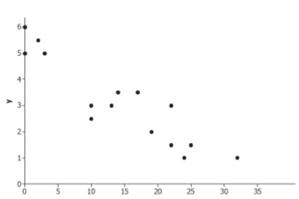
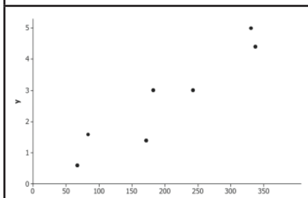
KEY CONCEPT OVERVIEW

In this topic, students connect their study of linear functions to applications involving **bivariate data sets**. A key tool in developing this connection is a **scatter plot**. Students construct scatter plots and focus on identifying linear versus **nonlinear relationships**. Students describe **trends** in the scatter plot, including linear **association**, **clusters**, and **outliers**. Students informally (i.e., without extreme precision) draw a straight line that best represents the data in a scatter plot.

You can expect to see homework that asks your child to do the following:

- Construct and interpret a scatter plot and determine the statistical relationship (e.g., **increasing** or **decreasing**) of the data.
- Identify clusters and outliers in a scatter plot.
- Draw a straight line that fits the data in a scatter plot and use it to make predictions about the data.
- Find the equation of the line that fits the data in a scatter plot.
- Match the equation of a line with the scatter plot that best represents that line.

SAMPLE PROBLEMS *(From Lesson 7)*

	Is there a relationship between the two variables used to make the scatter plot? If so, explain the relationship.	If there is a relationship, does it appear to be linear or nonlinear?	If the relationship appears to be linear, is the relationship a **positive linear relationship** or a **negative linear relationship**?
	***Yes, as the value of x increases, the value of y decreases.***	***Linear***	***Negative linear relationship***
	***Yes, as the value of x increases, the value of y increases.***	***Linear***	***Positive linear relationship***

(table continued on next page)

EUREKA MATH™ TIPS FOR PARENTS

KEY CONCEPT OVERVIEW

In this topic, students interpret and use **linear models** to provide explanations for how one variable changes in relation to the other variable for linear and nonlinear associations. Students use scatter plots to describe patterns of positive and negative associations. Students also use graphs and the patterns of linear associations to answer questions about the relationship of the data, including finding the equation of the line that best fits the data.

You can expect to see homework that asks your child to do the following:

- Using descriptive words, write a linear model describing the relationship between two variables. (See Sample Problems.)
- Write an equation, in symbols, that models a given context.
- Interpret the slope and y-intercept of an equation within the context of a problem. Draw a scatter plot and line that best fit the data given.
- Determine whether scattered data are best fit with the graph of a line or a curve. Draw the line or curve to model the data.

SAMPLE PROBLEMS *(From Lesson 10)*

A cell phone company offers the following basic cell phone plan to its customers: A customer pays a monthly fee of \$40.00. In addition, the customer pays \$0.15 per text message sent from the cell phone. There is no limit to the number of text messages per month that the customer can send, and there is no charge for receiving text messages.

1. Use descriptive words to write a linear model describing the relationship between the number of text messages sent and the total monthly cost.

Total monthly cost **= \$40.00 +** ***(number of text messages)*** **· \$0.15**

2. Let x represent the **independent variable** and y represent the **dependent variable**. Use these variables to write the function representing the relationship you described in Problem 1.

$y = 40 + 0.15x$ ***or*** $y = 0.15x + 40$

3. During a typical month, Abbey sends 25 text messages. What is her total cost for a typical month?

Abbey's typical monthly cost is **\$40.00 + 0.15(25),** ***or*** **\$43.75.**

Additional sample problems with detailed answer steps are found in the *Eureka Math Homework Helpers* books. Learn more at GreatMinds.org.

EUREKA MATH™ TIPS FOR PARENTS

KEY CONCEPT OVERVIEW

This topic extends the concept of a relationship between variables to **bivariate categorical data**. Students organize bivariate categorical data in a two-way table. They calculate **row** and **column relative frequencies**, decide whether there is an **association** by examining the differences (or similarities), and interpret the frequencies in the context of problems. Students discover that when two categorical variables have an association, knowing the value of one variable can help them predict the value of the other variable.

You can expect to see homework that asks your child to do the following:

- Organize data in a two-way table.
- Calculate relative frequencies.
- Determine whether there is an association in the data.

SAMPLE PROBLEMS *(From Lesson 14)*

Below is a two-way table of row relative frequencies for preferred movie types based on gender.

	Movie Preference			
	Action	**Drama**	**Science Fiction**	**Comedy**
Female	0.25	0.325	0.033	0.392
Male	0.625	0.0125	0.2	0.1625

1. If you randomly select a female participant, would you predict that her favorite type of movie is action? If not, what would you predict and why?

I would not predict that a female participant's favorite type of movie is action. I would predict that a female participant is more likely to prefer comedy since it has the greatest row relative frequency in the female row.

2. Is there an association between the variables of gender and movie preference? Explain your answer.

Yes, there is an association because the row relative frequencies are not the same in each row in the table. If I know a participant's gender, I can use the highest row relative frequency to predict that participant's movie preference.

Additional sample problems with detailed answer steps are found in the *Eureka Math Homework Helpers* books. Learn more at GreatMinds.org.

EUREKA MATH™ TIPS FOR PARENTS

KEY CONCEPT OVERVIEW

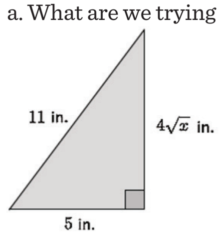
Welcome to the last module of Grade 8. In this topic, students are introduced to **irrational numbers**. As they continue using the Pythagorean theorem to determine side lengths of right triangles, students learn about **square roots** and about irrational numbers in general. Students have previously applied the Pythagorean theorem by using **perfect squares**. Now they learn to estimate the length of an unknown side of a right triangle by determining between which two perfect squares a squared number falls. This leads to the introduction of the notation and meaning of square roots. Students then solve simple equations that require them to find the square root or **cube root** of a number. They then solve multi-step equations by using the properties of equality to transform an equation until it is in the form $x^2 = p$ or $x^3 = p$, where they can use square roots or cube roots to calculate an answer.

You can expect to see homework that asks your child to do the following:

- Determine the length of one side of a right triangle by using the Pythagorean theorem.
- Determine which two **integers** a square root is between and to which integer it is closest.
- Estimate square roots and place them on a number line.
- Solve and check solutions to equations that can be converted to the form $x^2 = p$ or $x^3 = p$.

SAMPLE PROBLEM *(From Lesson 5)*

a. What are we trying to determine in the diagram?



Student work may vary.
We need to determine the value of x so that its square root, when multiplied by 4, satisfies the equation $5^2 + \left(4\sqrt{x}\right)^2 = 11^2$.

b. Determine the value of x. Then check your answer.

$$5^2 + (4\sqrt{x})^2 = 11^2$$
$$25 + 4^2(\sqrt{x})^2 = 121$$
$$25 + 16x = 121$$
$$25 - 25 + 16x = 121 - 25$$
$$16x = 96$$
$$\left(\frac{1}{16}\right)16x = \left(\frac{1}{16}\right)96$$
$$x = 6$$

The value of x is 6.

Check:
$$5^2 + (4\sqrt{x})^2 = 11^2$$
$$5^2 + (4\sqrt{6})^2 = 11^2$$
$$25 + 16(6) = 121$$
$$25 + 96 = 121$$
$$121 = 121$$

Additional sample problems with detailed answer steps are found in the *Eureka Math Homework Helpers* books. Learn more at GreatMinds.org.

EUREKA MATH™ TIPS FOR PARENTS

KEY CONCEPT OVERVIEW

In this topic, students learn that every number has a **decimal expansion** that is either **finite** (ending) or infinite (never-ending). Students learn many strategies for writing a fraction as a decimal and vice versa. Students then work with infinite decimals such as $0.33333\ldots$ and $0.78146925\ldots$. This work prepares students for understanding how to approximate an irrational number. Students realize that irrational numbers are different from **rational numbers** because irrational numbers have infinite decimal expansions that do not have a repeating block of numbers. Therefore, the value of an irrational number can only be estimated; it cannot be stated exactly. Students then use a number line to compare the estimated value of an irrational number with a rational number in the form of a fraction, decimal, perfect square, or perfect cube. Finally, students approximate pi (π), the most famous irrational number, by using the area of a quarter circle that is drawn on grid paper. Students use this approximation to determine the approximate values of expressions involving π.

You can expect to see homework that asks your child to do the following:

- Convert fractions to finite or infinite decimals and vice versa.
- Write the **expanded form of a decimal** by using powers of 10.
- Approximate an infinite decimal, identify the size of error in the approximation, and find the decimal's location on a number line.
- Determine whether a number is rational or irrational.
- Approximate irrational square roots and cube roots.
- Order a group of rational and irrational numbers and graph those values (or approximations) on a number line.
- Approximate π and use that approximation in calculations.

SAMPLE PROBLEM *(From Lesson 11)*

Between which two consecutive hundredths does $\sqrt{14}$ lie? Show your work.

The number $\sqrt{14}$ lies between the consecutive hundredths of 3.74 and 3.75.

To begin, the number $\sqrt{14}$ is between 3 and 4 because $3^2 < \left(\sqrt{14}\right)^2 < 4^2$. I then checked the tenths intervals between 3 and 4. Since $\left(\sqrt{14}\right)^2$ is closer to 4^2, I began with 3.9 to 4.0. The number $\sqrt{14}$ is not between those values, so I moved to 3.8 and 3.9. That interval did not work either. The number $\sqrt{14}$ is actually between 3.7 and 3.8 because $3.7^2 = 13.69$ and $3.8^2 = 14.44$. Then I looked at the hundredths intervals between 3.7 and 3.8. Since $\left(\sqrt{14}\right)^2$ is closer to 3.7^2, I began with the interval 3.70 to 3.71. It is not between those values; $\sqrt{14}$ is actually between 3.74 and 3.75 because $3.74^2 = 13.9876$ and $3.75^2 = 14.0625$.

Additional sample problems with detailed answer steps are found in the *Eureka Math Homework Helpers* books. Learn more at GreatMinds.org.

EUREKA MATH™ TIPS FOR PARENTS

KEY CONCEPT OVERVIEW

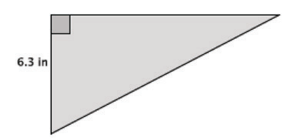
Building on students' new knowledge of square roots, this topic introduces another proof of the Pythagorean theorem (if a triangle is a right triangle, then $a^2 + b^2 = c^2$) and its converse (if $a^2 + b^2 = c^2$, then the triangle is a right triangle). Students learn to determine the approximate length of a side of a right triangle, even when the length is not a whole number. Students also practice explaining proofs in their own words, and they apply the converse of the Pythagorean theorem to make informal arguments about whether certain triangles are right triangles. To finish the topic, students focus on applications of the Pythagorean theorem. They calculate the distance between two points on a diagonal line in the coordinate plane and apply the theorem to a variety of other mathematical and real-world scenarios.

You can expect to see homework that asks your child to do the following:

- Use similar triangles to illustrate the Pythagorean theorem in particular situations.
- Use the Pythagorean theorem to find the unknown length of a side of a right triangle.
- Use the converse of the Pythagorean theorem to determine whether a triangle is a right triangle.
- Find the distance between two points on the coordinate plane.
- Use the Pythagorean theorem in a variety of mathematical and real-world scenarios.

SAMPLE PROBLEM *(From Lesson 18)*

The area of the right triangle shown is 26.46 in². What is the perimeter of the right triangle? Round your answer to the tenths place.



Let b inches represent the length of the base of the triangle.

Let h inches represent the height of the triangle, where $h = 6.3$.

$$A = \frac{bh}{2}$$
$$26.46 = \frac{6.3b}{2}$$
$$(2)26.46 = (2)\frac{6.3b}{2}$$
$$52.92 = 6.3b$$
$$\frac{52.92}{6.3} = \frac{6.3b}{6.3}$$
$$8.4 = b$$

Let c inches represent the length of the hypotenuse.

$$6.3^2 + 8.4^2 = c^2$$
$$39.69 + 70.56 = c^2$$
$$110.25 = c^2$$
$$\sqrt{110.25} = \sqrt{c^2}$$
$$\sqrt{110.25} = c$$

The number $\sqrt{110.25}$ is between 10 and 11. When comparing with tenths, the number is actually equal to 10.5 because $10.5^2 = 110.25$. Therefore, the length of the hypotenuse is 10.5 inches.

The perimeter of the triangle is
6.3 in. + 8.4 in. + 10.5 in. = 25.2 in.

Additional sample problems with detailed answer steps are found in the *Eureka Math Homework Helpers* books. Learn more at GreatMinds.org.

EUREKA MATH™ TIPS FOR PARENTS

KEY CONCEPT OVERVIEW

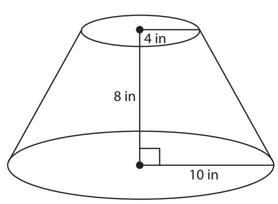
In this topic, students use the Pythagorean theorem to determine an unknown dimension (e.g., radius, **lateral length/slant height**) of a cone or a sphere, given the length of a **chord**, and to find the volume or surface area of a figure by using that dimension. Students are introduced to **truncated cones** and calculate their volumes. Students also learn that the volume of a pyramid is exactly one-third the volume of a rectangular prism with the same base area and height. In addition, students determine the volumes of **composite solids** composed of cylinders, cones, and spheres. Students then apply their knowledge of volume to compute the average rate of change in the height of the water level when water drains into a cone-shaped container. The lessons in this topic challenge students to reason while making sense of problems. Students apply their knowledge of concepts they have learned throughout the year to persevere in solving problems.

You can expect to see homework that asks your child to do the following:

- Use the Pythagorean theorem to find unknown lengths of segments in three-dimensional figures.
- Find the volume and surface area of a variety of solids, including composite solids.
- Use similar triangles to find unknown lengths of segments in pyramids and truncated cones.
- Using knowledge of volume, determine the number of minutes it would take to fill a particular three-dimensional figure.

SAMPLE PROBLEM *(From Lesson 20)*

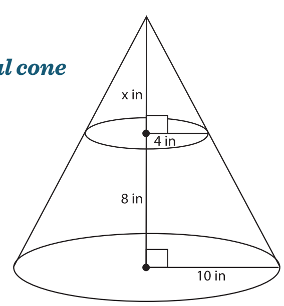
Determine the volume of the truncated cone shown below.



Let x inches represent the height of the small cone on top of the truncated cone.

$$\frac{4}{10} = \frac{x}{x+8}$$
$$4(x+8) = 10x$$
$$4x + 32 = 10x$$
$$32 = 6x$$
$$\frac{32}{6} = \frac{6x}{6}$$
$$5.\overline{3} = x$$

We must use the original cone to determine the height.



The volume of the whole cone is approximately $\frac{1}{3}\pi(10)^2(13.3)\text{in}^3$ ***or*** $\frac{1330}{3}\pi\ \text{in}^3$.