Family Support Materials

Scale Drawings

Here are the video lesson summaries for Grade 7, Unit 1 Scale Drawings. Each video highlights key concepts and vocabulary that students learn across one or more lessons in the unit. The content of these video lesson summaries is based on the written Lesson Summaries found at the end of lessons in the curriculum. The goal of these videos is to support students in reviewing and checking their understanding of important concepts and vocabulary. Here are some possible ways families can use these videos:

- Keep informed on concepts and vocabulary students are learning about in class.
- Watch with their student and pause at key points to predict what comes next or think up other examples of vocabulary terms (the bolded words).
- Consider following the Connecting to Other Units links to review the math concepts that led up to this unit or to preview where the concepts in this unit lead to in future units.

Grade 7, Unit 1 Scale Drawings	Vimeo	YouTube
Video 1: Scaled Copies (Lessons 1–4)	Link	Link
Video 2: More about Scale Factor (Lessons 5–6)	Link	Link
Video 3: What are Scaled Drawings (Lessons 7–9, 11)	Link	Link
Video 4: Scale Drawings with Different Scales (Lessons 10 and 12)	Link	Link

Video 1

Video 'VLS G7U1V1 Scaled Copies (Lessons 1–4)' available here: https://player.vimeo.com/video/442940614.

Video 2

Video 'VLS G7U1V2 More about Scale Factor (Lessons 5–6)' available here: https://player.vimeo.com/video/442941809.

Video 3

Video 'VLS G7U1V3 What are Scaled Drawings (Lessons 7–9, 11)' available here: https://player.vimeo.com/video/443567589.

Video 4

Video 'VLS G7U1V4 Scale Drawings with Different Scales (Lessons 10 and 12)' available here: https://player.vimeo.com/video/443579195.

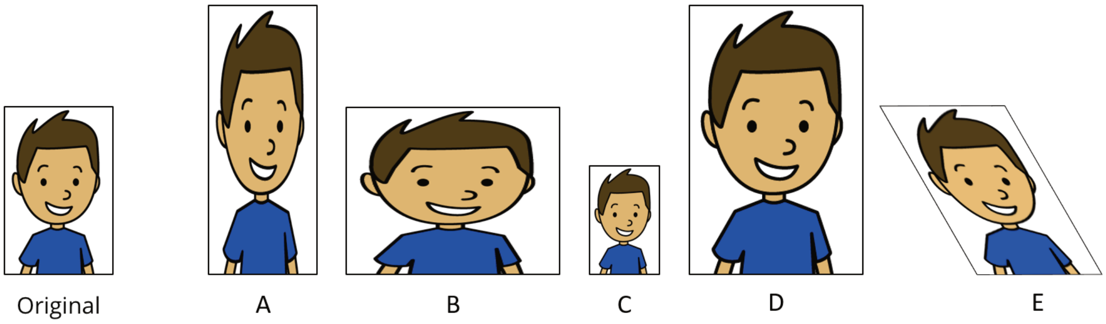
Connecting to Other Units

- *Coming soon*

Scaled Copies

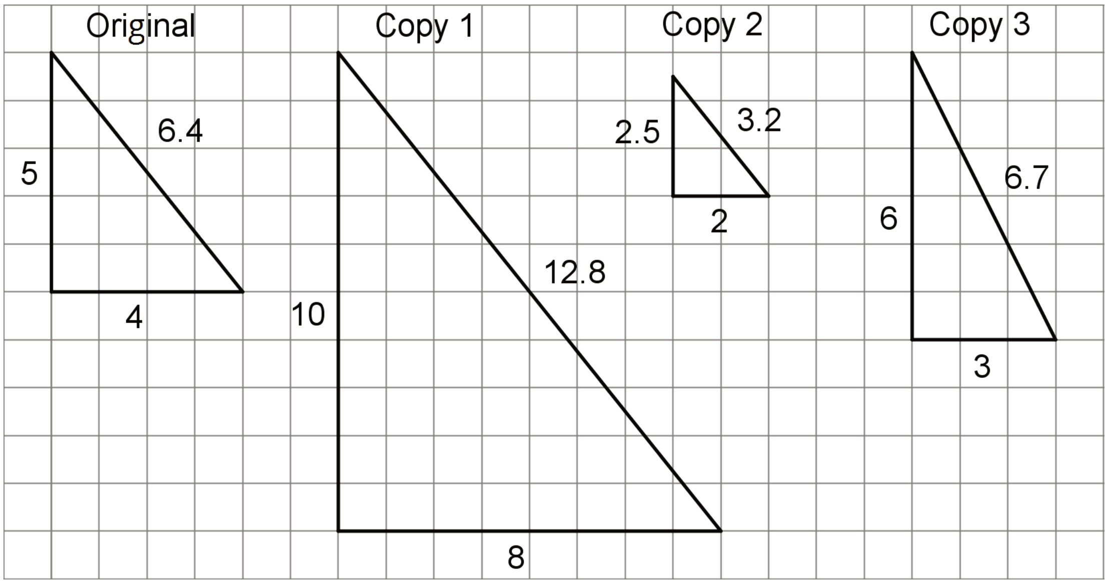
Family Support Materials 1

This week your student will learn about scaling shapes. An image is a **scaled copy** of the original if the shape is stretched in a way that does not distort it. For example, here is an original picture and five copies. Pictures C and D are scaled copies of the original, but pictures A, B, and E are not.



In each scaled copy, the sides are a certain number of times as long as the corresponding sides in the original. We call this number the **scale factor**. The size of the scale factor affects the size of the copy. A scale factor greater than 1 makes a copy that is larger than the original. A scale factor less than 1 makes a copy that is smaller.

Here is a task to try with your student:



1. For each copy, tell whether it is a scaled copy of the original triangle. If so, what is the scale factor?

2. Draw another scaled copy of the original triangle using a different scale factor.

Solution:

1. a. Copy 1 is a scaled copy of the original triangle. The scale factor is 2, because each side in Copy 1 is twice as long as the corresponding side in the original triangle. $5 \cdot 2 = 10$, $4 \cdot 2 = 8$, $(6.4) \cdot 2 = 12.8$

   b. Copy 2 is a scaled copy of the original triangle. The scale factor is $\frac{1}{2}$ or 0.5, because each side in Copy 2 is half as long as the corresponding side in the original triangle. $5 \cdot (0.5) = 2.5$, $4 \cdot (0.5) = 2$, $(6.4) \cdot (0.5) = 3.2$

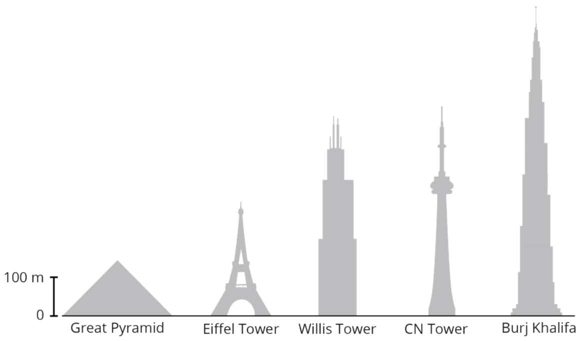
   c. Copy 3 is not a scaled copy of the original triangle. The shape has been distorted. The angles are different sizes and there is not one number we can multiply by each side length of the original triangle to get the corresponding side length in Copy 3.

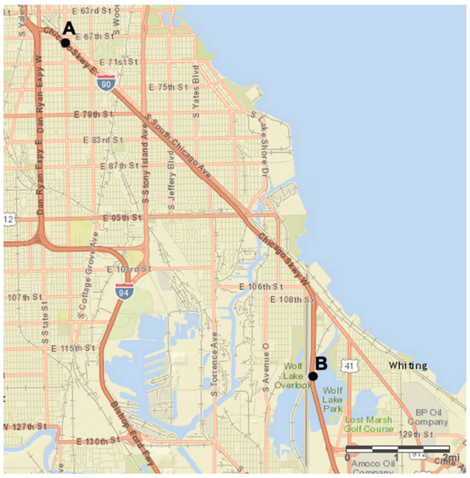
2. Answers vary. Sample response: A right triangle with side lengths of 12, 15, and 19.2 units would be a scaled copy of the original triangle using a scale factor of 3.

Scale Drawings

Family Support Materials 2

This week your student will be learning about scale drawings. A **scale drawing** is a two-dimensional representation of an actual object or place. Maps and floor plans are some examples of scale drawings.





The **scale** tells us what some length on the scale drawing represents in actual length. For example, a scale of "1 inch to 5 miles" means that 1 inch on the drawing represents 5 actual miles. If the drawing shows a road that is 2 inches long, we know the road is actually $2 \cdot 5$, or 10 miles long.

Scales can be written with units (e.g. 1 inch to 5 miles), or without units (e.g., 1 to 50, or 1 to 400). When a scale does not have units, the same unit is used for distances on the scale drawing and actual distances. For example, a scale of "1 to 50" means 1 centimeter on the drawing represents 50 actual centimeters,1 inch represents 50 inches, etc.

Here is a task to try with your student:

Kiran drew a floor plan of his classroom using the scale 1 inch to 6 feet.

1. Kiran's drawing is 4 inches wide and $5\frac{1}{2}$ inches long. What are the dimensions of the actual classroom?
2. A table in the classroom is 3 feet wide and 6 feet long. What size should it be on the scale drawing?

3. Kiran wants to make a larger scale drawing of the same classroom. Which of these scales could he use?
    a. 1 to 50
    b. 1 to 72
    c. 1 to 100

Solution:

1. 24 feet wide and 33 feet long. Since each inch on the drawing represents 6 feet, we can multiply by 6 to find the actual measurements. The actual classroom is 24 feet wide because $4 \cdot 6 = 24$. The classroom is 33 feet long because $5\frac{1}{2} \cdot 6 = 5 \cdot 6 + \frac{1}{2} \cdot 6 = 30 + 3 = 33$.
2. $\frac{1}{2}$ inch wide and 1 inch long. We can divide by 6 to find the measurements on the drawing. $6 \div 6 = 1$ and $3 \div 6 = \frac{1}{2}$.
3. A, 1 to 50. The scale “1 inch to 6 feet” is equivalent to the scale “1 to 72,” because there are 72 inches in 6 feet. The scale “1 to 100” would make a scale drawing that is smaller than the scale “1 to 72,” because each inch on the new drawing would represent more actual length. The scale “1 to 50” would make a scale drawing that is larger than the scale “1 to 72,” because Kiran would need more inches on the drawing to represent the same actual length.

Family Support Materials

Introducing Proportional Relationships

Here are the video lesson summaries for Grade 7, Unit 2: Introducing Proportional Relationships. Each video highlights key concepts and vocabulary that students learn across one or more lessons in the unit. The content of these video lesson summaries is based on the written Lesson Summaries found at the end of lessons in the curriculum. The goal of these videos is to support students in reviewing and checking their understanding of important concepts and vocabulary. Here are some possible ways families can use these videos:

- Keep informed on concepts and vocabulary students are learning about in class.
- Watch with their student and pause at key points to predict what comes next or think up other examples of vocabulary terms (the bolded words).
- Consider following the Connecting to Other Units links to review the math concepts that led up to this unit or to preview where the concepts in this unit lead to in future units.

Grade 7, Unit 2: Introducing Proportional Relationships	Vimeo	YouTube
Video 1: Representing Proportional Relationships with Tables (Lessons 2–3)	Link	Link
Video 2: Representing Proportional Relationships with Equations (Lessons 4–6)	Link	Link
Video 3: Comparing Proportional and Nonproportional Relationships (Lessons 7–8)	Link	Link
Video 4: Representing Proportional Relationships with Graphs (Lessons 10–13)	Link	Link

Video 1

Video 'VLS G7U2V1 Representing Proportional Relationships with Tables (Lessons 2–3)' available here: https://player.vimeo.com/video/448929694.

Video 2

Video 'VLS G7U2V2 Representing Proportional Relationships with Equations (Lessons 4–6)' available here: https://player.vimeo.com/video/452381809.

Video 3

Video 'VLS G7U2V3 Comparing Proportional and Nonproportional Relationships (Lessons 7–8)' available here: https://player.vimeo.com/video/452389946.

Video 4

Video 'VLS G7U2V4 Representing Proportional Relationships with Graphs (Lessons 10–13)' available here: https://player.vimeo.com/video/455063345.

Connecting to Other Units

- *Coming soon*

Representing Proportional Relationships with Tables

Family Support Materials 1

This week your student will learn about proportional relationships. This builds on the work they did with equivalent ratios in grade 6. For example, a recipe says "for every 5 cups of grape juice, mix in 2 cups of peach juice." We can make different-sized batches of this recipe that will taste the same.

grape juice (cups)	peach juice (cups)
5	2
10	4
30	12
2.5	1

The amounts of grape juice and peach juice in each of these batches form equivalent ratios.

The relationship between the quantities of grape juice and peach juice is a **proportional relationship**. In a table of a proportional relationship, there is always some number that you can multiply by the number in the first column to get the number in the second column for any row. This number is called the **constant of proportionality.**

In the fruit juice example, the constant of proportionality is 0.4. There are 0.4 cups of peach juice per cup of grape juice.

grape juice (cups)	peach juice (cups)
5	2
10	4
30	12
2.5	1

Here is a task you can try with your student:

Using the recipe "for every 5 cups of grape juice, mix in 2 cups of peach juice"

1. How much peach juice would you mix with 20 cups of grape juice?

2. How much grape juice would you mix with 20 cups of peach juice?

Solution:

1. 8 cups of peach juice. Sample reasoning: We can multiply any amount of grape juice by 0.4 to find the corresponding amount of peach juice, $20 \cdot (0.4) = 8$.

2. 50 cups of grape juice. Sample reasoning: We can *divide* any amount of peach juice by 0.4 to find the corresponding amount of grape juice, $20 \div 0.4 = 50$.

Representing Proportional Relationships with Equations

Family Support Materials 2

This week your student will learn to write equations that represent proportional relationships. For example, if each square foot of carpet costs \$1.50, then the cost of the carpet is proportional to the number of square feet.

The *constant of proportionality* in this situation is 1.5. We can multiply by the constant of proportionality to find the cost of a specific number of square feet of carpet.

carpet (square feet)	cost (dollars)	
10	15.00	$\cdot 1.5$
20	30.00	$\cdot 1.5$
50	75.00	$\cdot 1.5$

We can represent this relationship with the equation $c = 1.5f$, where f represents the number of square feet, and c represents the cost in dollars. Remember that the cost of carpeting is always the number of square feet of carpeting times 1.5 dollars per square foot. This equation is just stating that relationship with symbols.

The equation for any proportional relationship looks like $y = kx$, where x and y represent the related quantities and k is the constant of proportionality. Some other examples are $y = 4x$ and $d = \frac{1}{3}t$. Examples of equations that do not represent proportional relationships are $y = 4 + x$, $A = 6s^2$, and $w = \frac{36}{L}$.

Here is a task to try with your student:

1. Write an equation that represents that relationship between the amounts of grape juice and peach juice in the recipe "for every 5 cups of grape juice, mix in 2 cups of peach juice."

2. Select **all** the equations that could represent a proportional relationship:

   a. $K = C + 273$

   b. $s = \frac{1}{4}p$

   c. $V = s^3$

   d. $h = 14 - x$

e. $c = 6.28r$

Solution:

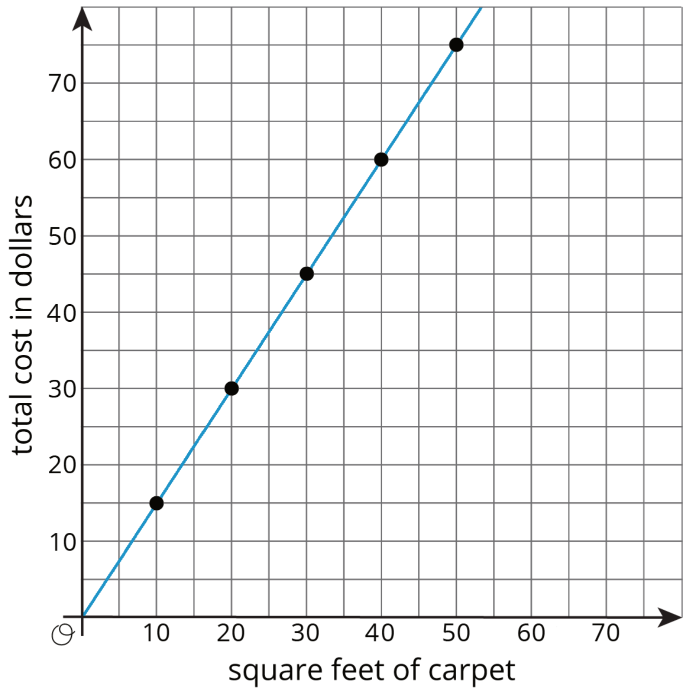
1. Answers vary. Sample response: If p represents the number of cups of peach juice and g represents the number of cups of grape juice, the relationship could be written as $p = 0.4g$. Some other equivalent equations are $p = \frac{2}{5}g$, $g = \frac{5}{2}p$, or $g = 2.5p$.

2. B and E. For the equation $s = \frac{1}{4}p$, the constant of proportionality is $\frac{1}{4}$. For the equation $c = 6.28r$, the constant of proportionality is 6.28.

Representing Proportional Relationships with Graphs

Family Support Materials 3

This week your student will work with graphs that represent proportional relationships. For example, here is a graph that represents a relationship between the amount of square feet of carpet purchased and the cost in dollars.

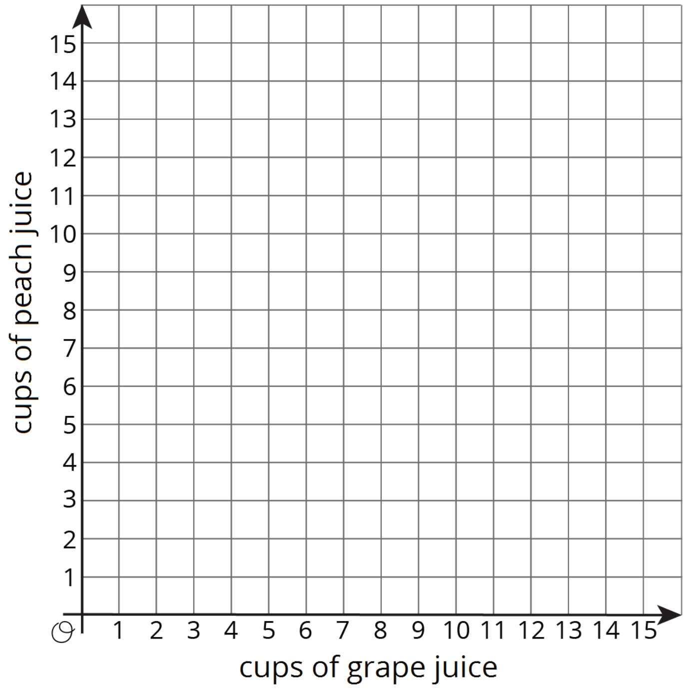


Each square foot of carpet costs $1.50. The point $(10, 15)$ on the graph tells us that 10 square feet of carpet cost $15.

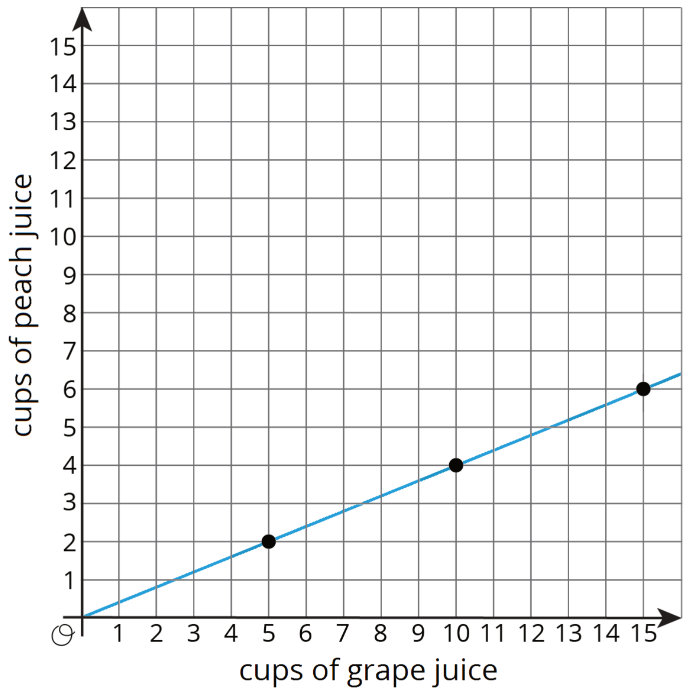
Notice that the points on the graph are arranged in a straight line. If you buy 0 square feet of carpet, it would cost $0. Graphs of proportional relationships are always parts of straight lines including the point $(0, 0)$.

Here is a task to try with your student:

Create a graph that represents the relationship between the amounts of grape juice and peach juice in different-sized batches of fruit juice using the recipe “for every 5 cups of grape juice, mix in 2 cups of peach juice.”


cups of peach juice
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
cups of grape juice

Solution:


cups of peach juice
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
cups of grape juice

Family Support Materials

Measuring Circles

Here are the video lesson summaries for Grade 7, Unit 3: Measuring Circles. Each video highlights key concepts and vocabulary that students learn across one or more lessons in the unit. The content of these video lesson summaries is based on the written Lesson Summaries found at the end of lessons in the curriculum. The goal of these videos is to support students in reviewing and checking their understanding of important concepts and vocabulary. Here are some possible ways families can use these videos:

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Grade 7, Unit 3: Measuring Circles	Vimeo	YouTube
Video 1: Measuring Relationships (Lesson 1)	Link	Link
Video 2: Circumference of a Circle (Lessons 2–5)	Link	Link
Video 3: Area of a Circle (Lessons 7–9)	Link	Link
Video 4: Distinguishing Circumference and Area (Lesson 10)	Link	Link

Video 1

Video 'VLS G7U3V1 Measuring Relationships (Lesson 1)' available here: https://player.vimeo.com/video/469037534.

Video 2

Video 'VLS G7U3V2 Circumference of a Circle (Lessons 2–5)' available here: https://player.vimeo.com/video/471194480.

Video 3

Video 'VLS G7U3V3 Area of a Circle (Lessons 7–9)' available here: https://player.vimeo.com/video/471419816.

Video 4

Video 'VLS G7U3V4 Distinguishing Circumference and Area (Lesson 10)' available here: https://player.vimeo.com/video/469897330.

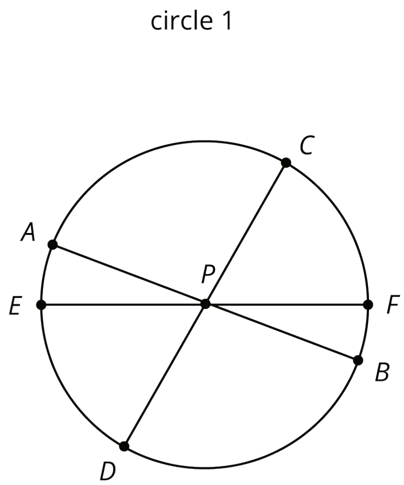
Connecting to Other Units

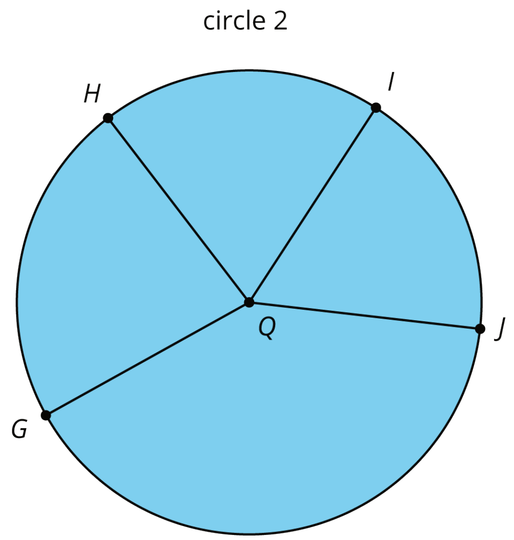
- *Coming soon*

Circumference of a Circle

Family Support Materials 1

This week your student will learn why circles are different from other shapes, such as triangles and squares. Circles are perfectly round because they are made up of all the points that are the same distance away from a center.





- This line segment from the center to a point on the circle is called the **radius**. For example, the segment from P to F is a radius of circle 1.
- The line segment between two points on the circle and through the center is called the **diameter.** It is twice the length of the radius. For example, the segment from E to F is a diameter of circle 1. Notice how segment EF is twice as long as segment PF.
- The distance around a circle is called the **circumference**. It is a little more than 3 times the length of the diameter. The exact relationship is $C = \pi d$, where π is a constant with infinitely many digits after the decimal point. One common approximation for π is 3.14.

We can use the proportional relationships between radius, diameter, and circumference to solve problems.

Here is a task to try with your student:

A cereal bowl has a diameter of 16 centimeters.

1. What is the *radius* of the cereal bowl?
    a. 5 centimeters

b. 8 centimeters

c. 32 centimeters

d. 50 centimeters

2. What is the *circumference* of the cereal bowl?
   a. 5 centimeters

   b. 8 centimeters

   c. 32 centimeters

   d. 50 centimeters

Solution:

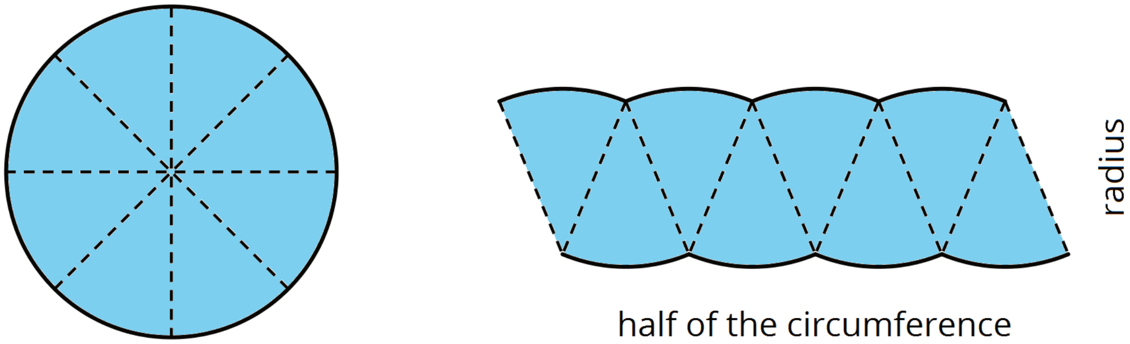
1. B, 8 centimeters. The diameter of a circle is twice the length of the radius, so the radius is half the length of the diameter. We can divide the diameter by 2 to find the radius. $16 \div 2 = 8$.

2. D, 50 centimeters. The circumference of a circle is π times the diameter. $16 \boldsymbol{\cdot} 3.14 \approx 50$.

Area of a Circle

Family Support Materials 2

This week your student will solve problems about the area inside circles. We can cut a circle into wedges and rearrange the pieces without changing the area of the shape. The smaller we cut the wedges, the more the rearranged shape looks like a parallelogram.



The area of a circle can be found by multiplying half of the circumference times the radius. Using $C = 2\pi r$ we can represent this relationship with the equation:

$$A = \frac{1}{2}(2\pi r) \cdot r$$

Or

$$A = \pi r^2$$

This means that if we know the radius, we can find the area. For example, if a circle has radius 10 cm, then the area is about 314 cm^2, because $3.14 \cdot 10^2 = 314$. We can also say that the area is 100π cm^2.

Here is a task to try with your student:

A rectangular wooden board, 20 inches wide and 40 inches long, has a circular hole cut out of it.

1. The diameter of the circle is 6 inches. What is the area?
2. What is the area of the board after the circle is removed?

Solution:

1. 9π or about 28.26 in^2. The radius of the hole is half of the diameter, so we can divide $6 \div 2 = 3$. The area of a circle can be calculated $A = \pi r^2$. For a radius of 3, we get $3^2 = 9$. We can write 9π or use 3.14 as an approximation of pi, $3.14 \cdot 9 = 28.26$.

2. $800 - 9\pi$ or about 771.74 in^2. Before the hole was cut out, the entire board had an area of $20 \cdot 40$ or 800 in^2. We can subtract the area of the missing part to get the area of the remaining board, $800 - 28.26 = 771.74$.

Family Support Materials

Proportional Relationships and Percentages

Here are the video lesson summaries for Grade 7, Unit 4: Proportional Relationships and Percentages. Each video highlights key concepts and vocabulary that students learn across one or more lessons in the unit. The content of these video lesson summaries is based on the written Lesson Summaries found at the end of lessons in the curriculum. The goal of these videos is to support students in reviewing and checking their understanding of important concepts and vocabulary. Here are some possible ways families can use these videos:

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Grade 7, Unit 4: Proportional Relationships and Percentages	Vimeo	YouTube
Video 1: Proportional Relationships with Fractions & Decimals (Lessons 4–5)	Link	Link
Video 2: Percent Increase and Decrease (Lessons 6–8)	Link	Link
Video 3: Applications of Percentages (Lessons 10–12)	Link	Link
Video 4: More Applications of Percentages (Lessons 14–15)	Link	Link

Video 1

Video 'VLS G7U4V1 Proportional Relationships with Fractions & Decimals (Lessons 4–5)' available here: https://player.vimeo.com/video/479532770.

Video 2

Video 'VLS G7U4V2 Percent Increase and Decrease (Lessons 6–8)' available here: https://player.vimeo.com/video/479533112.

Video 3

Video 'VLS G7U4V3 Applications of Percentages (Lessons 10–12)' available here: https://player.vimeo.com/video/479535287.

Video 4

Video 'VLS G7U4V4 More Applications of Percentages (Lessons 14–15)' available here: https://player.vimeo.com/video/480921819.

Connecting to Other Units

- *Coming soon*

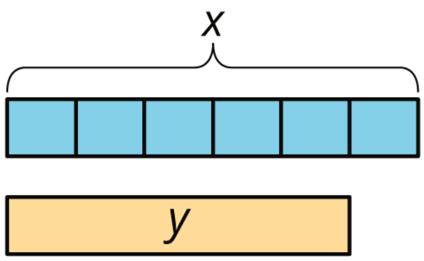
Proportional Relationships with Fractions

Family Support Materials 1

This week your student is learning about proportional relationships that involve fractions and decimals. For example, a baker decides to start using $\frac{1}{6}$ less than the amount of sugar called for in each recipe. If the recipe calls for 2 cups of sugar, the baker will leave out $\frac{1}{6} \cdot 2$, or $\frac{1}{3}$ cup of sugar. That means the baker will only use $2 - \frac{1}{3}$, or $1\frac{2}{3}$ cups of sugar.

amount of sugar in the recipe (x)	amount of sugar the baker uses (y)
1 cup	$\frac{5}{6}$ cup
$1\frac{1}{2}$ cups	$1\frac{1}{4}$ cups
2 cups	$1\frac{2}{3}$ cups

The amount of sugar the baker actually uses, y, is proportional to the amount of sugar called for in the recipe, x. The constant of proportionality is $\frac{5}{6}$.



$$y = x - \frac{1}{6}x$$

$$y = (1 - \frac{1}{6})x$$

$$y = \frac{5}{6}x$$

Another way to write this equation is $y = 0.8\overline{3}x$. The line above the 3 tells us that if we use long division to divide $5 \div 6$, we will keep getting the answer 3 over and over. This is an example of a **repeating decimal**.

Here is a task to try with your student:

The baker also decides to start using $\frac{1}{6}$ more than the amount of liquid called for in each recipe.

1. How much of each ingredient will the baker use if the recipe calls for:
    a. $1\frac{1}{2}$ cups of milk?

    b. 3 tablespoons of oil?

2. What is the constant of proportionality for the relationship between the amount of liquid called for in the recipe and the amount this baker uses?

Solution:

1. a. $1\frac{3}{4}$ cups.

   b. $3\frac{1}{2}$ tablespoons.

2. $\frac{7}{6}, 1.1\overline{6}$, or equivalent.

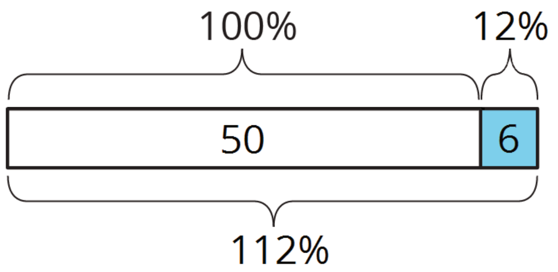
Percent Increase and Decrease

Family Support Materials 2

This week, your student is learning to describe increases and decreases as a percentage of the starting amount. For example, two different school clubs can gain the same number of students, but have different percent increases.

The cooking club had 50 students. Then they gained 6 students.

This is a 12% increase, because $6 \div 50 = 0.12$.

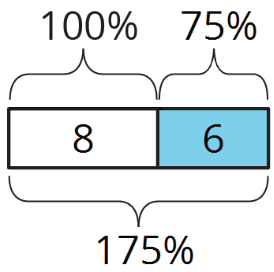


They now have 56 students, which is 112% of the starting amount.

$$1.12 \cdot 50 = 56$$

The computer club had 8 students. Then they gained 6 students.

This is a 75% increase, because $6 \div 8 = 0.75$.



They now have 14 students, which is 175% of the starting amount.

$$1.75 \cdot 8 = 14$$

Here is a task to try with your student:

The photography club had 20 students. Then the number of students increased by 35%. How many students are in the photography club now?

Solution:

27 students. Possible strategies:

- The club gained 7 new students, because $0.35 \cdot 20 = 7$. The club now has 27 students, because $20 + 7 = 27$.
- The club now has 135% as many students as they started with, because $100 + 35 = 135$. That means they have 27 students, because $1.35 \cdot 20 = 27$.

Applying Percentages

Family Support Materials 3

This week, your student is learning about real-world situations that use percent increase and percent decrease, such as tax, interest, mark-up, and discounts.

For example, the price tag on a jacket says $24. The customer must also pay a sales tax equal to 7.5% of the price. What is the total cost of the jacket, including tax?

$$24 \cdot 1.075 = 25.80$$

The customer will pay 107.5% of the price listed on the tag, which is $25.80.

We can also find the percentage. For example, a backpack originally cost $22.50, but is on sale for $18.99. The discount is what percentage of the original price?

$$\begin{aligned} 22.50x &= 18.99 \\ x &= 18.99 \div 22.50 \\ x &= 0.844 \end{aligned}$$

The sale price is 84.4% of the original price. The discount is $100 - 84.4$, or 15.6% of the original price.

Here is a task to try with your student:

A restaurant bill is $18.75. If you paid $22, what percentage tip did you leave for the server?

Solution:

$17.\overline{3}\%$. Possible strategy: You paid $117.\overline{3}\%$ of the bill, because $22 \div 18.75 = 1.17\overline{3}$. You left a $17.\overline{3}\%$ tip, because $117.\overline{3} - 100 = 17.\overline{3}$.

Family Support Materials

Rational Number Arithmetic

Here are the video lesson summaries for Grade 7, Unit 5: Rational Number Arithmetic. Each video highlights key concepts and vocabulary that students learn across one or more lessons in the unit. The content of these video lesson summaries is based on the written Lesson Summaries found at the end of lessons in the curriculum. The goal of these videos is to support students in reviewing and checking their understanding of important concepts and vocabulary. Here are some possible ways families can use these videos:

- Keep informed on concepts and vocabulary students are learning about in class.
- Watch with their student and pause at key points to predict what comes next or think up other examples of vocabulary terms (the bolded words).
- Consider following the Connecting to Other Units links to review the math concepts that led up to this unit or to preview where the concepts in this unit lead to in future units.

Grade 7, Unit 5: Rational Number Arithmetic	Vimeo	YouTube
Video 1: Adding Rational Numbers (Lessons 1–4)	Link	Link
Video 2: Subtracting Rational Numbers (Lessons 5–7)	Link	Link
Video 3: Multiplying and Dividing Rational Numbers (Lessons 8–11)	Link	Link
Video 4: Solving With Rational Numbers (Lessons 12–16)	Link	Link

Video 1

Video 'VLS G7U5V1 Adding Rational Numbers (Lessons 1–4)' available here: https://player.vimeo.com/video/494808053.

Video 2

Video 'VLS G7U5V2 Subtracting Rational Numbers (Lessons 5–7)' available here: https://player.vimeo.com/video/495520145.

Video 3

Video 'VLS G7U5V3 Multiplying and Dividing Rational Numbers (Lessons 8–11)' available here: https://player.vimeo.com/video/503252065.

Video 4

Video 'VLS G7U5V4 Solving With Rational Numbers (Lessons 12–16)' available here: https://player.vimeo.com/video/503606703.

Connecting to Other Units

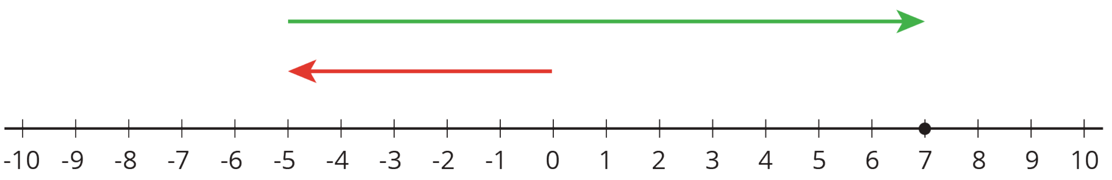
- *Coming soon*

Adding and Subtracting Rational Numbers

Family Support Materials 1

This week your student will be adding and subtracting with negative numbers. We can represent this on a number line using arrows. The arrow for a positive number points right, and the arrow for a negative number points left. We add numbers by putting the arrows tail to tip.

For example, here is a number line that shows $-5 + 12 = 7$.



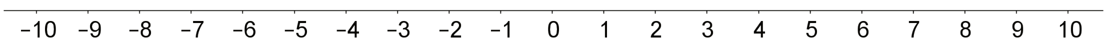
The first number is represented by an arrow that starts at 0 and points 5 units to the left. The next number is represented by an arrow that starts directly above the tip of the first arrow and points 12 units to the right. The answer is 7 because the tip of this arrow ends above the 7 on the number line.

In elementary school, students learned that every addition equation has two related subtraction equations. For example, if we know $3 + 5 = 8$, then we also know $8 - 5 = 3$ and $8 - 3 = 5$.

The same thing works when there are negative numbers in the equation. From the previous example, $-5 + 12 = 7$, we also know $7 - 12 = -5$ and $7 - -5 = 12$.

Here is a task to try with your student:

1. Use the number line to show $3 + -5$.

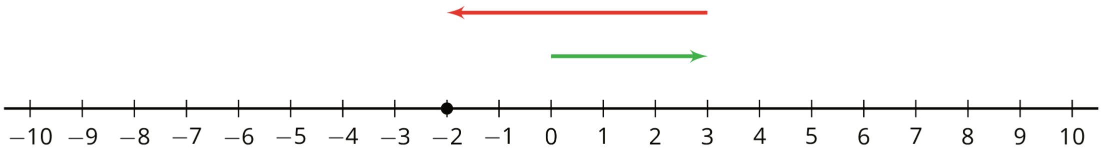


2. What does your answer tell you about the value of:
    a. $-2 - 3$?

    b. $-2 - -5$?

Solution:

1. The first arrow starts at 0 and points 3 units to the right. The next arrow starts at the tip of the first arrow and points 5 units to the left. This arrow ends above the -2, so $3 + -5 = -2$.



2. From the addition equation $3 + -5 = -2$, we get the related subtraction equations:

a. $-2 - 3 = -5$

b. $-2 - -5 = 3$

Multiplying and Dividing Rational Numbers

Family Support Materials 2

This week your student will be multiplying and dividing with negative numbers. The rules for multiplying positive and negative numbers are designed to make sure that addition and multiplication work the same way they always have.

For example, in elementary school students learned to think of “4 times 3” as 4 groups of 3, like $4 \cdot 3 = 3 + 3 + 3 = 12$. We can think of “4 times -3” the same way: $4 \cdot \text{-}3 = (\text{-}3) + (\text{-}3) + (\text{-}3) + (\text{-}3) = \text{-}12$. Also, an important property of multiplication is that we can multiply numbers in either order. This means that $\text{-}3 \cdot 4 = 4 \cdot \text{-}3 = \text{-}12$.

What about $\text{-}3 \cdot \text{-}4$? It may seem strange, but the answer is 12. To understand why this is, we can think of -4 as $(0 - 4)$.

$$(\text{-}3) \cdot (\text{-}4)$$

$$(\text{-}3) \cdot (0 - 4)$$

$$(\text{-}3 \cdot 0) - (\text{-}3 \cdot 4)$$

$$0 - \text{-}12$$

$$12$$

After more practice, your student will be able to remember this without needing to think through examples:

- A positive times a negative is a negative.
- A negative times a positive is a negative.
- A negative times a negative is a positive.

Here is a task to try with your student:

1. Calculate $5 \cdot \text{-}2$.
2. Use your answer to the previous question to calculate:
    a. $\text{-}2 \cdot 5$
    b. $\text{-}2 \cdot \text{-}5$
    c. $\text{-}5 \cdot \text{-}2$

Solution:

1. The answer is -10. We can think of $5 \cdot -2$ as 5 groups of -2, so $5 \cdot -2 = (-2) + (-2) + (-2) + (-2) + (-2) = -10$

2.
   a. The answer is -10. We can multiply numbers in either order, so $-2 \cdot 5 = 5 \cdot -2 = -10$

   b. The answer is 10. We can think of -5 as $(0 - 5)$, and $-2 \cdot (0 - 5) = 0 - -10 = 10$.

   c. The answer is 10. Possible Strategies:
      - We can think of -2 as $(0 - 2)$, and $-5 \cdot (0 - 2) = 0 - -10 = 10$.
      - We can multiply numbers in either order, so $-5 \cdot -2 = -2 \cdot -5 = 10$.

Four Operations with Rational Numbers

Family Support Materials 3

This week your student will use what they know about negative numbers to solve equations.

- The *opposite* of 5 is -5, because $5 + -5 = 0$. This is also called the additive inverse.
- The *reciprocal* of 5 is $\frac{1}{5}$, because $5 \cdot \frac{1}{5} = 1$. This is also called the multiplicative inverse.

Thinking about opposites and reciprocals can help us solve equations. For example, what value of x makes the equation $x + 11 = -4$ true?

$$\begin{aligned} x + 11 &= -4 \\ x + 11 + -11 &= -4 + -11 \\ x &= -15 \end{aligned}$$

11 and -11 are opposites.

The solution is -15.

What value of y makes the equation $\frac{-1}{3}y = 6$ true?

$$\begin{aligned} \frac{-1}{3}y &= 6 \\ -3 \cdot \frac{-1}{3}y &= -3 \cdot 6 \\ y &= -18 \end{aligned}$$

$\frac{-1}{3}$ and -3 are reciprocals.

The solution is -18.

Here is a task to try with your student:

Solve each equation:

$25 + a = 17$

$-4b = -30$

$\frac{-3}{4}c = 12$

Solution:

1. -8, because $17 + -25 = -8$.
2. 7.5 or equivalent, because $\frac{-1}{4} \cdot -30 = 7.5$.
3. -16, because $\frac{-4}{3} \cdot 12 = -16$.

Family Support Materials

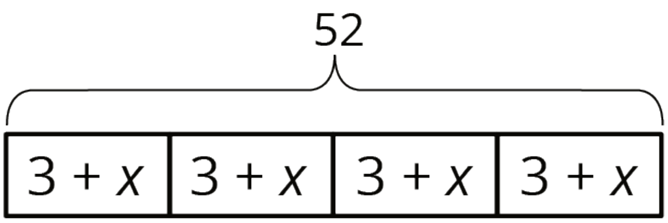
Expressions, Equations, and Inequalities

Representing Situations of the Form $px + q = r$ and $p(x + q) = r$

Family Support Materials 1

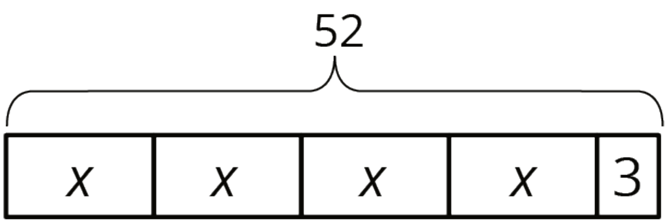
In this unit, your student will be representing situations with diagrams and equations. There are two main categories of situations with associated diagrams and equations.

Here is an example of the first type: A standard deck of playing cards has four suits. In each suit, there are 3 face cards and x other cards. There are 52 total cards in the deck. A diagram we might use to represent this situation is:



and its associated equation could be $52 = 4(3 + x)$. There are 4 groups of cards, each group contains $x + 3$ cards, and there are 52 cards in all.

Here is an example of the second type: A chef makes 52 pints of spaghetti sauce. She reserves 3 pints to take home to her family, and divides the remaining sauce equally into 4 containers. A diagram we might use to represent this situation is:



and its associated equation could be $52 = 4x + 3$. From the 52 pints of sauce, 3 were set aside, and each of 4 containers holds x pints of sauce.

Here is a task to try with your student:

1. Draw a diagram to represent the equation $3x + 6 = 39$

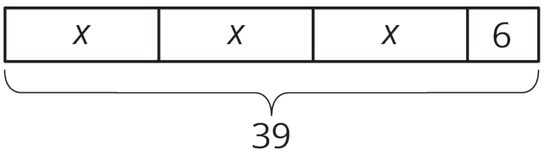
2. Draw a diagram to represent the equation $39 = 3(y + 6)$

3. Decide which story goes with which equation-diagram pair:
   - Three friends went cherry picking and each picked the same amount of cherries, in pounds. Before they left the cherry farm, someone gave them an additional 6 pounds of cherries. Altogether, they had 39 pounds of cherries.
   - One of the friends made three cherry tarts. She put the same number of cherries in each tart, and then added 6 more cherries to each tart. Altogether, the three tarts contained 39 cherries.

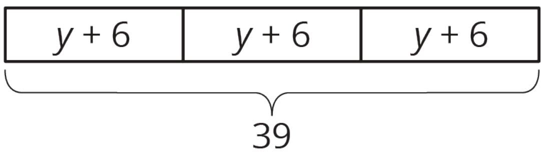
Solution:

Diagram A represents $3x + 6 = 39$ and the story about cherry picking. Diagram B represents $3(y + 6) = 39$ and the story about making cherry tarts.

A



B



Solving Equations of the Form $px + q = r$ and $p(x + q) = r$ and Problems That Lead to Those Equations

Family Support Materials 2

Your student is studying efficient methods to solve equations and working to understand why these methods work. Sometimes to solve an equation, we can just think of a number that would make the equation true. For example, the solution to $12 - c = 10$ is 2, because we know that $12 - 2 = 10$. For more complicated equations that may include decimals, fractions, and negative numbers, the solution may not be so obvious.

An important method for solving equations is *doing the same thing to each side*. For example, let's show how we might solve $-4(x - 1) = 20$ by doing the same thing to each side.

$$\begin{aligned} -4(x-1) &= 24 & \\ -\tfrac{1}{4} \cdot -4(x-1) &= -\tfrac{1}{4} \cdot 24 & \text{multiply each side by } -\tfrac{1}{4} \\ x - 1 &= -6 & \\ x - 1 + 1 &= -6 + 1 & \text{add 1 to each side} \\ x &= -5 & \end{aligned}$$

Another helpful tool for solving equations is to apply the distributive property. In the example above, instead of multiplying each side by $-\frac{1}{4}$, you could apply the distributive property to $-4(x - 1)$ and replace it with $-4x + 4$. Your solution would look like this:

$$\begin{aligned} -4(x-1) &= 24 & \\ -4x + 4 &= 24 & \text{apply the distributive property} \\ -4x + 4 - 4 &= 24 - 4 & \text{subtract 4 from each side} \\ -4x &= 20 & \\ -4x \div -4 &= 20 \div -4 & \text{divide each side by -4} \\ x &= -5 & \end{aligned}$$

Here is a task to try with your student:

Elena picks a number, adds 45 to it, and then multiplies by $\frac{1}{2}$. The result is 29. Elena says that you can find her number by solving the equation $29 = \frac{1}{2}(x + 45)$.

Find Elena’s number. Describe the steps you used.

Solution:

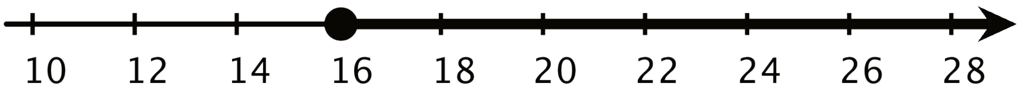
Elena’s number was 13. There are many different ways to solve her equation. Here is one example:

$$
\begin{aligned}
29 &= \frac{1}{2}(x+45) \\
2 \cdot 29 &= 2 \cdot \frac{1}{2}(x+45) && \text{multiply each side by 2} \\
58 &= x+45 \\
58-45 &= x+45-45 && \text{subtract 45 from each side} \\
13 &= x
\end{aligned}
$$

Inequalities

Family Support Materials 3

This week your student will be working with inequalities (expressions with $>$ or $<$ instead of $=$). We use inequalities to describe a range of numbers. For example, in many places you need to be at least 16 years old to be allowed to drive. We can represent this situation with the inequality $a \geq 16$. We can show all the solutions to this inequality on the number line.



Here is a task to try with your student:

Noah already has \$10.50, and he earns \$3 each time he runs an errand for his neighbor. Noah wants to know how many errands he needs to run to have at least \$30, so he writes this inequality:

$$3e + 10.50 \geq 30$$

We can test this inequality for different values of e. For example, 4 errands is not enough for Noah to reach his goal, because $3 \cdot 4 + 10.50 = 22.5$, and \$22.50 is less than \$30.

1. Will Noah reach his goal if he runs:
    a. 8 errands?

    b. 9 errands?

2. What value of e makes the equation $3e + 10.50 = 30$ true?

3. What does this tell you about all the solutions to the inequality $3e + 10.50 \geq 30$?

4. What does this mean for Noah's situation?

Solution:

1.
    a. Yes, if Noah runs 8 errands, he will have $3 \cdot 8 + 10.50$, or \$34.50.

    b. Yes, since 9 is more than 8, and 8 errands was enough, so 9 will also be enough.

2. The equation is true when $e = 6.5$. We can rewrite the equation as $3e = 30 - 10.50$, or $3e = 19.50$. Then we can rewrite this as $e = 19.50 \div 3$, or $e = 6.5$.

3. This means that when $e \geq 6.5$ then Noah's inequality is true.

4. Noah can't really run 6.5 errands, but he could run 7 or more errands, and then he would have more than \$30.

Writing Equivalent Expressions

Family Support Materials 4

This week your student will be working with equivalent expressions (expressions that are always equal, for any value of the variable). For example, $2x + 7 + 4x$ and $6x + 10 - 3$ are equivalent expressions. We can see that these expressions are equal when we try different values for x.

	$2x + 7 + 4x$	$6x + 10 - 3$
when x is 5	$2 \cdot 5 + 7 + 4 \cdot 5$ $10 + 7 + 20$ 37	$6 \cdot 5 + 10 - 3$ $30 + 10 - 3$ 37
when x is -1	$2 \cdot \text{-}1 + 7 + 4 \cdot \text{-}1$ $\text{-}2 + 7 + \text{-}4$ 1	$6 \cdot \text{-}1 + 10 - 3$ $\text{-}6 + 10 - 3$ 1

We can also use properties of operations to see why these expressions have to be equivalent—they are each equivalent to the expression $6x + 7$.

Here is a task to try with your student:

Match each expression with an equivalent expression from the list below. One expression in the list will be left over.

1. $5x + 8 - 2x + 1$
2. $6(4x - 3)$
3. $(5x + 8) - (2x + 1)$
4. $\text{-}12x + 9$

List:

- $3x + 7$
- $3x + 9$
- $\text{-}3(4x - 3)$
- $24x + 3$
- $24x - 18$

Solution:

1. $3x + 9$ is equivalent to $5x + 8 - 2x + 1$, because $5x + \text{-}2x = 3x$ and $8 + 1 = 9$.

2. $24x - 18$ is equivalent to $6(4x - 3)$, because $6 \cdot 4x = 24x$ and $6 \cdot \text{-}3 = \text{-}18$.

3. $3x + 7$ is equivalent to $(5x + 8) - (2x + 1)$, because $5x - 2x = 3x$ and $8 - 1 = 7$.

4. $\text{-}3(4x - 3)$ is equivalent to $\text{-}12x + 9$, because $\text{-}3 \cdot 4x = \text{-}12x$ and $\text{-}3 \cdot \text{-}3 = 9$.

Family Support Materials

Angles, Triangles, and Prisms

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Grade 7, Unit 7: Angles, Triangles, and Prisms	Vimeo	YouTube
Video 1: Angle Relationships (Lessons 1–5)	Link	Link
Video 2: Drawing Polygons with Given Conditions (Lessons 6–10)	Link	Link
Video 3: Volume of Right Prisms and Pyramids (Lessons 11–13)	Link	Link
Video 4: Volume and Surface Area of Right Prisms (Lessons 14–16)	Link	Link

Video 1

Video 'VLS G7U7V1 Angle Relationships (Lessons 1–5)' available here: https://player.vimeo.com/video/516923320.

Video 2

Video 'VLS G7U7V2 Drawing Polygons with Given Conditions (Lessons 6–10)' available here: https://player.vimeo.com/video/516924015.

Video 3

Video 'VLS G7U7V3 Volume of Right Prisms and Pyramids (Lessons 11–13)' available here: https://player.vimeo.com/video/519998551.

Video 4

Video 'VLS G7U7V4 Volume and Surface Area of Right Prisms (Lessons 14–16)' available here: https://player.vimeo.com/video/520348663.

Connecting to Other Units

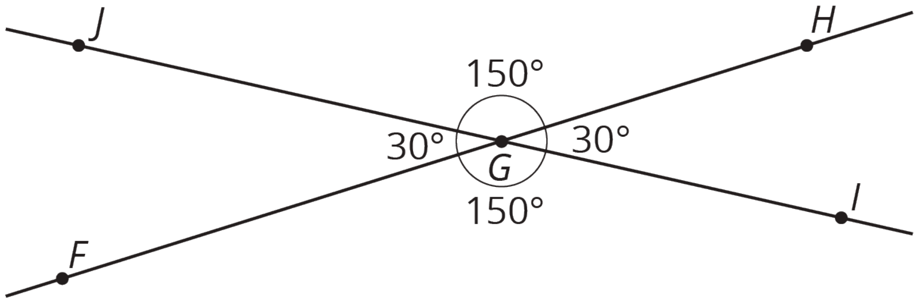
- *Coming soon*

Angle Relationships

Family Support Materials 1

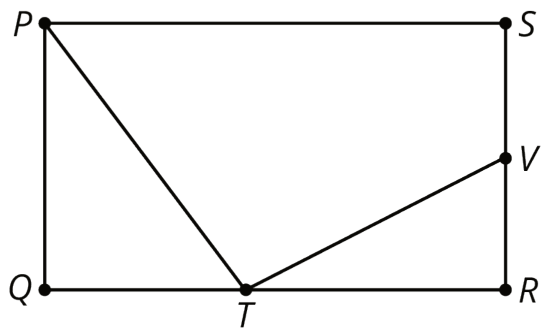
This week your student will be working with some relationships between pairs of angles.

- If two angles add to 90°, then we say they are **complementary angles**. If two angles add to 180°, then we say they are **supplementary angles.** For example, angles JGF and JGH below are supplementary angles, because $30 + 150 = 180$.



- When two lines cross, they form two pairs of **vertical angles** across from one another. In the previous figure, angles JGF and HGI are vertical angles. So are angles JGH and FGJ. Vertical angles always have equal measures.

Here is a task to try with your student: Rectangle $PQRS$ has points T and V on two of its sides.



1. Angles SVT and TVR are supplementary. If angle SVT measures 117°, what is the measure of angle TVR?

2. Angles QTP and QPT are complementary. If angle QTP measures 53°, what is the measure of angle QPT?

Solution:

1. Angle TVR measures 63°, because $180 - 117 = 63$.

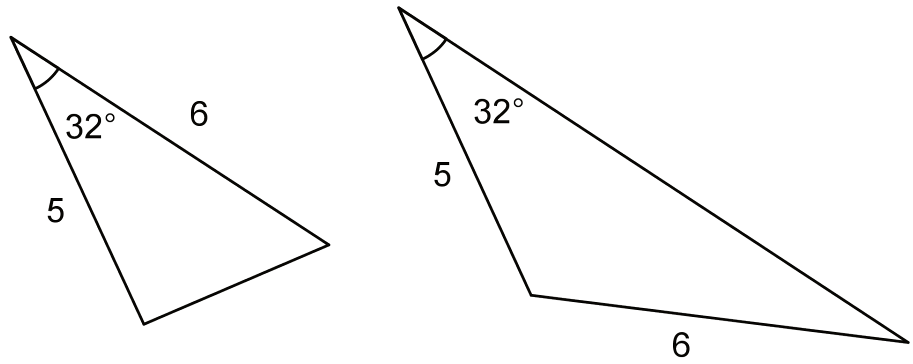
2. Angle QPT measures 37°, because $90 - 53 = 37$.

Drawing Polygons with Given Conditions

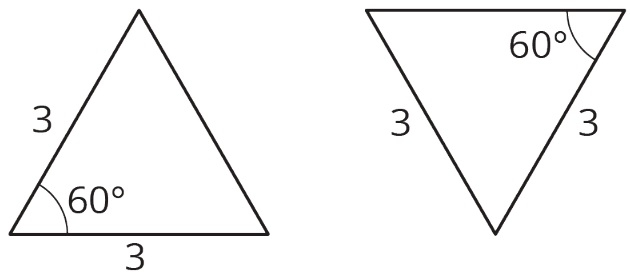
Family Support Materials 2

This week your student will be drawing shapes based on a description. What options do we have if we need to draw a triangle, but we only know some of its side lengths and angle measures?

- Sometimes we can draw more than one kind of triangle with the given information. For example, “sides measuring 5 units and 6 units, and an angle measuring 32°” could describe two triangles that are not identical copies of each other.



- Sometimes there is only one unique triangle based on the description. For example, here are two identical copies of a triangle with two sides of length 3 units and an angle measuring 60°. There is no way to draw a *different* triangle (a triangle that is not an identical copy) with this description.

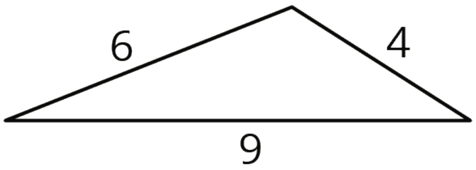


- Sometimes it is not possible to draw a triangle with the given information. For example, there is no triangle with sides measuring 4 inches, 5 inches, and 12 inches. (Try to draw it and see for yourself!)

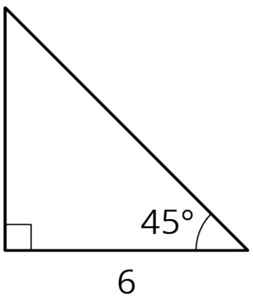
Here is a task to try with your student:

Using each set of conditions, can you draw a triangle that is *not an identical copy* of the one shown?

1. A triangle with sides that measure 4, 6, and 9 units.

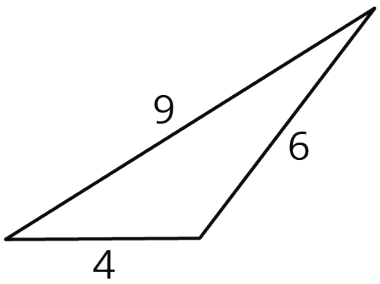


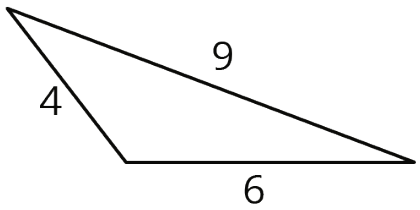
2. A triangle with a side that measures 6 units and angles that measure 45° and 90°



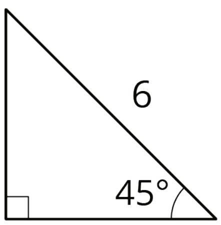
Solution:

1. There is no way to draw a *different* triangle with these side lengths. Every possibility is an identical copy of the given triangle. (You could cut out one of the triangles and match it up exactly to the other.) Here are some examples:





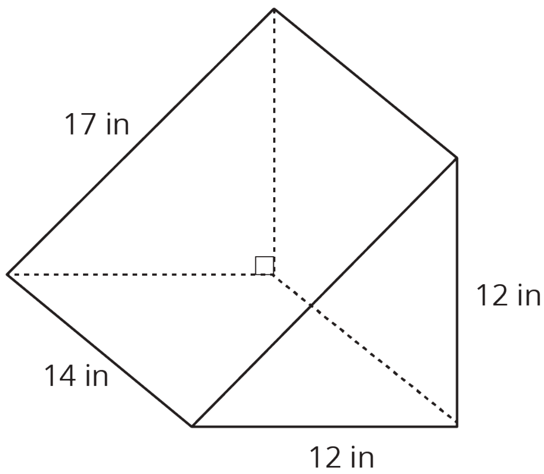
2. You can draw a different triangle by putting the side that is 6 opposite from the 90° angle instead of next to it. This is not an identical copy of the given triangle, because it is smaller.



Solid Geometry

Family Support Materials 3

This week your student will be thinking about the surface area and volume of three-dimensional figures. Here is a triangular prism. Its base is a right triangle with sides that measure 12, 12, and 17 inches.

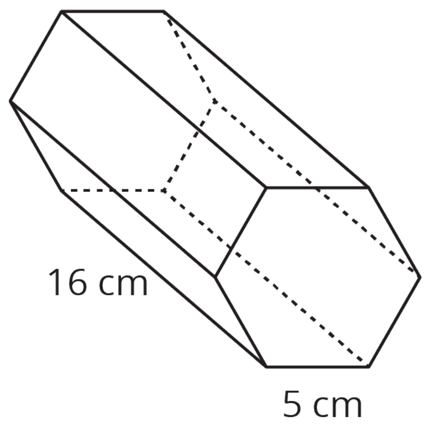


In general, we can find the volume of any prism by multiplying the area of its base times its height. For this prism, the area of the triangular base is 72 in^2, so the volume is $72 \cdot 14$, or 1,008 in^3.

To find the surface area of a prism, we can find the area of each of the faces and add them up. The example prism has two faces that are triangles and three faces that are rectangles. When we add all these areas together, we see that the prism has a total surface area of $72 + 72 + 168 + 168 + 238$, or 718 in^2.

Here is a task to try with your student:

The base of this prism is a hexagon where all the sides measure 5 cm. The area of the base is about 65 cm^2.



1. What is the volume of the prism?

2. What is the surface area of the prism?

Solution:

1. The volume of the prism is about 1,040 cm^3, because $65 \cdot 16 = 1{,}040$.

2. The surface area of the prism is 610 cm^2, because $16 \cdot 5 = 80$ and $65 + 65 + 80 + 80 + 80 + 80 + 80 + 80 = 610$.

Family Support Materials

Probability and Sampling

Probabilities of Single Step Events

Family Support Materials 1

This week your student will be working with probability. A **probability** is a number that represents how likely something is to happen. For example, think about flipping a coin.

- The probability that the coin lands somewhere is 1. That is certain.
- The probability that the coin lands heads up is $\frac{1}{2}$, or 0.5.
- The probability that the coin turns into a bottle of ketchup is 0. That is impossible.

Sometimes we can figure out an exact probability. For example, if we pick a random date, the chance that it is on a weekend is $\frac{2}{7}$, because 2 out of every 7 days fall on the weekend. Other times, we can estimate a probability based on what we have observed in the past.

Here is a task to try with your student:

People at a fishing contest are writing down the type of each fish they catch. Here are their results:

- Person 1: bass, catfish, catfish, bass, bass, bass
- Person 2: catfish, catfish, bass, bass, bass, bass, catfish, catfish, bass, catfish
- Person 3: bass, bass, bass, catfish, bass, bass, catfish, bass, catfish

1. Estimate the probability that the next fish that gets caught will be a bass.
2. Another person in the competition caught 5 fish. Predict how many of these fish were bass.
3. Before the competition, the lake was stocked with equal numbers of catfish and bass. Describe some possible reasons for why the results do not show a probability of $\frac{1}{2}$ for catching a bass.

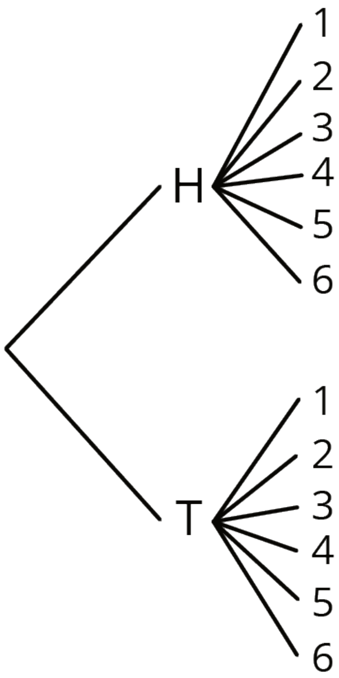
Solution:

1. About $\frac{15}{25}$, or 0.6, because of the 25 fish that have been caught, 15 of them were bass.
2. About 3 bass, because $\frac{3}{5} = 0.6$. It would also be reasonable if they caught 2 or 4 bass, out of their 5 fish.
3. There are many possible answers. For example:
    - Maybe the lures or bait they were using are more likely to catch bass.
    - With results from only 25 total fish caught, we can expect the results to vary a little from the exact probability.

Probabilities of Multi-step Events

Family Support Materials 2

To find an exact probability, it is important to know what outcomes are possible. For example, to show all the possible outcomes for flipping a coin and rolling a number cube, we can draw this tree diagram:



The branches on this tree diagram represent the 12 possible outcomes, from "heads 1" to "tails 6." To find the probability of getting heads on the coin and an even number on the number cube, we can see that there are 3 ways this could happen ("heads 2", "heads 4", or "heads 6") out of 12 possible outcomes. That means the probability is $\frac{3}{12}$, or 0.25.

Here is a task to try with your student:

A board game uses cards that say "forward" or "backward" and a spinner numbered from 1 to 5.

1. On their turn, a person picks a card and spins the spinner to find out which way and how far to move their piece. How many different outcomes are possible?
2. On their next turn, what is the probability that the person will:
   a. get to move their piece forward 5 spaces?

   b. have to move their piece backward some odd number of spaces?

Solution:

1. There are 10 possible outcomes ("forward 1", "forward 2", "forward 3", "forward 4", "forward 5", "backward 1", "backward 2", "backward 3", "backward 4", or "backward 5").

2. a. $\frac{1}{10}$ or 0.1, because "forward 5" is 1 out of the 10 possibilities.

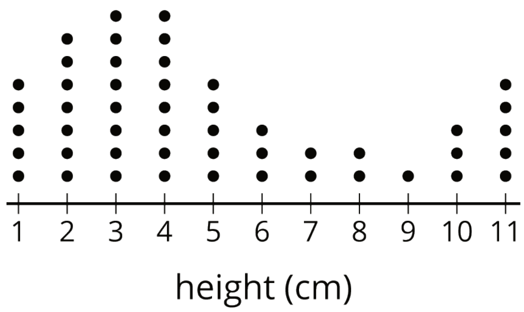
   b. $\frac{3}{10}$ or 0.3, because there are 3 such possibilities ("backward 1", "backward 3", or "backward 5")

Sampling

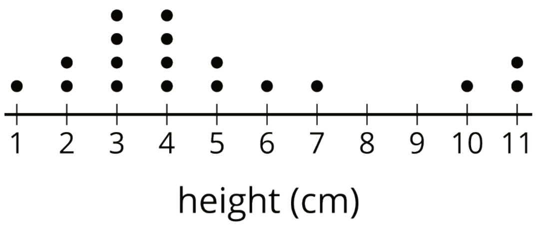
Family Support Materials 3

This week your student will be working with data. Sometimes we want to know information about a group, but the group is too large for us to be able to ask everyone. It can be useful to collect data from a **sample** (some of the group) of the **population** (the whole group). It is important for the sample to resemble the population.

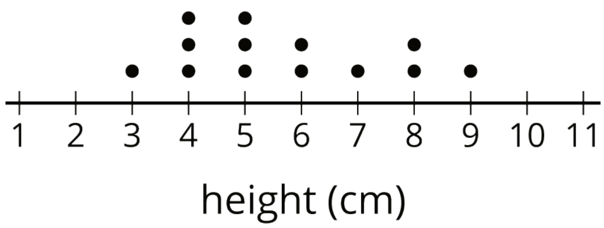
- For example, here is a dot plot showing a population: the height of 49 plants in a sprout garden.



- This sample is **representative** of the population, because it includes only a part of the data, but it still resembles the population in shape, center, and spread.



- This sample is not representative of the population. It has too many plant heights in the middle and not enough really short or really tall ones.



A sample that is selected at random is more likely to be representative of the population than a sample that was selected some other way.

Here is a task to try with your student:

A city council needs to know how many buildings in the city have lead paint, but they don't have enough time to test all 100,000 buildings in the city. They want to test a sample of buildings that will be representative of the population.

1. What would be a *bad* way to pick a sample of the buildings?

2. What would be a *good* way to pick a sample of the buildings?

Solution:

1. There are many possible answers.
    - Testing all the same type of buildings (like all the schools, or all the gas stations) would not lead to a representative sample of all the buildings in the city.
    - Testing buildings all in the same location, such as the buildings closest to city hall, would also be a bad way to get a sample.
    - Testing all the newest buildings would *bias* the sample towards buildings that don't have any lead paint.
    - Testing a small number of buildings, like 5 or 10, would also make it harder to use the sample to make predictions about the entire population.
2. To select a sample at random, they could put the addresses of all 100,000 buildings into a computer and have the computer select 50 addresses randomly from the list. Another possibility could be picking papers out a bag, but with so many buildings in the city, this method would be difficult.

Using Samples

Family Support Materials 4

We can use statistics from a sample (a part of the entire group) to estimate information about a population (the entire group). If the sample has more variability (is very spread out), we may not trust the estimate as much as we would if the numbers were closer together. For example, it would be easier to estimate the average height of all 3-year olds than all 40-year olds, because there is a wider range of adult heights.

We can also use samples to help predict whether there is a meaningful difference between two populations, or whether there is a lot of overlap in the data.

Here is a task to try with your student:

Students from seventh grade and ninth grade were selected at random to answer the question, "How many pencils do you have with you right now?" Here are the results:

how many pencils each seventh grade student had

4	1	2	5	2	1	1	2	3	3

how many pencils each ninth grade student had

9	4	1	14	6	2	0	8	2	5

1. Use the sample data to estimate the mean (average) number of pencils carried by:
    a. all the seventh grade students in the whole school.

    b. all the ninth grade students in the whole school.

2. Which sample had more variability? What does this tell you about your estimates in the previous question?

3. A student, who was not in the survey, has 5 pencils with them. If this is all you know, can you predict which grade they are in?

Solution:

1. Since the samples were selected at random, we predict they will represent the whole population fairly well.
   a. About 2.4 pencils for all seventh graders, because the mean of the sample is $(4+1+2+5+2+1+1+2+3+3) \div 10$ or 2.4 pencils.

   b. About 5.1 pencils for all ninth graders, because the mean of the sample is $(9+4+1+14+6+2+0+8+2+5) \div 10$ or 5.1 pencils.

2. The survey of ninth graders had more variability. Those numbers were more spread out, so I trust my estimate for seventh grade more than I trust my estimate for ninth grade.

3. There are many possible answers. For example:
   - Since they only asked 10 students from each grade, it is hard to predict. It would help if they could ask more students.

   - The student is probably in ninth grade, because 5 is closer to the sample mean from ninth grade than from seventh grade.

   - The student could possibly be in seventh grade, because at least one student in seventh grade has 5 pencils.