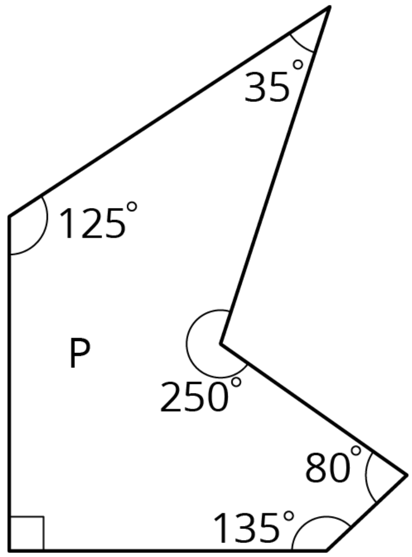
Use this page for reviewing student work on the printed practice problems. Note that occasionally there are differences between the print and digital versions of practice items. For answers on the digital practice problems, refer to the digital practice set.

Problem 1

Select **all** the statements that must be true for *any* scaled copy Q of Polygon P.



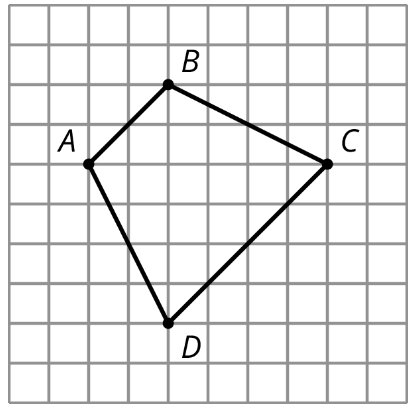
A.The side lengths are all whole numbers.
B. The angle measures are all whole numbers.
C. Q has exactly 1 right angle.
D. If the scale factor between P and Q is $\frac{1}{5}$, then each side length of P is multiplied by $\frac{1}{5}$ to get the corresponding side length of Q.
E. If the scale factor is 2, each angle in P is multiplied by 2 to get the corresponding angle in Q.
F. Q has 2 acute angles and 3 obtuse angles.

Solution

B, C, D, F

Problem 2

Here is Quadrilateral $ABCD$.



Quadrilateral $PQRS$ is a scaled copy of Quadrilateral $ABCD$. Point P corresponds to A, Q to B, R to C, and S to D.

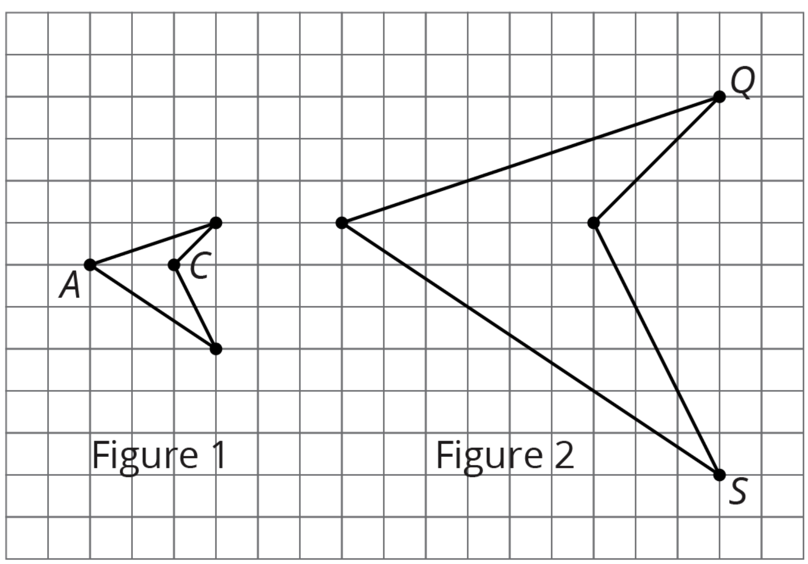
If the distance from P to R is 3 units, what is the distance from Q to S? Explain your reasoning.

Solution

Since the lengths of AC and BD are 6, and AC corresponds to PR, the scale factor must be $\frac{1}{2}$. Since QS corresponds to BD, QS must also be 3 units long.

Problem 3

Figure 2 is a scaled copy of Figure 1.

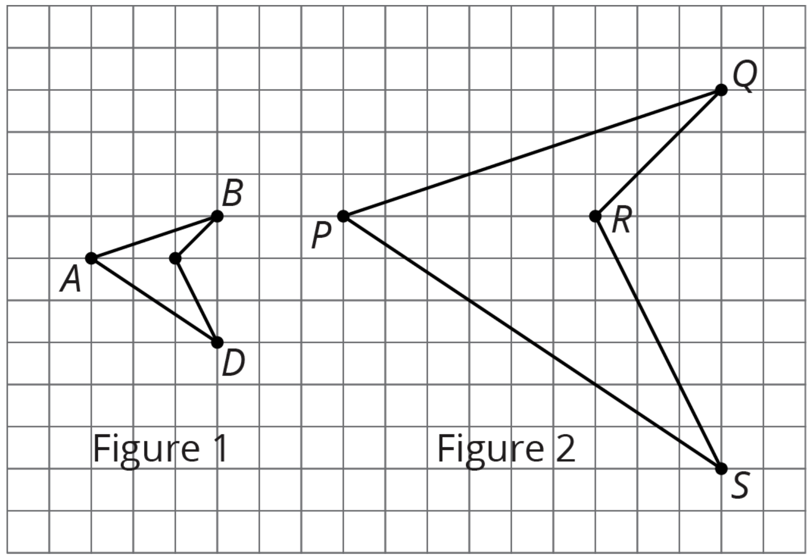


1. Identify the points in Figure 2 that correspond to the points A and C in Figure 1. Label them P and R. What is the distance between P and R?
2. Identify the points in Figure 1 that correspond to the points Q and S in Figure 2. Label them B and D. What is the distance between B and D?
3. What is the scale factor that takes Figure 1 to Figure 2?

4. G and H are two points on Figure 1, but they are not shown. The distance between G and H is 1. What is the distance between the corresponding points on Figure 2?

Solution

1. 6 units



2. 3 units
3. 3 because distances between points in Figure 2 are three times the corresponding distances in Figure 1
4. 3 units because the scale factor is 3

Problem 4

(from Grade 7, Unit 2, Lesson 4)

To make 1 batch of lavender paint, the ratio of cups of pink paint to cups of blue paint is 6 to 5. Find two more ratios of cups of pink paint to cups of blue paint that are equivalent to this ratio.

Solution

Answers vary. Sample response: 12 cups of pink paint to 10 cups of blue paint and 18 cups of pink paint to 15 cups of blue paint. This is 2 batches and 3 batches, respectively, of this shade of lavender paint.

Unit 6 Lesson 21 Cumulative Practice Problems

1. - Noah says that $9x - 2x + 4x$ is equivalent to $3x$, because the subtraction sign tells us to subtract everything that comes after $9x$.
   - Elena says that $9x - 2x + 4x$ is equivalent to $11x$, because the subtraction only applies to $2x$.

   Do you agree with either of them? Explain your reasoning.

2. Identify the error in generating an expression equivalent to $4 + 2x - \frac{1}{2}(10 - 4x)$. Then correct the error.

   $4 + 2x + \frac{-1}{2}(10 + -4x)$
   $4 + 2x + -5 + 2x$
   $4 + 2x - 5 + 2x$
   -1

3. Select **all** expressions that are equivalent to $5x - 15 - 20x + 10$.

   A. $5x - (15 + 20x) + 10$

   B. $5x + -15 + -20x + 10$

   C. $5(x - 3 - 4x + 2)$

   D. $-5(-x + 3 + 4x + -2)$

   E. $-15x - 5$

   F. $-5(3x + 1)$

   G. $-15(x - \frac{1}{3})$

4. The school marching band has a budget of up to \$750 to cover 15 new uniforms and competition fees that total \$300. How much can they spend for one uniform?

    a. Write an inequality to represent this situation.

    b. Solve the inequality and describe what it means in the situation.

(From Unit 6, Lesson 14.)

5. Solve the inequality that represents each story. Then interpret what the solution means in the story.

    a. For every \$9 that Elena earns, she gives x dollars to charity. This happens 7 times this month. Elena wants to be sure she keeps at least \$42 from this month's earnings. $7(9-x) \geq 42$

    b. Lin buys a candle that is 9 inches tall and burns down x inches per minute. She wants to let the candle burn for 7 minutes until it is less than 6 inches tall. $9-7x<6$

(From Unit 6, Lesson 16.)

6. A certain shade of blue paint is made by mixing $1\frac{1}{2}$ quarts of blue paint with 5 quarts of white paint. If you need a total of 16.25 gallons of this shade of blue paint, how much of each color should you mix?

(From Unit 4, Lesson 3.)

This unit covers four big topics. Read about each topic and find a task or activity to complete with your student below.

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

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

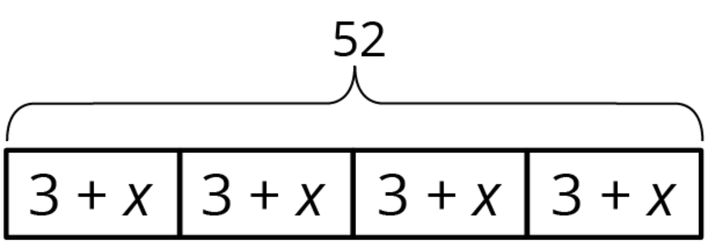
Inequalities

Writing Equivalent Expressions

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

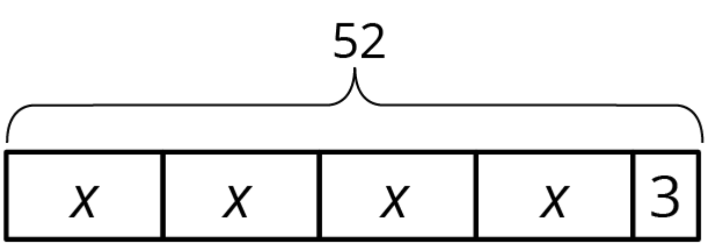
In this unit, your student will be representing situations with diagrams and equations. There are two main categories of situations with associated diagrams and equations.

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.

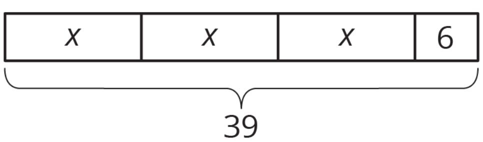
Here is a task to try with your student:

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.

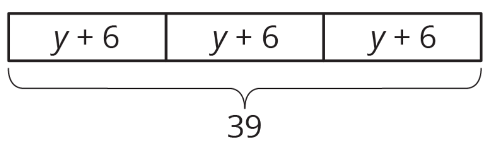
Solution:

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

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.

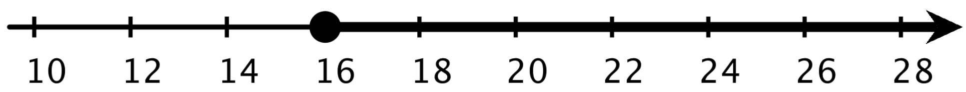
Solution:

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

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?

Solutions

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

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 $5x + -2x = 3x$ and $8 + 1 = 9$.
2. $24x - 18$ is equivalent to $6(4x - 3)$, because $6 \cdot 4x = 24x$ and $6 \cdot -3 = -18$.
3. $3x + 7$ is equivalent to $(5x + 8) - (2x + 1)$, because $5x - 2x = 3x$ and $8 - 1 = 7$.
4. $-3(4x - 3)$ is equivalent to $-12x + 9$, because $-3 \cdot 4x = -12x$ and $-3 \cdot -3 = 9$.

Spanish language family materials

7.6 Spanish Family Materials (PDF)

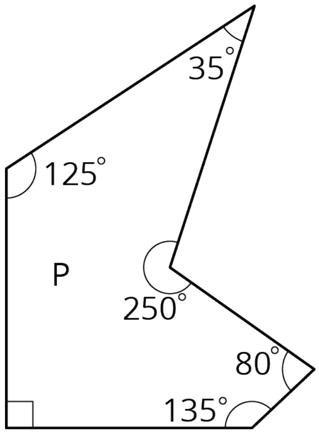
From Illustrative Mathematics

Print or share this guide to help families support their students with the key concepts and ideas in Grade 7, Unit 6.

Type PDF

Unit 1 Lesson 4 Cumulative Practice Problems

1. Select **all** the statements that must be true for *any* scaled copy Q of Polygon P.



A. The side lengths are all whole numbers.

B. The angle measures are all whole numbers.

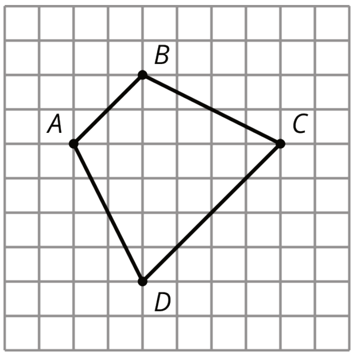
C. Q has exactly 1 right angle.

D. If the scale factor between P and Q is $\frac{1}{5}$, then each side length of P is multiplied by $\frac{1}{5}$ to get the corresponding side length of Q.

E. If the scale factor is 2, each angle in P is multiplied by 2 to get the corresponding angle in Q.

F. Q has 2 acute angles and 3 obtuse angles.

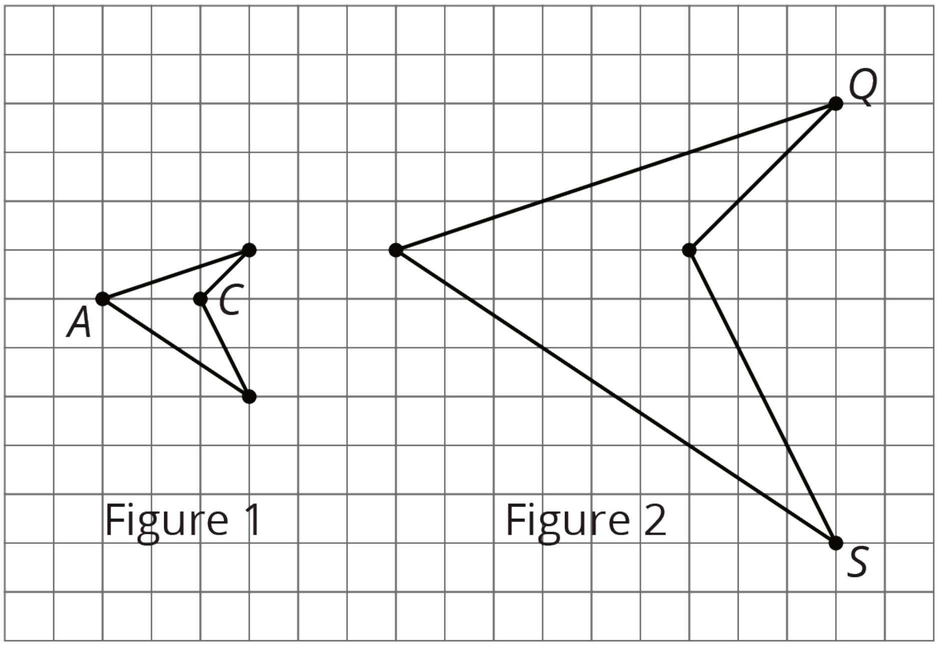
2. Here is Quadrilateral $ABCD$.



Quadrilateral $PQRS$ is a scaled copy of Quadrilateral $ABCD$. Point P corresponds to A, Q to B, R to C, and S to D.

If the distance from P to R is 3 units, what is the distance from Q to S? Explain your reasoning.

3. Figure 2 is a scaled copy of Figure 1.



a. Identify the points in Figure 2 that correspond to the points A and C in Figure 1. Label them P and R. What is the distance between P and R?

b. Identify the points in Figure 1 that correspond to the points Q and S in Figure 2. Label them B and D. What is the distance between B and D?

c. What is the scale factor that takes Figure 1 to Figure 2?

d. G and H are two points on Figure 1, but they are not shown. The distance between G and H is 1. What is the distance between the corresponding points on Figure 2?

4. To make 1 batch of lavender paint, the ratio of cups of pink paint to cups of blue paint is 6 to 5. Find two more ratios of cups of pink paint to cups of blue paint that are equivalent to this ratio.

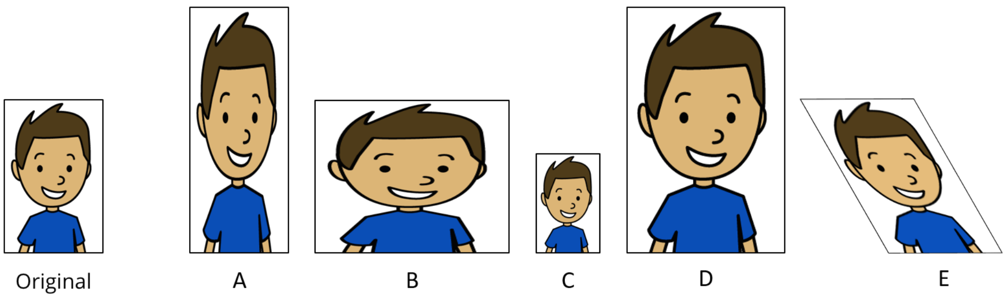
This unit covers two big topics. Read about each topic and find a task or activity to complete with your student below.

Scaled Copies

Scale Drawings

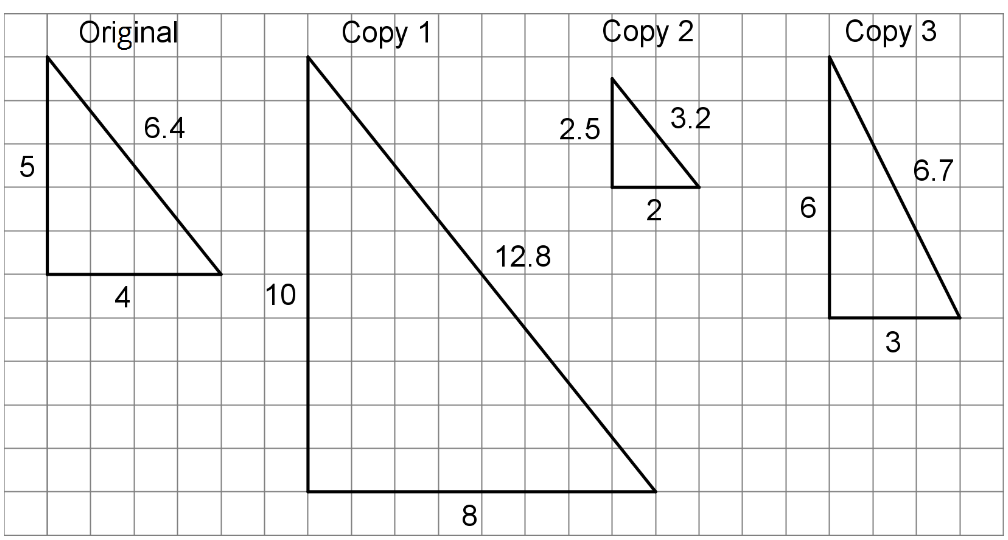
Scaled Copies

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:



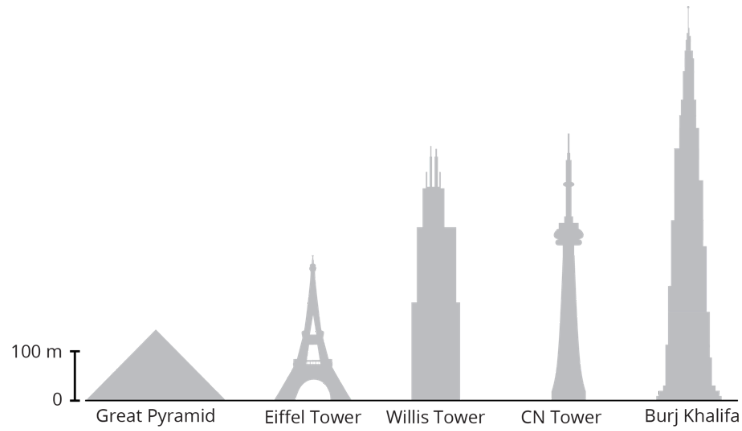
1. For each copy, tell whether it is a scaled copy of the original triangle. If so, what is the scale factor?
2. Draw another scaled copy of the original triangle using a different scale factor.

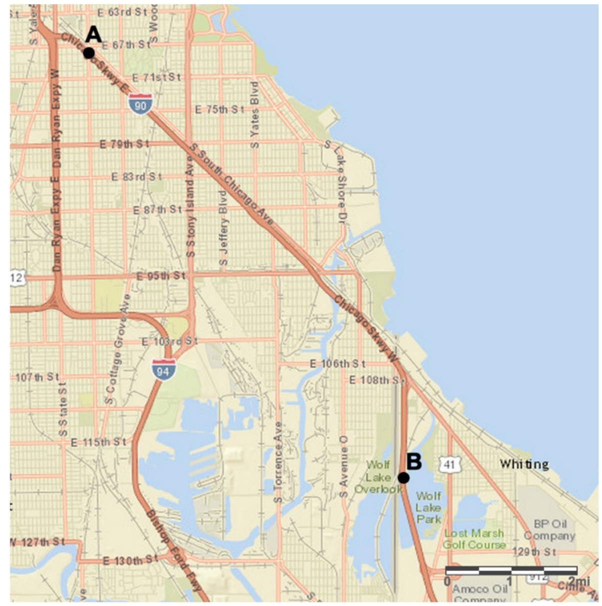
Solution:

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

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.

Spanish language family materials

7.1 Spanish Family Materials (PDF)

From Illustrative Mathematics

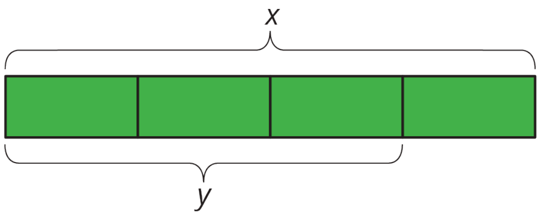
Print or share this guide to help families support their students with the key concepts and ideas in Grade 7, Unit 1.

Type PDF

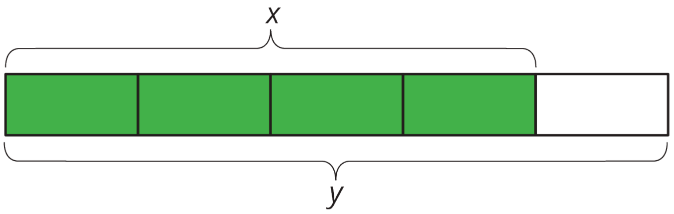
Unit 4 Lesson 6 Cumulative Practice Problems

1. For each diagram, decide if y is an increase or a decrease relative to x. Then determine the percent increase or decrease.

A



B



2. Draw diagrams to represent the following situations.

   a. The amount of flour that the bakery used this month was a 50% increase relative to last month.

   b. The amount of milk that the bakery used this month was a 75% decrease relative to last month.

3. Write each percent increase or decrease as a percentage of the initial amount. The first one is done for you.

   a. This year, there was 40% more snow than last year.

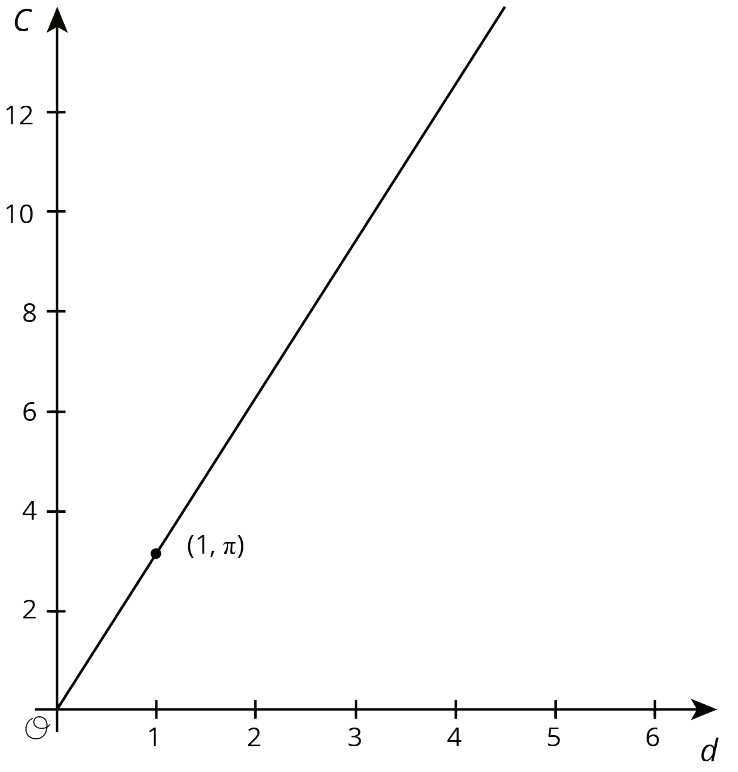
   The amount of snow this year is 140% of the amount of snow last year.

   b. This year, there were 25% fewer sunny days than last year.

   c. Compared to last month, there was a 50% increase in the number of houses sold this month.

   d. The runner's time to complete the marathon was a 10% less than the time to complete the last marathon.

4. The graph shows the relationship between the diameter and the circumference of a circle with the point $(1, \pi)$ shown. Find 3 more points that are on the line.



(From Unit 3, Lesson 3.)

5. Priya bought x grams of flour. Clare bought $\frac{3}{8}$ more than that. Select **all** equations that represent the relationship between the amount of flour that Priya bought, x, and the amount of flour that Clare bought, y.

   A. $y = \frac{3}{8}x$

   B. $y = \frac{5}{8}x$

   C. $y = x + \frac{3}{8}x$

   D. $y = x - \frac{3}{8}x$

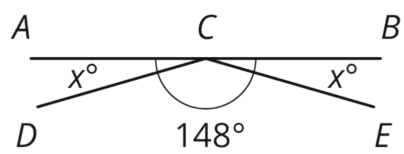
   E. $y = \frac{11}{8}x$

(From Unit 4, Lesson 4.)

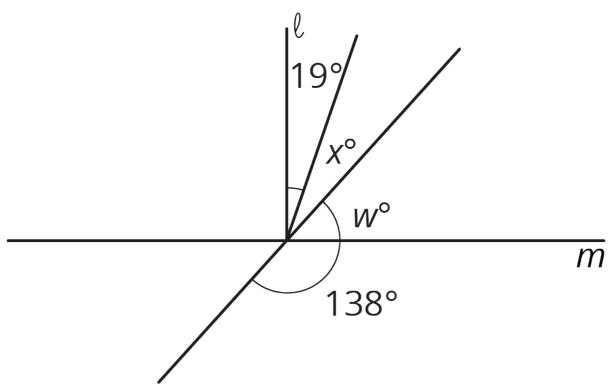
NAME DATE PERIOD

Unit 7, Lesson 5: Using Equations to Solve for Unknown Angles

1. Segments AB, DC, and EC intersect at point C. Angle DCE measures 148°. Find the value of x.



2. Line ℓ is perpendicular to line m. Find the value of x and w.



3. If you knew that two angles were complementary and were given the measure of one of those angles, would you be able to find the measure of the other angle? Explain your reasoning.

4. For each inequality, decide whether the solution is represented by $x < 4.5$ or $x > 4.5$.

   a. $-24 > -6(x - 0.5)$

   b. $-8x + 6 > -30$

c. $-2(x + 3.2) < -15.4$

(from Unit 6, Lesson 15)

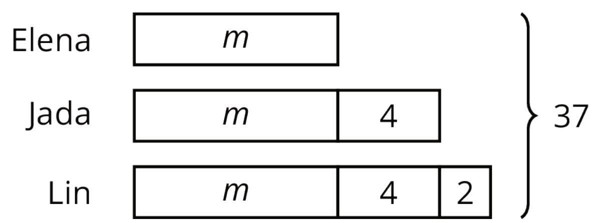
5. A runner ran $\frac{2}{3}$ of a 5 kilometer race in 21 minutes. They ran the entire race at a constant speed.

   a. How long did it take to run the entire race?

   b. How many minutes did it take to run 1 kilometer?

(from Unit 4, Lesson 2)

6. Jada, Elena, and Lin walked a total of 37 miles last week. Jada walked 4 more miles than Elena, and Lin walked 2 more miles than Jada. The diagram represents this situation:



Find the number of miles that they each walked. Explain or show your reasoning.

(from Unit 6, Lesson 12)

7. Select **all** the expressions that are equivalent to $-36x + 54y - 90$.

   A. $-9(4x - 6y - 10)$
   B. $-18(2x - 3y + 5)$
   C. $-6(6x + 9y - 15)$
   D. $18(-2x + 3y - 5)$
   E. $-2(18x - 27y + 45)$
   F. $2(-18x + 54y - 90)$

(from Unit 6, Lesson 19)

Use this page for reviewing student work on the printed practice problems. Note that occasionally there are differences between the print and digital versions of practice items. For answers on the digital practice problems, refer to the digital practice set.

Problem 1

Noah is running a portion of a marathon at a constant speed of 6 miles per hour.

Complete the table to predict how long it would take him to run different distances at that speed, and how far he would run in different time intervals.

time in hours	miles traveled at 6 miles per hour
1	
$\frac{1}{2}$	
$1\frac{1}{3}$	
	$1\frac{1}{2}$
	9
	$4\frac{1}{2}$

Solution

time in hours	miles traveled at 6 miles per hour
1	6
$\frac{1}{2}$	3
$1\frac{1}{3}$	8
$\frac{1}{4}$	$1\frac{1}{2}$
$1\frac{1}{2}$	9
$\frac{3}{4}$	$4\frac{1}{2}$

Problem 2

One kilometer is 1000 meters.

1. Complete the tables. What is the interpretation of the constant of proportionality in each case?

a.

meters	kilometers
1,000	1
250	
12	
1	

The constant of proportionality tells us that:

b.

kilometers	meters
1	1,000
5	
20	
0.3	

The constant of proportionality tells us that:

2. What is the relationship between the two constants of proportionality?

Solution

1.

a.

meters	kilometers
1,000	1
250	0.25
12	0.012

meters	kilometers
1	0.001

0.001 kilometers per meter

b.

kilometers	meters
1	1,000
5	5,000
20	20,000
0.3	300

1000 meters per kilometer

2. 0.001 and 1000 are reciprocals of each other. This is easier to see if 0.001 is written as $\frac{1}{1000}$.

Problem 3

Jada and Lin are comparing inches and feet. Jada says that the constant of proportionality is 12. Lin says it is $\frac{1}{12}$. Do you agree with either of them? Explain your reasoning.

Solution

Jada is saying that there are 12 inches for every 1 foot. Lin is saying that there are $\frac{1}{12}$ foot for every 1 inch.

Problem 4

(from Unit 1, Lesson 12)

The area of the Mojave desert is 25,000 square miles. A scale drawing of the Mojave desert has an area of 10 square inches. What is the scale of the map?

Solution

1 inch to 50 miles

Problem 5

(from Unit 1, Lesson 11)

Which of these scales is equivalent to the scale 1 cm to 5 km? Select **all** that apply.

A. 3 cm to 15 km
B. 1 mm to 150 km
C. 5 cm to 1 km
D. 5 mm to 2.5 km
E. 1 mm to 500 m

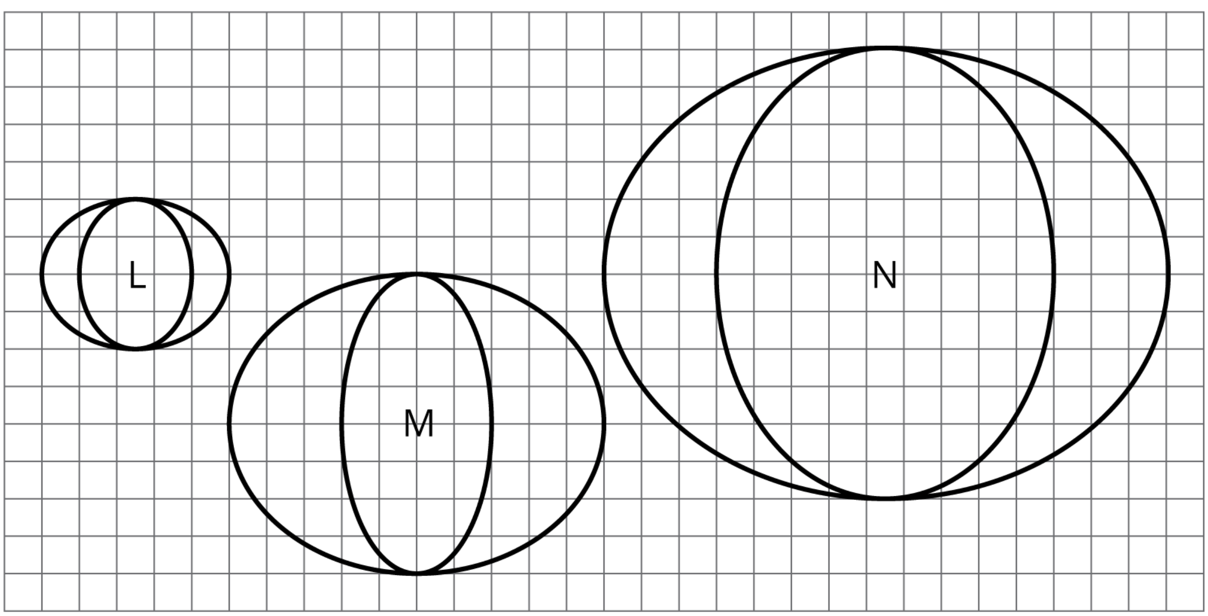
Solution

A, D, E

Problem 6

(from Unit 2, Lesson 1)

Which one of these pictures is not like the others? Explain what makes it different using ratios.



Solution

M is different from L and N. The width:height ratios for the outsides of the pictures are all equivalent to 5:4. However, the width:height ratios of the insides of L and N both have a 3:4

ratio of width:height, while the inside of M has a width of 4 units and a height of 8 units, making its ratio 1:2.

Alternatively, the ratio of height to thickness at the widest part for L and N are both 4:1. But M has a height of 8 units and a thickness of 3 units, making that ratio 8:3.

Use this page for reviewing student work on the printed practice problems. Note that occasionally there are differences between the print and digital versions of practice items. For answers on the digital practice problems, refer to the digital practice set.

Problem 1

For each problem, decide whether the circumference of the circle or the area of the circle is most useful for finding a solution. Explain your reasoning.

1. A car's wheels spin at 1000 revolutions per minute. The diameter of the wheels is 23 inches. You want to know how fast the car is travelling.
2. A circular kitchen table has a diameter of 60 inches. You want to know how much fabric is needed to cover the table top.
3. A circular puzzle is 20 inches in diameter. All of the pieces are about the same size. You want to know about how many pieces there are in the puzzle.
4. You want to know about how long it takes to walk around a circular pond.

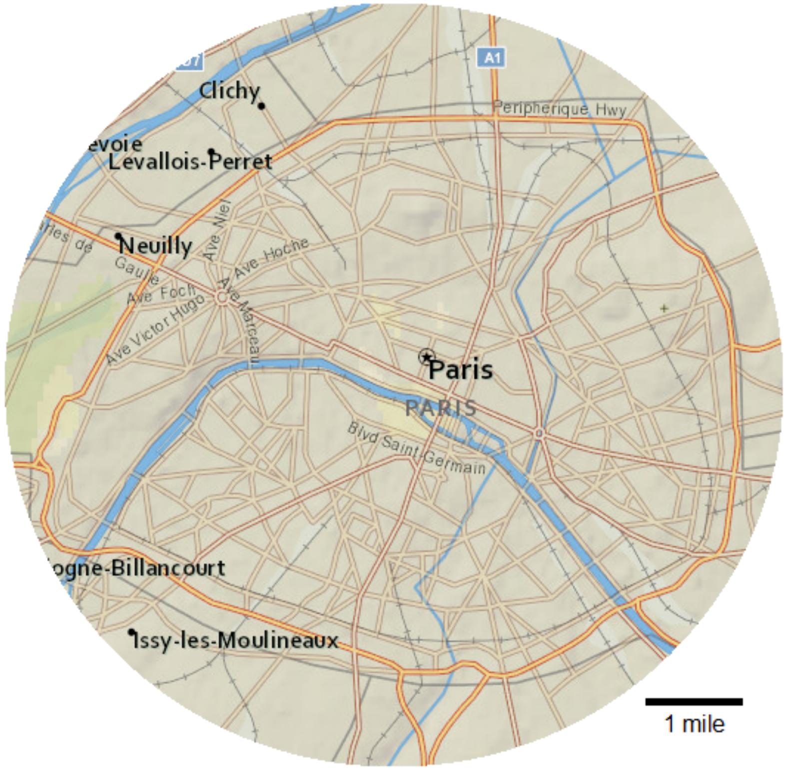
Solution

1. Circumference. The circumference of the wheels and the number of revolutions per minute tells you how far the car is traveling and this can be used to calculate the speed.
2. Area. The fabric covers the surface of the table and it is this area that is needed.
3. Area. The area of the puzzle divided by the area of a puzzle piece will give an estimate of the number of pieces.
4. Circumference. You need to know the distance around the pond which is its circumference.

Problem 2

The city of Paris, France is completely contained within an almost circular road that goes around the edge. Use the map with its scale to:

1. Estimate the circumference of Paris.
2. Estimate the area of Paris.



Solution

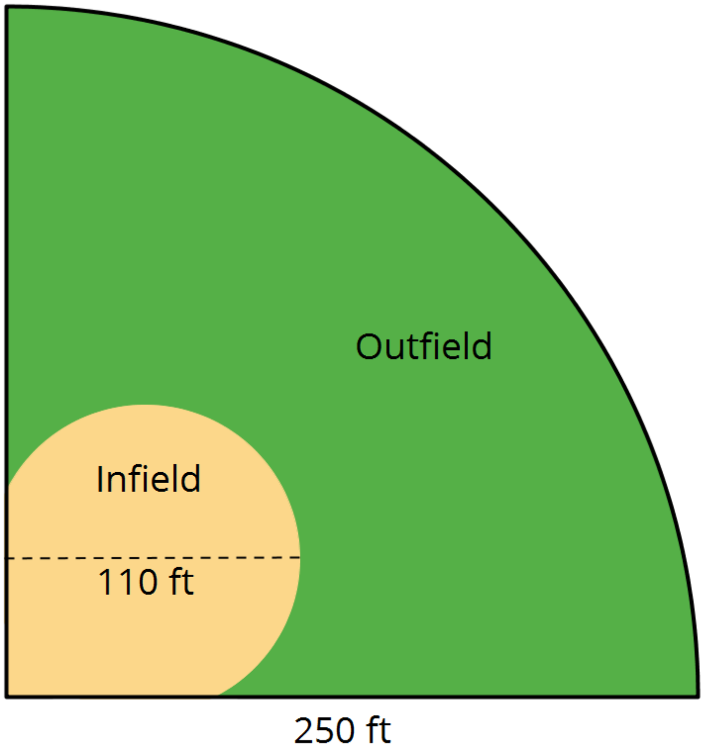
Answers vary. Sample response:

1. About 6π miles (or about 20 miles)
2. About $(3)^2\pi$ mi^2 (or about 30 mi^2)

Problem 3

Here is a diagram of a softball field:

1. About how long is the fence around the field?
2. About how big is the outfield?



Solution

Answers vary. Sample responses:

1. $500 + 125\pi$ (or about 893 ft): This estimate assumes that the curved boundary of the outfield is modeled by a quarter circle.
2. $12{,}600\pi$ (or about 39,600 ft^2): The area of the full softball field, modeled by a quarter circle, is $\frac{1}{4} \cdot \pi \cdot 250^2$ or $15{,}625\pi$ square feet. The infield, which needs to be subtracted, has about the same area as a circle of radius 55 feet or $3{,}025\pi$ square feet. The difference is $12{,}600\pi$ square feet. Note that if we draw a circle with diameter 110 feet (where the 110 foot measurement is marked), it misses some of the lower left part of the infield but also contains some extra area below the softball field so this is a good estimate.

Problem 4

(from Unit 2, Lesson 5)

While in math class, Priya and Kiran come up with two ways of thinking about the proportional relationship shown in the table.

x	y
2	?

x	y
5	1750

Both students agree that they can solve the equation $5k = 1750$ to find the constant of proportionality.

- Priya says, “I can solve this equation by dividing 1750 by 5.”
- Kiran says, “I can solve this equation by multiplying 1750 by $\frac{1}{5}$.”

1. What value of k would each student get using their own method?
2. How are Priya and Kiran's approaches related?
3. Explain how each student might approach solving the equation $\frac{2}{3}k = 50$.

Solution

1. 350
2. Priya divided each side of the equation by the same number. Seeing that 5 and k were multiplied in the equation, she used division to get k by itself. Meanwhile, Kiran multiplied by the reciprocal of 5.
3. Priya divides by $\frac{2}{3}$ since k is being multiplied by $\frac{2}{3}$. Her equation is $k = 50 \div \frac{2}{3}$. Kiran multiplies by the reciprocal of $\frac{2}{3}$. His equation is $k = \frac{3}{2} \cdot 50$.

This unit covers three big topics. Read about each topic and find a task or activity to complete with your student below.

Proportional Relationships with Fractions

Percent Increase and Decrease

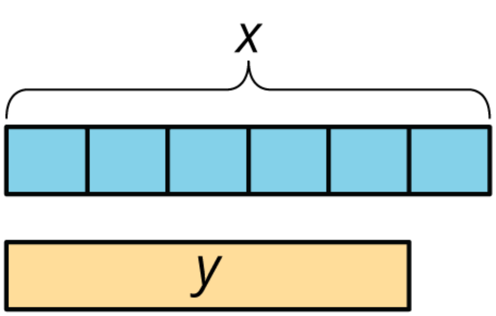
Applying Percentages

Proportional Relationships with Fractions

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:

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

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

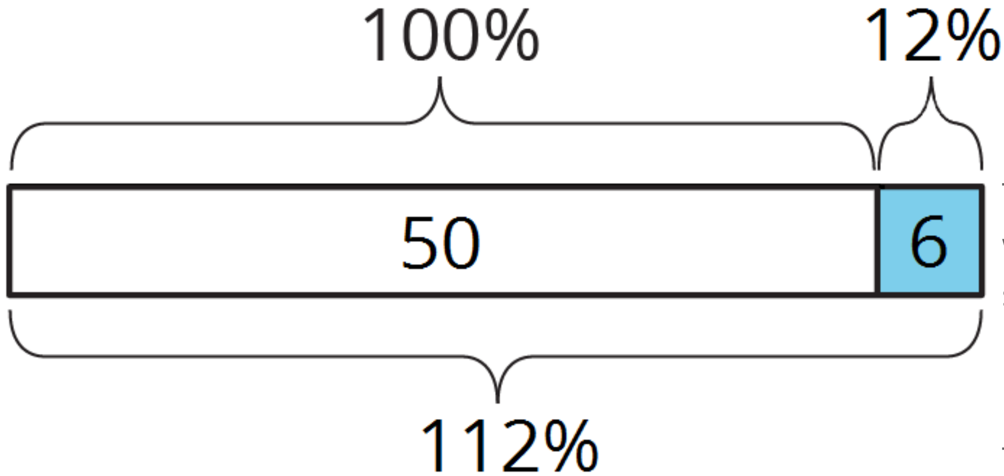
2. $\frac{7}{6}$, $1.1\overline{6}$, or equivalent.

Percent Increase and Decrease

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 $6 \div 50 = 0.12$.

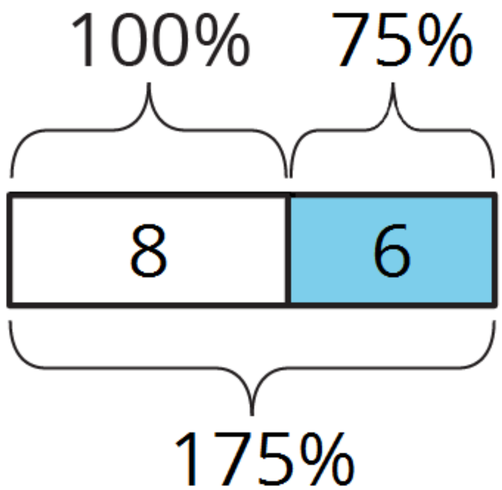


They now have 56 students, which is 112% of the starting amount.

$$1.12 \cdot 50 = 56$$

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

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 $117.\overline{3} - 100 = 17.\overline{3}$.

Spanish language family materials

7.4 Spanish Family Materials (PDF)

From Illustrative Mathematics

Print or share this guide to help families support their students with the key concepts and ideas in Grade 7, Unit 4.

Type PDF

This unit covers three big topics. Read about each topic and find a task or activity to complete with your student below.

Representing Proportional Relationships with Tables

Representing Proportional Relationships with Equations

Representing Proportional Relationships with Graphs

Representing Proportional Relationships with Tables

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	• 0.4
10	4	• 0.4
30	12	• 0.4
2.5	1	• 0.4

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

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
20	30.00
50	75.00

$\cdot 1.5$ $\cdot 1.5$ $\cdot 1.5$

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:

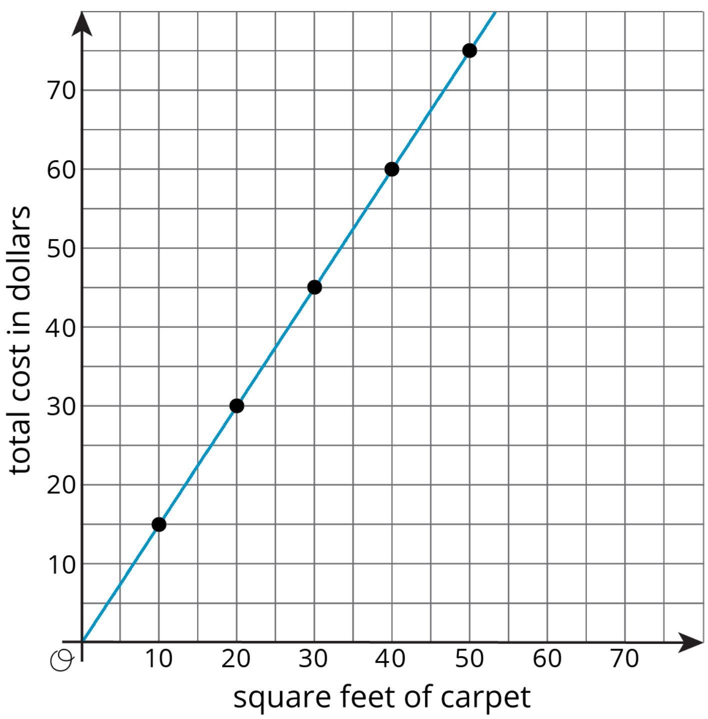
1. Write an equation that represents that relationship between the amounts of grape juice and peach juice in the recipe "for every 5 cups of grape juice, mix in 2 cups of peach juice."
2. Select **all** the equations that could represent a proportional relationship:
   A. $K = C + 273$
   B. $s = \frac{1}{4}p$
   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

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.

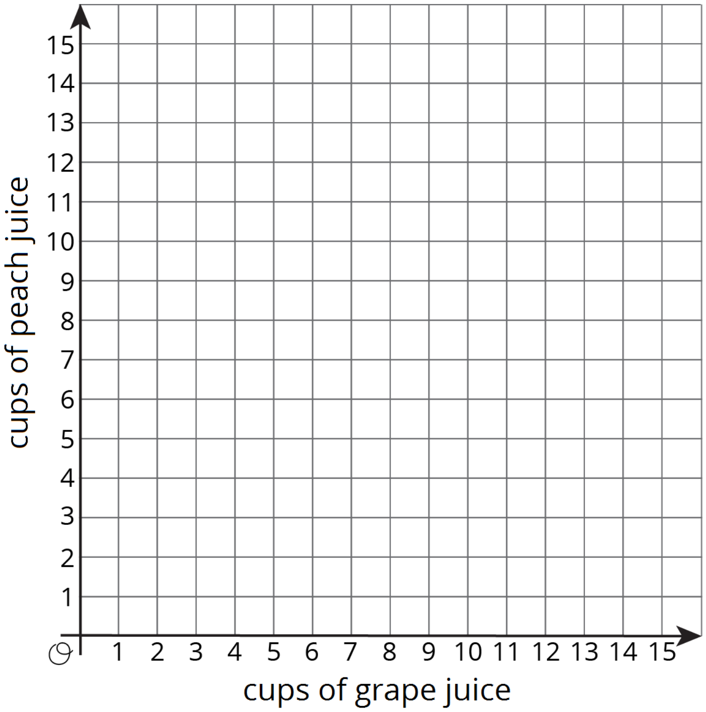


Each square foot of carpet costs \$1.50. The point $(10, 15)$ on the graph tells us that 10 square feet of carpet cost \$15.

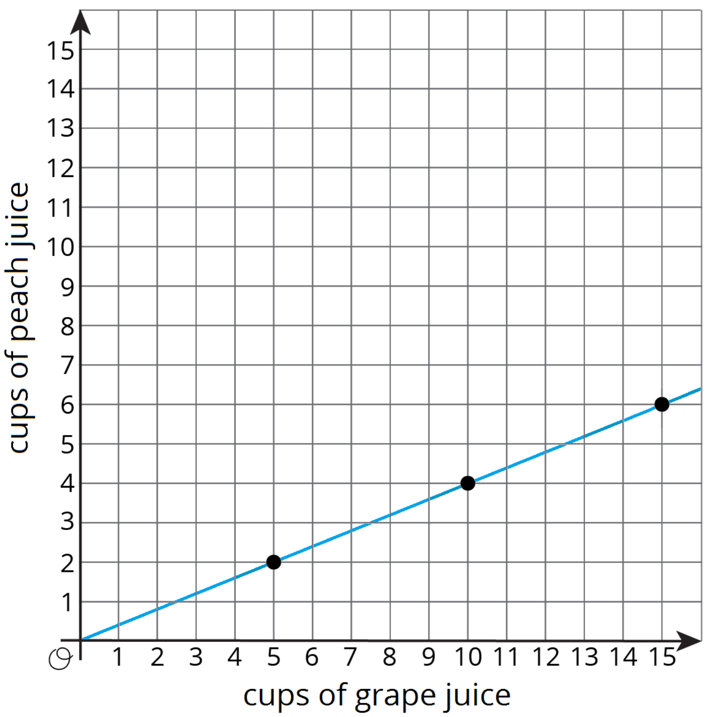
Notice that the points on the graph are arranged in a straight line. If you buy 0 square feet of carpet, it would cost \$0. Graphs of proportional relationships are always parts of straight lines including the point $(0, 0)$.

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.”



Solution:



Spanish language family materials

7.2 Spanish Family Materials (PDF)

From iM Illustrative Mathematics

Print or share this guide to help families support their students with the key concepts and ideas in Grade 7, Unit 2.

Type PDF

This unit covers three big topics. Read about each topic and find a task or activity to complete with your student below.

Angle Relationships

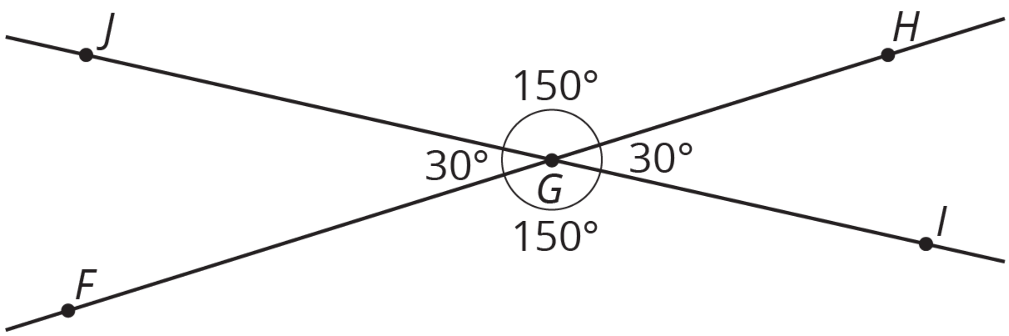
Drawing Polygons with Given Conditions

Solid Geometry

Angle Relationships

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

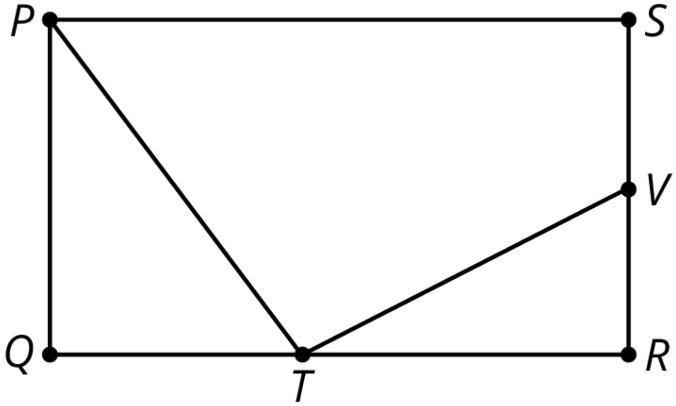
- If two angles add to 90°, then we say they are **complementary angles**. If two angles add to 180°, then we say they are **supplementary angles.** For example, angles JGF and JGH below are supplementary angles, because $30 + 150 = 180$.



- 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?

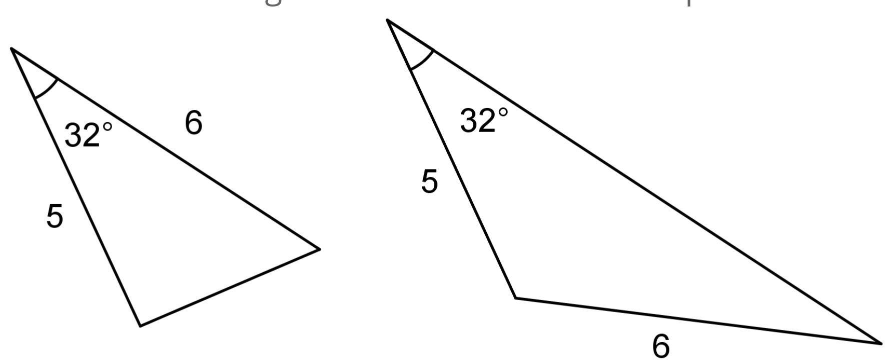
Solution:

1. Angle TVR measures 63°, because $180 - 117 = 63$.
2. Angle QPT measures 37°, because $90 - 53 = 37$.

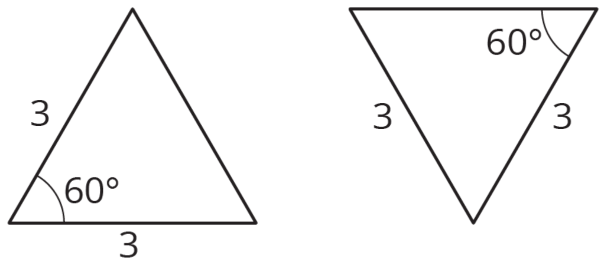
Drawing Polygons with Given Conditions

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.

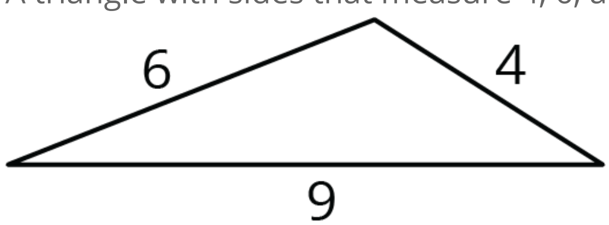


- Sometimes it is not possible to draw a triangle with the given information. For example, there is no triangle with sides measuring 4 inches, 5 inches, and 12 inches. (Try to draw it and see for yourself!)

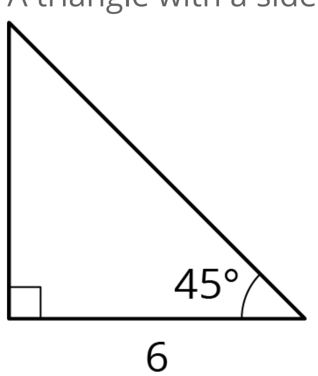
Here is a task to try with your student:

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.



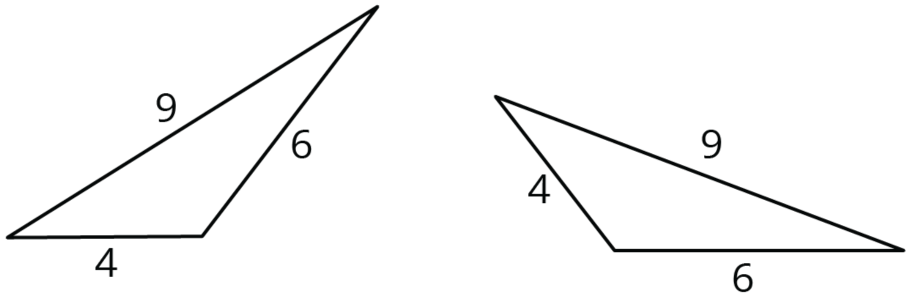
2. A triangle with a side that measures 6 units and angles that measure 45° and 90°



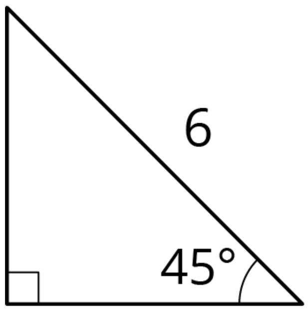
Solution:

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:

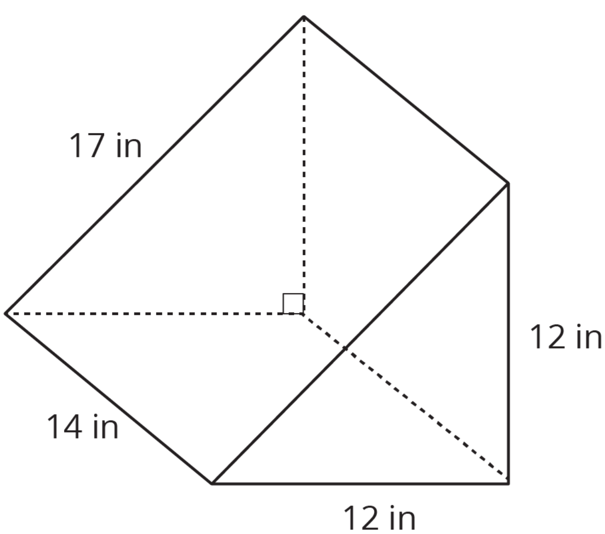


2. You can draw a different triangle by putting the side that is 6 opposite from the 90° angle instead of next to it. This is not an identical copy of the given triangle, because it is smaller.



Solid Geometry

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.

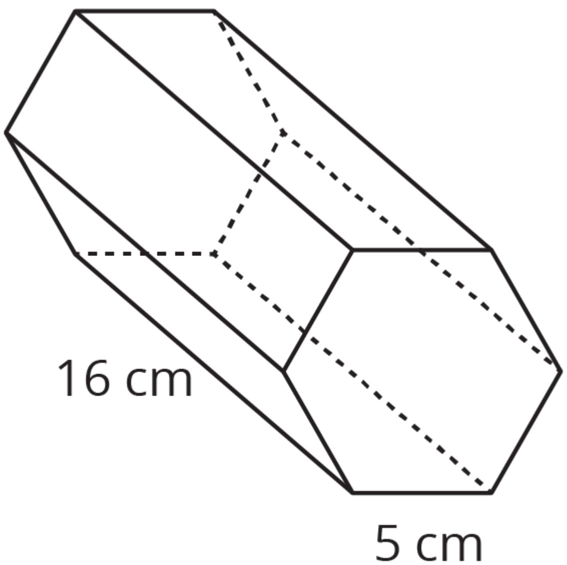


In general, we can find the volume of any prism by multiplying the area of its base times its height. For this prism, the area of the triangular base is 72 in^2, so the volume is $72 \cdot 14$, or 1,008 in^3.

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 $65 + 65 + 80 + 80 + 80 + 80 + 80 + 80 = 610$.

Spanish language family materials

7.7 Spanish Family Materials (PDF)

From iM Illustrative Mathematics

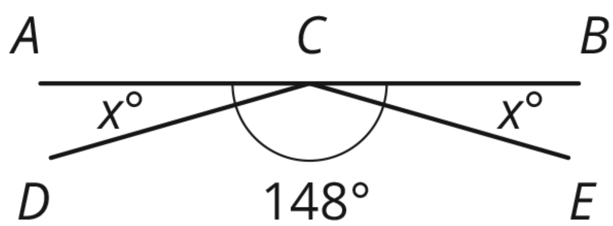
Print or share this guide to help families support their students with the key concepts and ideas in Grade 7, Unit 7.

Type PDF

Use this page for reviewing student work on the printed practice problems. Note that occasionally there are differences between the print and digital versions of practice items. For answers on the digital practice problems, refer to the digital practice set.

Problem 1

Segments AB, DC, and EC intersect at point C. Angle DCE measures $148°$. Find the value of x.

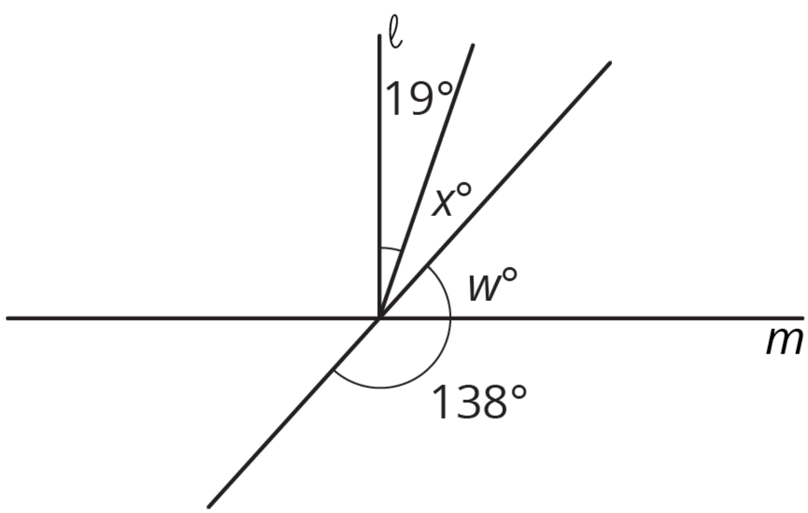


Solution

16

Problem 2

Line ℓ is perpendicular to line m. Find the value of x and w.



Solution

$x = 29$ and $w = 42$

Problem 3

If you knew that two angles were complementary and were given the measure of one of those angles, would you be able to find the measure of the other angle? Explain your reasoning.

Solution

Yes, because one angle would be known and if two angles are complementary, then the measures of the two angles sum to 90°.

Problem 4

(from Unit 6, Lesson 15)

For each inequality, decide whether the solution is represented by $x < 4.5$ or $x > 4.5$.

1. $-24 > -6(x - 0.5)$
2. $-8x + 6 > -30$
3. $-2(x + 3.2) < -15.4$

Solution

1. $x > 4.5$
2. $x < 4.5$
3. $x > 4.5$

Problem 5

(from Unit 4, Lesson 2)

A runner ran $\frac{2}{3}$ of a 5 kilometer race in 21 minutes. They ran the entire race at a constant speed.

1. How long did it take to run the entire race?
2. How many minutes did it take to run 1 kilometer?

Solution

1. 31.5 minutes
2. 6.3 minutes

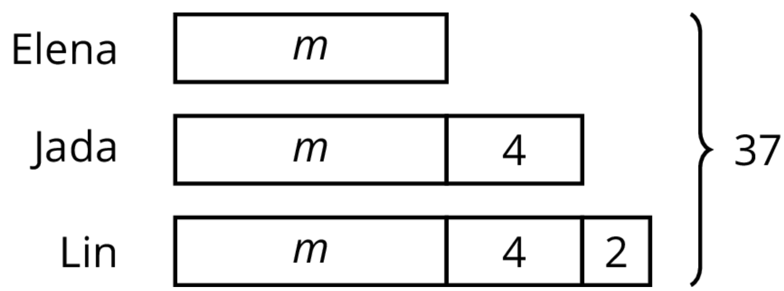
One way to find the answers to both questions is using a ratio table:

distance (km)	time (min)
$\frac{10}{3}$	21
10	63
5	31.5
1	6.3

Problem 6

(from Unit 6, Lesson 12)

Jada, Elena, and Lin walked a total of 37 miles last week. Jada walked 4 more miles than Elena, and Lin walked 2 more miles than Jada. The diagram represents this situation:



Find the number of miles that they each walked. Explain or show your reasoning.

Solution

Elena: 9 miles, Jada: 13 miles, Lin: 15 miles

Possible strategies:

- $3m + 10 = 37$, $m = 9$
- Start with the total of 37 miles, subtract 10, and divide by 3

Problem 7

(from Unit 6, Lesson 19)

Select **all** the expressions that are equivalent to -$36x + 54y - 90$.

A. $-9(4x - 6y - 10)$
B. $-18(2x - 3y + 5)$
C. $-6(6x + 9y - 15)$
D. $18(-2x + 3y - 5)$
E. $-2(18x - 27y + 45)$
F. $2(-18x + 54y - 90)$

Solution

B, D, E

This unit covers three big topics. Read about each topic and find a task or activity to complete with your student below.

Adding and Subtracting Rational Numbers

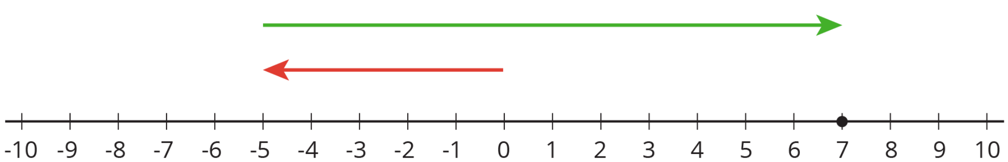
Multiplying and Dividing Rational Numbers

Four Operations with Rational Numbers

Adding and Subtracting Rational Numbers

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 $-5 + 12 = 7$.



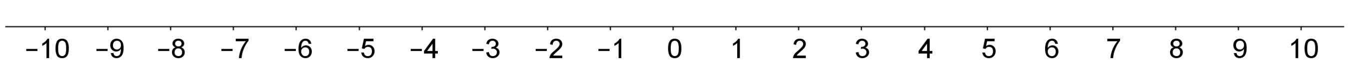
The first number is represented by an arrow that starts at 0 and points 5 units to the left. The next number is represented by an arrow that starts directly above the tip of the first arrow and points 12 units to the right. The answer is 7 because the tip of this arrow ends above the 7 on the number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

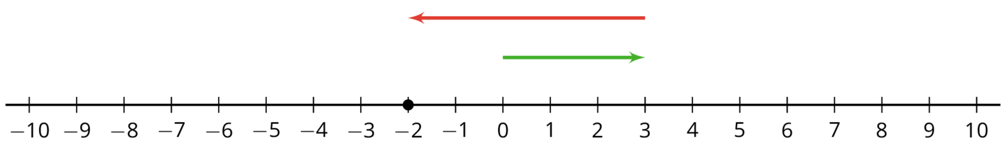
1. Use the number line to show $3 + -5$.



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

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: $4 \cdot -3 = (-3) + (-3) + (-3) + (-3) = -12$. Also, an important property of multiplication is that we can multiply numbers in either order. This means that $-3 \cdot 4 = 4 \cdot -3 = -12$.

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

$$(-3) \cdot (-4)$$

$$(-3) \cdot (0 - 4)$$

$$(-3 \cdot 0) - (-3 \cdot 4)$$

$$0 - -12$$

$$12$$

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 $5 \cdot -2$.
2. Use your answer to the previous question to calculate:
   a. $-2 \cdot 5$
   b. $-2 \cdot -5$
   c. $-5 \cdot -2$

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

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:

1. $25 + a = 17$
2. $-4b = -30$
3. $\frac{-3}{4}c = 12$

Solution:

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

Spanish language family materials

7.5 Spanish Family Materials (PDF)

From Illustrative Mathematics

Print or share this guide to help families support their students with the key concepts and ideas in Grade 7, Unit 5.

Type PDF

Unit 3 Lesson 10 Cumulative Practice Problems

1. For each problem, decide whether the circumference of the circle or the area of the circle is most useful for finding a solution. Explain your reasoning.

    a. A car's wheels spin at 1000 revolutions per minute. The diameter of the wheels is 23 inches. You want to know how fast the car is travelling.

    b. A circular kitchen table has a diameter of 60 inches. You want to know how much fabric is needed to cover the table top.

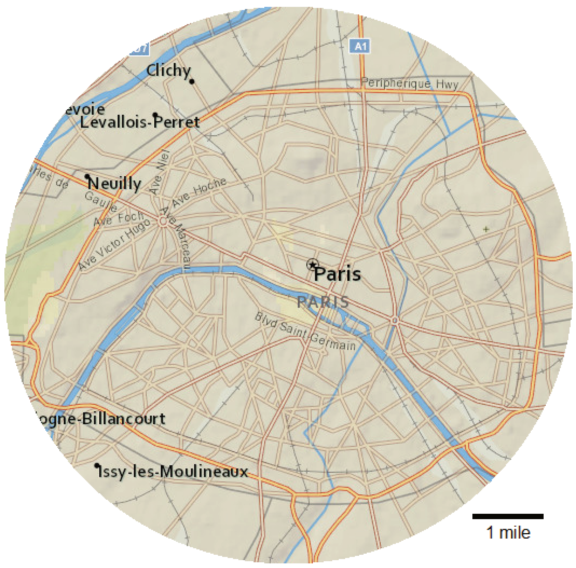
    c. A circular puzzle is 20 inches in diameter. All of the pieces are about the same size. You want to know about how many pieces there are in the puzzle.

    d. You want to know about how long it takes to walk around a circular pond.

2. The city of Paris, France is completely contained within an almost circular road that goes around the edge. Use the map with its scale to:

    a. Estimate the circumference of Paris.

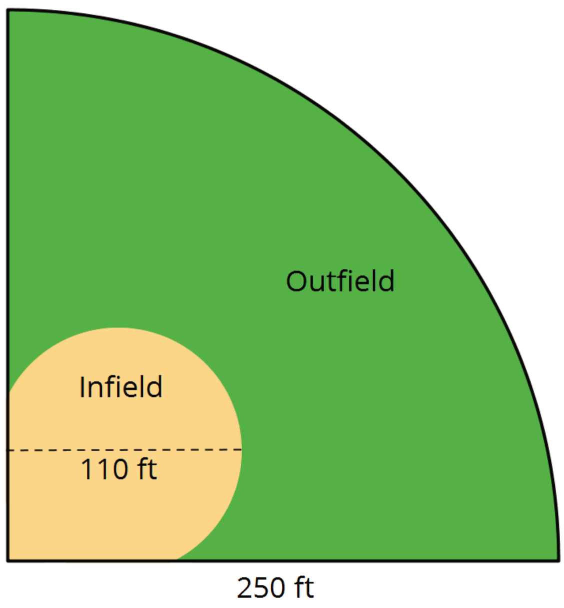
    b. Estimate the area of Paris.



3. Here is a diagram of a softball field:

    a. About how long is the fence around the field?

    b. About how big is the outfield?



4. While in math class, Priya and Kiran come up with two ways of thinking about the proportional relationship shown in the table.

x	y
2	?
5	1750

Both students agree that they can solve the equation $5k = 1750$ to find the constant of proportionality.

- Priya says, "I can solve this equation by dividing 1750 by 5."
- Kiran says, "I can solve this equation by multiplying 1750 by $\frac{1}{5}$."

a. What value of k would each student get using their own method?

b. How are Priya and Kiran's approaches related?

c. Explain how each student might approach solving the equation $\frac{2}{3}k = 50$.

(From Unit 2, Lesson 5.)

Use this page for reviewing student work on the printed practice problems. Note that occasionally there are differences between the print and digital versions of practice items. For answers on the digital practice problems, refer to the digital practice set.

Problem 1

A bank charges a service fee of $7.50 per month for a checking account.

A bank account has $85.00. If no money is deposited or withdrawn except the service charge, how many months until the account balance is negative?

Solution

12, because $85 \div 7.50 = 11\frac{1}{3}$ which means it will take 12 months to have a negative balance in the account

Problem 2

The table shows transactions in a checking account.

January
-38.50
126.30
429.40
-265.00

February
250.00
-135.20
35.50
-62.30

March
-14.00
99.90
-82.70
-1.50

April
-86.80
-570.00
100.00
-280.10

1. Find the total of the transactions for each month.
2. Find the mean total for the four months.

Solution

1. January: 252.20; February: 88; March 1.70; April: -836.90
2. -123.75, because $[252.20 + 88 + 1.70 + (-836.9)] \div 4 = -123.75$

Problem 3

A large aquarium of water is being filled with a hose. Due to a problem, the sensor does not start working until some time into the filling process. The sensor starts its recording at the time zero minutes. The sensor initially detects the tank has 225 liters of water in it.

1. The hose fills the aquarium at a constant rate of 15 liters per minute. What will the sensor read at the time 5 minutes?
2. Later, someone wants to use the data to find the amount of water at times before the sensor started. What should the sensor have read at the time -7 minutes?

Solution

1. 300 liters, because $225 + 15 \cdot 5 = 300$
2. 120 liters, because $225 + 15 \cdot (\text{-}7) = 120$

Problem 4

(from Unit 4, Lesson 11)

A furniture store pays a wholesale price for a mattress. Then, the store marks up the retail price to 150% of the wholesale price. Later, they put the mattress on sale for 50% off of the retail price. A customer just bought the mattress on sale and paid $1,200.

1. What was the retail price of the mattress, before the discount?
2. What was the wholesale price, before the markup?

Solution

1. $, because $1{,}200 \div 0.5 = 2{,}400$.
2. $, because $2{,}400 \div 1.5 = 1{,}600$.

Problem 5

(from Unit 4, Lesson 10)

1. A restaurant bill is $21. You leave a 15% tip. How much do you pay including the tip?
2. Which of the following represents the amount a customer pays including the tip of 15% if the bill was b dollars? Select **all** that apply.
    - $15b$
    - $b + 0.15b$
    - $1.15b$
    - $1.015b$
    - $b + \frac{15}{100}b$
    - $b + 0.15$
    - $0.15b$

Solution

1. $24.15
2. $b + 0.15b$, $1.15b$, $b + \frac{15}{100}b$

Use this page for reviewing student work on the printed practice problems. Note that occasionally there are differences between the print and digital versions of practice items. For answers on the digital practice problems, refer to the digital practice set.

Problem 1

- Noah says that $9x - 2x + 4x$ is equivalent to $3x$, because the subtraction sign tells us to subtract everything that comes after $9x$.
- Elena says that $9x - 2x + 4x$ is equivalent to $11x$, because the subtraction only applies to $2x$.

Do you agree with either of them? Explain your reasoning.

Solution

Elena is correct. Rewriting addition as subtraction gives us $9x + \text{-}2x + 4x$, which shows that the subtraction symbol in front of the $2x$ applies only to the $2x$ and not to the terms that come after it.

Problem 2

Identify the error in generating an expression equivalent to $4 + 2x - \frac{1}{2}(10 - 4x)$. Then correct the error.

$4 + 2x + \frac{\text{-}1}{2}(10 + \text{-}4x)$
$4 + 2x + \text{-}5 + 2x$
$4 + 2x - 5 + 2x$
$\text{-}1$

Solution

The error is in the last step. The second $2x$ was subtracted instead of being added. This would be correct if there were parentheses around $5 + 2x$. The last step should be $4x - 1$.

Problem 3

Select **all** expressions that are equivalent to $5x - 15 - 20x + 10$.

A: $5x - (15 + 20x) + 10$
B: $5x + \text{-}15 + \text{-}20x + 10$

C: $5(x - 3 - 4x + 2)$
D: $-5(-x + 3 + 4x + -2)$
E: $-15x - 5$
F: $-5(3x + 1)$
G: $-15(x - \frac{1}{3})$

Solution

A, B, C, D, E, F

Problem 4

(from Unit 6, Lesson 14)

The school marching band has a budget of up to $750 to cover 15 new uniforms and competition fees that total $300. How much can they spend for one uniform?

1. Write an inequality to represent this situation.
2. Solve the inequality and describe what it means in the situation.

Solution

1. $15x + 300 \leq 750$
2. $x \leq 30$. They can spend at most $30 on each uniform.

Problem 5

(from Unit 6, Lesson 16)

Solve the inequality that represents each story. Then interpret what the solution means in the story.

1. For every $9 that Elena earns, she gives x dollars to charity. This happens 7 times this month. Elena wants to be sure she keeps at least $42 from this month's earnings. $7(9 - x) \geq 42$
2. Lin buys a candle that is 9 inches tall and burns down x inches per minute. She wants to let the candle burn for 7 minutes until it is less than 6 inches tall. $9 - 7x < 6$

Solution

1. $x \leq 3$. Elena can give $3 or less to charity for every $9 she earns.
2. $x > \frac{3}{7}$. The candle needs to burn down more than $\frac{3}{7}$ inch each minute.

Problem 6

(from Unit 4, Lesson 3)

A certain shade of blue paint is made by mixing $1\frac{1}{2}$ quarts of blue paint with 5 quarts of white paint. If you need a total of 16.25 gallons of this shade of blue paint, how much of each color should you mix?

Solution

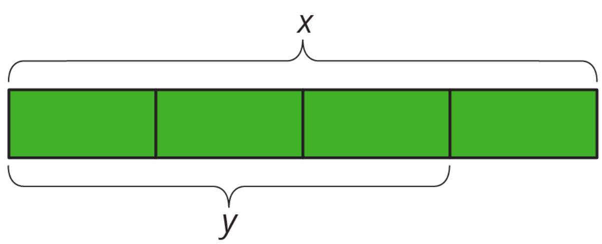
You should mix $3\frac{3}{4}$ gallons of blue paint with $12\frac{1}{2}$ gallons of white paint.

Use this page for reviewing student work on the printed practice problems. Note that occasionally there are differences between the print and digital versions of practice items. For answers on the digital practice problems, refer to the digital practice set.

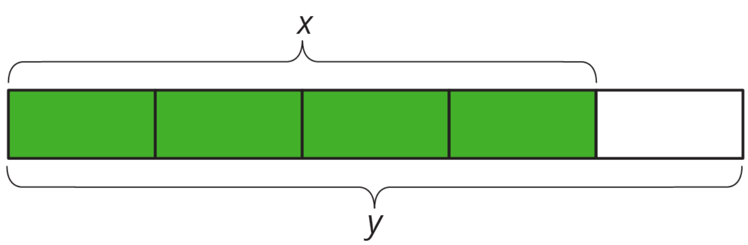
Problem 1

For each diagram, decide if y is an increase or a decrease relative to x. Then determine the percent increase or decrease.

A



B



Solution

For A, y is a 25% decrease of x.

For B, y is a 25% increase of x.

Problem 2

Draw diagrams to represent the following situations.

1. The amount of flour that the bakery used this month was a 50% increase relative to last month.
2. The amount of milk that the bakery used this month was a 75% decrease relative to last month.

Solution

Answers vary.

Problem 3

Write each percent increase or decrease as a percentage of the initial amount. The first one is done for you.

1. This year, there was 40% more snow than last year.

   The amount of snow this year is 140% of the amount of snow last year.

2. This year, there were 25% fewer sunny days than last year.
3. Compared to last month, there was a 50% increase in the number of houses sold this month.
4. The runner’s time to complete the marathon was a 10% less than the time to complete the last marathon.

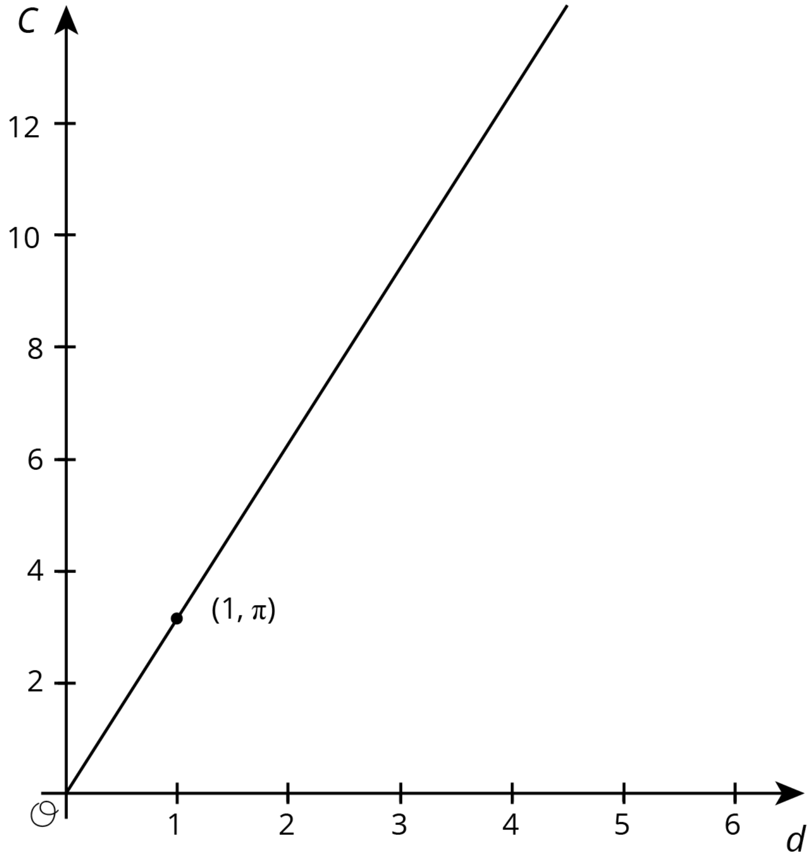
Solution

1. The amount of snow this year is 140% of the amount of snow last year.
2. The number of sunny days this year is 75% of the number of sunny days last year.
3. The number of houses sold this month is 150% of the number of houses sold last month.
4. The runner's time to complete the marathon was 90% of the time to complete the last marathon.

Problem 4

(from Unit 3, Lesson 3)

The graph shows the relationship between the diameter and the circumference of a circle with the point (1,π) shown. Find 3 more points that are on the line.



Solution

Answers vary. Possible answers: (0,0), (2,2π), (3,9.4)

Problem 5

(from Unit 4, Lesson 4)

Priya bought x grams of flour. Clare bought $\frac{3}{8}$ more than that. Select **all** equations that represent the relationship between the amount of flour that Priya bought, x, and the amount of flour that Clare bought, y.

A. $y=\frac{3}{8}x$

B. $y=\frac{5}{8}x$

C. $y=x+\frac{3}{8}x$

D. $y=x-\frac{3}{8}x$

E. $y=\frac{11}{8}x$

Solution

C, E

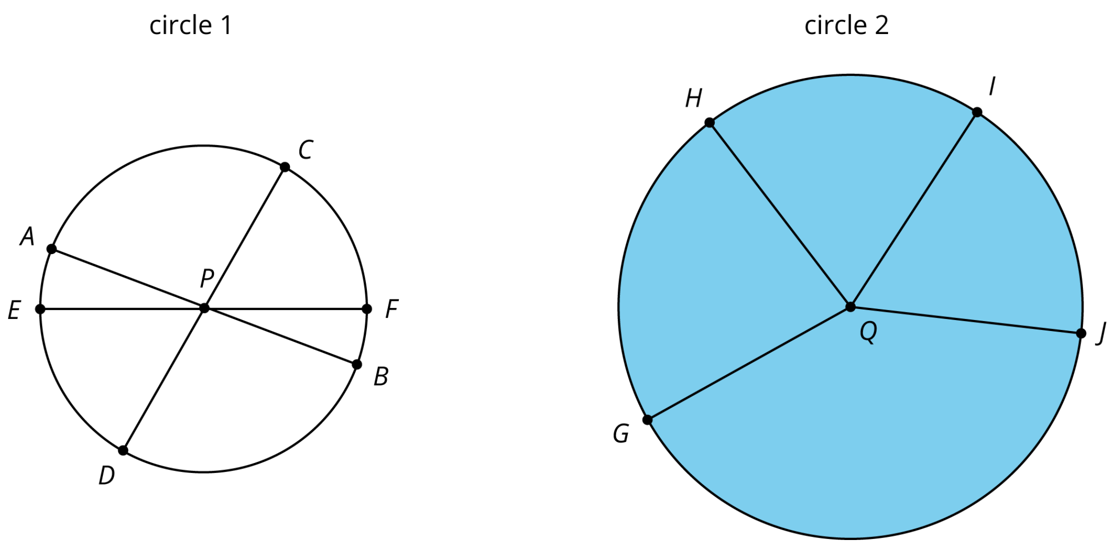
This unit covers two big topics. Read about each topic and find a task or activity to complete with your student below.

Circumference of a Circle

Area of a Circle

Circumference of a Circle

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.

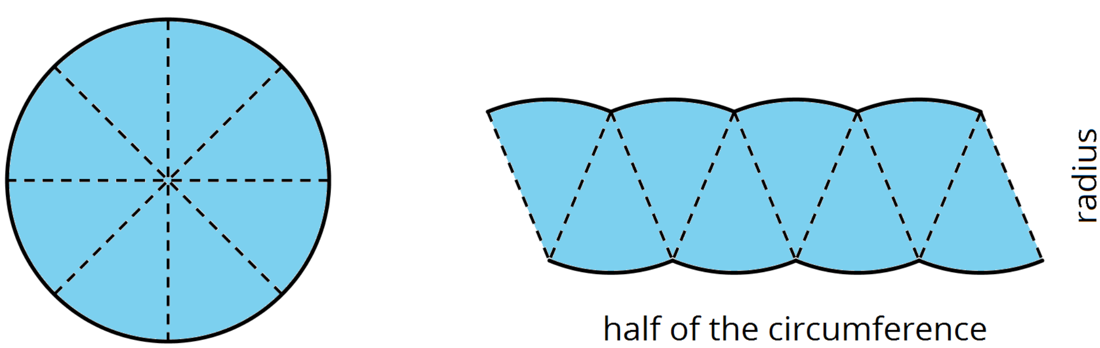
1. What is the *radius* of the cereal bowl?
   A. 5 centimeters
   B. 8 centimeters
   C. 32 centimeters
   D. 50 centimeters
2. What is the *circumference* of the cereal bowl?
   A. 5 centimeters
   B. 8 centimeters
   C. 32 centimeters
   D. 50 centimeters

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. $16 \cdot 3.14 \approx 50$.

Area of a Circle

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, $800 - 28.26 = 771.74$.

Spanish language family materials

7.3 Spanish Family Materials (PDF)

From Illustrative Mathematics

Print or share this guide to help families support their students with the key concepts and ideas in Grade 7, Unit 3.

Type PDF

Unit 5 Lesson 14 Cumulative Practice Problems

1. A bank charges a service fee of $7.50 per month for a checking account.

   A bank account has $85.00. If no money is deposited or withdrawn except the service charge, how many months until the account balance is negative?

2. The table shows transactions in a checking account.

January	February	March	April
-38.50	250.00	-14.00	-86.80
126.30	-135.20	99.90	-570.00
429.40	35.50	-82.70	100.00
-265.00	-62.30	-1.50	-280.10

   a. Find the total of the transactions for each month.

   b. Find the mean total for the four months.

3. A large aquarium of water is being filled with a hose. Due to a problem, the sensor does not start working until some time into the filling process. The sensor starts its recording at the time zero minutes. The sensor initially detects the tank has 225 liters of water in it.

    a. The hose fills the aquarium at a constant rate of 15 liters per minute. What will the sensor read at the time 5 minutes?

    b. Later, someone wants to use the data to find the amount of water at times before the sensor started. What should the sensor have read at the time -7 minutes?

4. A furniture store pays a wholesale price for a mattress. Then, the store marks up the retail price to 150% of the wholesale price. Later, they put the mattress on sale for 50% off of the retail price. A customer just bought the mattress on sale and paid $1,200.

    a. What was the retail price of the mattress, before the discount?

    b. What was the wholesale price, before the markup?

(From Unit 4, Lesson 11.)

5. a. A restaurant bill is \$21. You leave a 15% tip. How much do you pay including the tip?

   b. Which of the following represents the amount a customer pays including the tip of 15% if the bill was b dollars? Select **all** that apply.

   - $15b$
   - $b + 0.15b$
   - $1.15b$
   - $1.015b$
   - $b + \frac{15}{100}b$
   - $b + 0.15$
   - $0.15b$

(From Unit 4, Lesson 10.)

This unit covers four big topics. Read about each topic and find a task or activity to complete with your student below.

Probabilities of Single Step Events

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

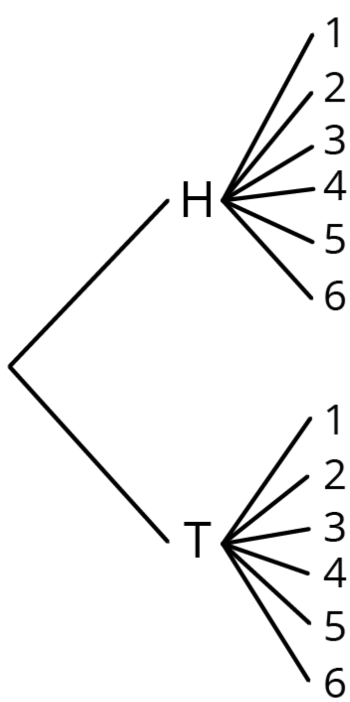
1. Estimate the probability that the next fish that gets caught will be a bass.
2. Another person in the competition caught 5 fish. Predict how many of these fish were bass.
3. Before the competition, the lake was stocked with equal numbers of catfish and bass. Describe some possible reasons for why 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

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?

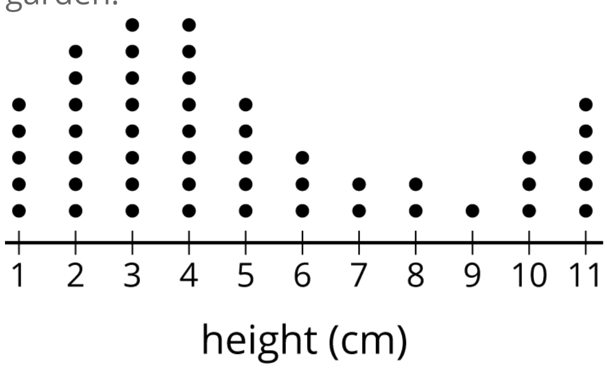
Solution:

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”)

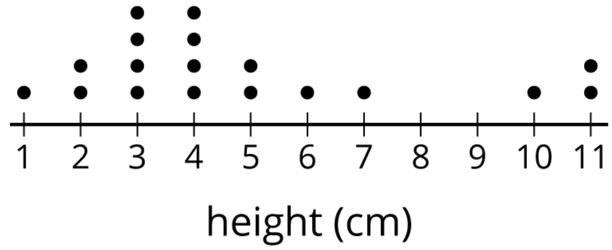
Sampling

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.

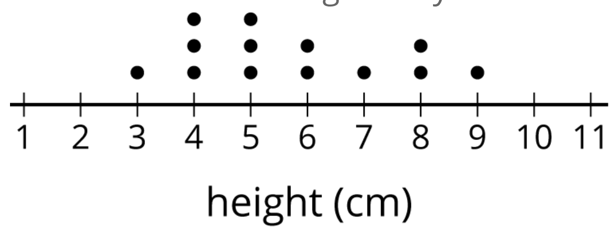
- For example, here is a dot plot showing a population: the height of 49 plants in a sprout garden.



- 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

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.

Spanish language family materials

7.8 Spanish Family Materials (PDF)

From Illustrative Mathematics

Print or share this guide to help families support their students with the key concepts and ideas in Grade 7, Unit 8.

Type PDF

Unit 2 Lesson 3 Cumulative Practice Problems

1. Noah is running a portion of a marathon at a constant speed of 6 miles per hour.

   Complete the table to predict how long it would take him to run different distances at that speed, and how far he would run in different time intervals.

time in hours	miles traveled at 6 miles per hour
1	
$\frac{1}{2}$	
$1\frac{1}{3}$	
	$1\frac{1}{2}$
	9
	$4\frac{1}{2}$

2. One kilometer is 1000 meters.

   a. Complete the tables. What is the interpretation of the constant of proportionality in each case?

meters	kilometers
1,000	1
250	
12	
1	

kilometers	meters
1	1,000
5	
20	
0.3	

   The constant of proportionality tells us that:

   The constant of proportionality tells us that:

   b. What is the relationship between the two constants of proportionality?

3. Jada and Lin are comparing inches and feet. Jada says that the constant of proportionality is 12. Lin says it is $\frac{1}{12}$. Do you agree with either of them? Explain your reasoning.

4. The area of the Mojave desert is 25,000 square miles. A scale drawing of the Mojave desert has an area of 10 square inches. What is the scale of the map?

(From Unit 1, Lesson 12.)

5. Which of these scales is equivalent to the scale 1 cm to 5 km? Select **all** that apply.

   A. 3 cm to 15 km

   B. 1 mm to 150 km

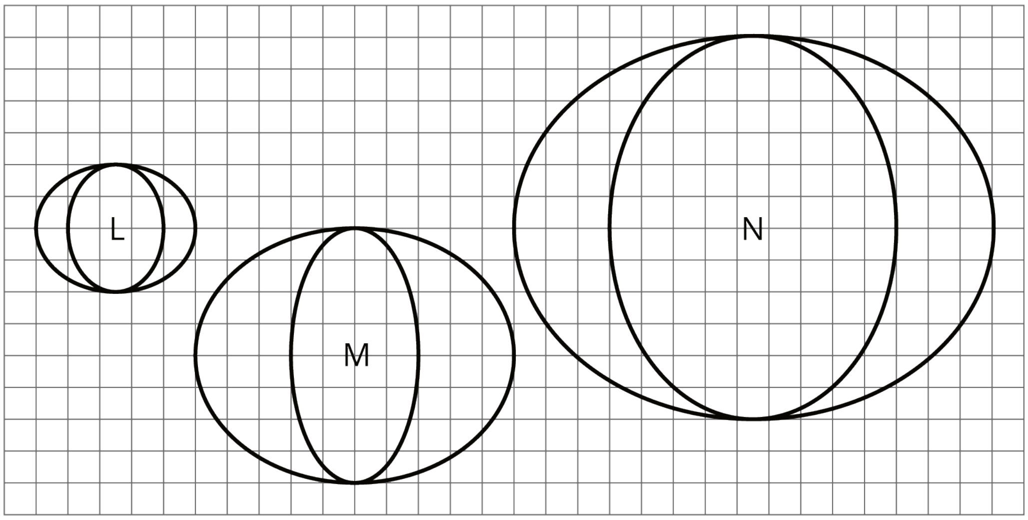
   C. 5 cm to 1 km

   D. 5 mm to 2.5 km

   E. 1 mm to 500 m

(From Unit 1, Lesson 11.)

6. Which one of these pictures is not like the others? Explain what makes it different using ratios.



(From Unit 2, Lesson 1.)

Name:
Date:
Period:

The Counters Game (pg. 103)

<u>*Directions:*</u> Place a total of 11 O's, any way you'd like to distribute them on your game board below. After everyone in your group has placed their 11 O's have a group member roll a pair of dice. When the number rolled matches one of your O's you may strike a line through one O on that number. When all your O's are struck through, you win.

<u>EXAMPLE:</u>

Will has a good feeling about 3's, 6's and 9's so he places 3 O's on each of them. His remaining two he spreads one each to the 11 and 8 squares. There have been two rolls so far. The first roll was a 12 so Will didn't get to strike any O's. The second roll was a 6, so Will was able to cross off one of his O's. Here's what his board looks like now:

2	3 o o o	4	5	6 ø o o	7	8 o	9 o o o	10	11 o	12

Will still has 10 more to remove before winning.

<u>Your boards:</u>

2	3	4	5	6	7	8	9	10	11	12

2	3	4	5	6	7	8	9	10	11	12

2	3	4	5	6	7	8	9	10	11	12

2	3	4	5	6	7	8	9	10	11	12

2	3	4	5	6	7	8	9	10	11	12

2	3	4	5	6	7	8	9	10	11	12

2	3	4	5	6	7	8	9	10	11	12

2	3	4	5	6	7	8	9	10	11	12

2	3	4	5	6	7	8	9	10	11	12

2	3	4	5	6	7	8	9	10	11	12

2	3	4	5	6	7	8	9	10	11	12

2	3	4	5	6	7	8	9	10	11	12

Conclusion: What was your strategy? What was your reasoning for placing your O's where you did? Why do you think it was a good strategy?