

Unit 8.3, Lesson 10: Practice Problems

1. Select all of the ordered pairs (x, y) that are solutions to the linear equation $2x + 3y = 6$.

(0, 2)

(0, 6)

(2, 3)

(3, -2)

(3, 0)

(6, -2)

Name _____

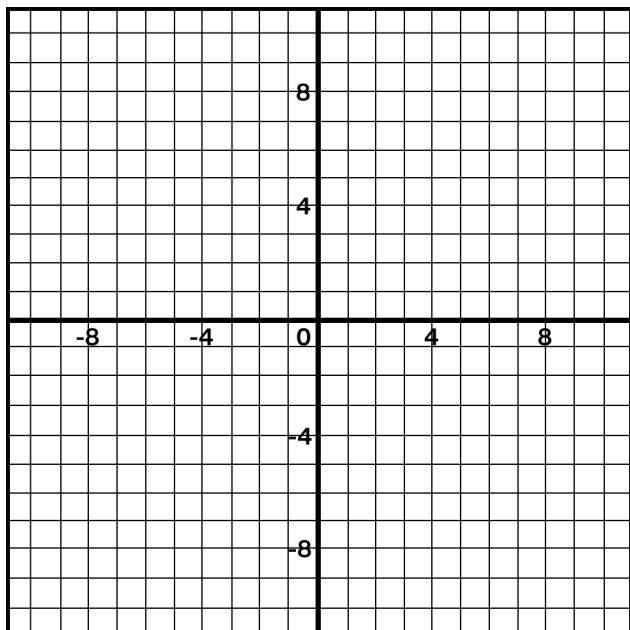
2. The graph of a linear equation passes through the points $(-4, 1)$ and $(4, 6)$. Which of these points are also solutions to this equation? Use the graph it helps you with your thinking.

(0, 3.5)

(12, 11)

(8, 5)

(-6, 0)



3. Here is a linear equation: $y = \frac{1}{4}x + \frac{5}{4}$.

Are $(1, 1.5)$ and $(12, 4)$ solutions to the equation?

Explain how you know.

4. Here is a linear equation: $y = \frac{1}{4}x + 2$.

What is the x -intercept of the graph of the equation? Explain your thinking.

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5. Write a letter in each box to match the equation with its three solutions.

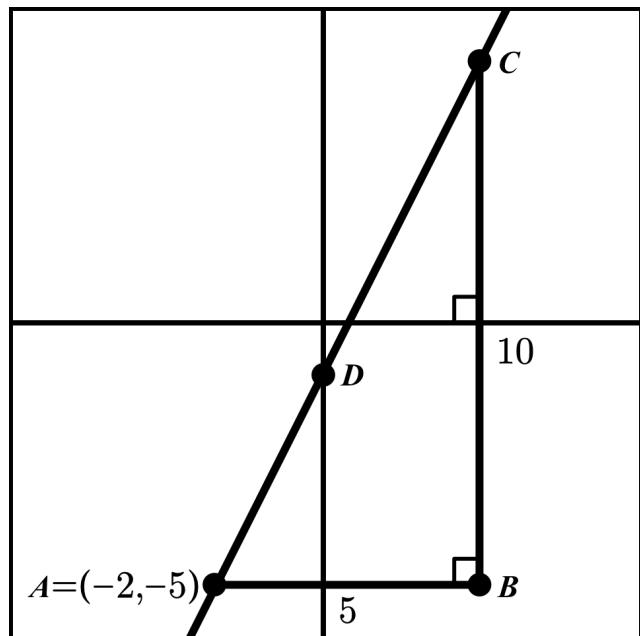
A. $2x + 3y = 7$		$(-3, -7), (0, -4), (-1, -5)$
B. $3x = \frac{y}{2}$		$(3\frac{1}{2}, 0), (-1, 3), (0, 2\frac{1}{3})$
C. $x - y = 4$		$(14, 21), (2, 3), (8, 12)$
D. $y = -x + 1$		$(0.5, 3), (1, 6), (1.2, 7.2)$
E. $y = 1.5x$		$(\frac{1}{2}, \frac{1}{2}), (\frac{1}{4}, \frac{3}{4}), (\frac{1}{8}, \frac{7}{8})$

6. A sandwich store charges a delivery fee to bring lunch to an office building. One office pays \$33 for 4 turkey sandwiches. Another office pays \$61 for 8 turkey sandwiches.

How much does each turkey sandwich cost (not including the cost of delivery)?

7. We know that $AB = 5$ and $BC = 10$.

Find the coordinate of B , C , and D .



1. ✓ (0, 2)
✓ (3, 0)
✓ (6, -2)
2. ✓ (0, 3.5)
✓ (12, 11)

3. No.

Responses vary.

(1, 1.5) is a solution because the x - and y -values make the equation true.

(12, 4) is not a solution because when $x = 12$, y would be 4.25, not 4.

4. $(-8, 0)$. Set $y = 0$ in the equation.

- 5.

A. $2x + 3y = 7$	C.	$(-3, -7), (0, -4), (-1, -5)$
B. $3x = \frac{y}{2}$	A.	$(3, \frac{1}{2}), (0, 0), (-1, 3), (0, 2 \frac{1}{3})$
C. $x - y = 4$	E.	$(14, 21), (2, 3), (8, 12)$
D. $y = -x + 1$	B.	$(0.5, 3), (1, 6), (1.2, 7.2)$
E. $y = 1.5x$	D.	$(\frac{1}{2}, \frac{1}{2}), (\frac{1}{4}, \frac{3}{4}), (\frac{1}{8}, \frac{7}{8})$

6. (Unit 3, Lesson 4)

7 dollars. The second office pays $61 - 33 = 28$ dollars more for $8 - 4 = 4$ more sandwiches.
So each sandwich adds $28 \div 4 = 7$ dollars to the cost.

7. $B = (3, -5)$
 $C = (3, 5)$
 $D = (0, -1)$

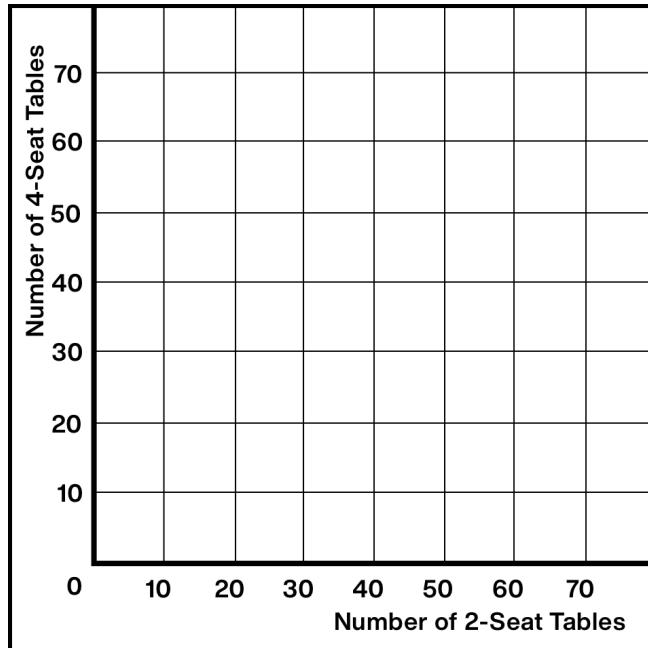
The owner of a restaurant is ordering tables and chairs. She wants to have only tables for 2 and tables for 4.

The total number of people that can be seated in the restaurant is 120.

- 1.1 Complete the table with possible combinations of 2 -seat tables and 4 -seat tables that will seat 120 customers.

Tables for 2	Tables for 4

- 1.2 Write an equation that represents the number of 2 -seat tables, x , and the number of 4 -seat tables, y , she should order.
- 1.3 Draw a graph of this situation.



- 1.4 What is the slope of the line on your graph?
- 1.5 Circle the x - and y -intercepts on your graph. Interpret the meaning of each intercept.

Unit 8.3, Lesson 11: Practice Problems

2. For which of the following equations is $(-6, -1)$ a solution?

$y = 4x + 23$

$3x = \frac{1}{2}y$

$2x - 13y = 1$

$3y = \frac{1}{2}x$

$2x + 6y = -6$

Consider the following graphs of linear equations.

3.1 Which of the following statements are true?

l has a positive slope.

m has a positive slope.

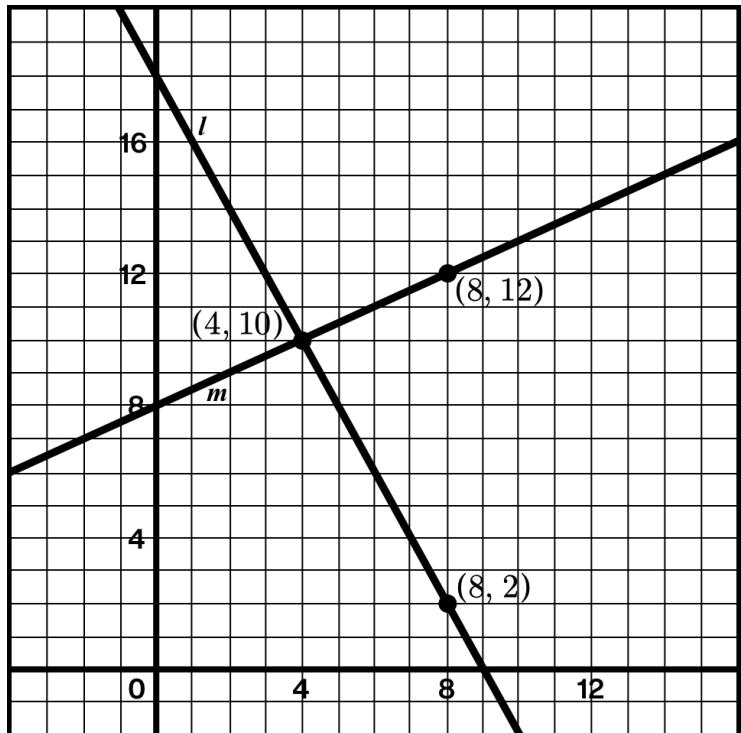
l has a positive y -intercept.

m has a positive y -intercept.

3.2 Calculate the slope of each line.

Line l slope:

Line m slope:



- 1.1 *Responses vary.* Any point with integer values satisfying the equation $2x + 4y = 120$.

Tables for 2	Tables for 4
0	30
10	25
40	10

1.2 $2x + 4y = 120$

1.3 The graph is a line connecting points $(0, 30)$ and $(60, 0)$.

1.4 *Responses vary.* The slope is $-\frac{1}{2}$. $-\frac{1}{2}$ tells us that for every 1 four-seat table we take away, we can use 2 two-seat tables.

1.5 *Responses vary.* The intercepts are $(0, 30)$ and $(60, 0)$.

They tell us how many tables there will be if only four-seat tables are used (30) or only two-seat tables are used (60).

2. ✓ $y = 4x + 23$

✓ $2x - 13y = 1$

✓ $3y = \frac{1}{2}x$

3.1 ✓ m has a positive slope.

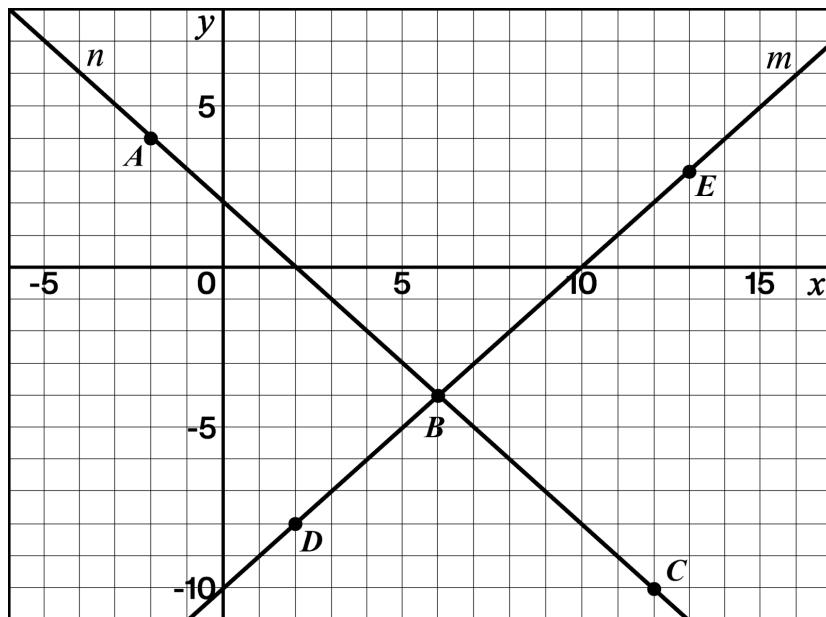
✓ l has a positive y -intercept.

✓ m has a positive y -intercept.

3.2 Line l slope: -2

Line m slope: $\frac{1}{2}$

Use this graph to answer the questions.



1.1 Which line, m or n , goes with each statement?

- a. A set of points where the coordinates of each point have a sum of 2.
- b. A set of points where the y -coordinate of each point is 10 less than its x -coordinate.

1.2 List all of the labeled points on the graph that go with each statement about their coordinates:

- a. Two numbers with a sum of 2.
- b. Two numbers where the y -coordinate is 10 less than the x -coordinate.
- c. Two numbers with a sum of 2 and where the y -coordinate of each point is 10 less than its x -coordinate.

Here is an equation: $4x - 4 = 4x + \underline{\hspace{2cm}}$.

Fill in the blanks to make the following statements true.

2.1 True for no values of x .

$$4x - 4 = 4x + \underline{\hspace{2cm}}$$

2.2 True for all values of x .

$$4x - 4 = 4x + \underline{\hspace{2cm}}$$

2.3 True for one value of x .

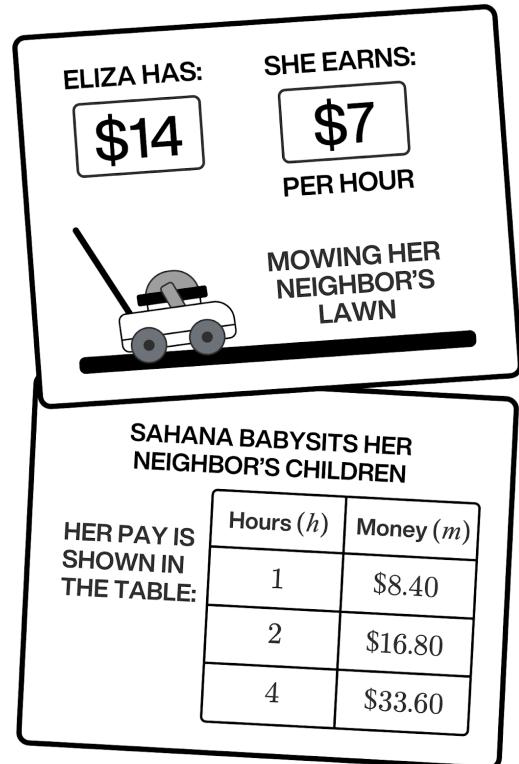
$$4x - 4 = 4x + \underline{\hspace{2cm}}$$

Unit 8.4, Lesson 9: Practice Problems

Eliza has a job mowing her neighbor's lawn, and Sahana babysits her neighbor's children. Their pay is given in the image.

Eliza and Sahana have agreed to go to the movies the weekend after they have earned the same amount of money for the same number of work hours.

- 3.1 How many hours do they have to work before they go to the movies?



- 3.2 How much will they have earned?

- 3.3 Explain where the solution can be seen in tables of values, in graphs, and in the equations that represent Eliza's and Sahana's hourly earnings.

4. Explain what you would do first to each side of the equation so that there would be no fractions. You do not have to solve the equations (unless you want more practice).

$$\frac{4p+3}{8} = \frac{p+2}{4}$$

1.1 a. Line n

b. Line m

1.2 a. Points A, B, C

b. Points B, D, E

c. Point B

2. (Unit 4, Lesson 7)

Responses vary.

2.1 $4x - 4 = 4x + 19$ has no solutions.

2.2 $4x - 4 = 4x + -4$ is true for all values of x .

2.3 $4x - 4 = 4x + 4x$ has one solution ($x = -1$).

3.1 10 hours

3.2 \$84

3.3 *Responses vary.*

In the table of values, we would see the same entry for h and m in both tables. In the graph, the solution is found in the coordinates of the point (h, m) , where the graphs of the two relationships intersect. In the equations, it is the value of h when we set the two expressions for m equal to each other: $8.4h = 7h + 14$.

4. (Unit 4, Lesson 6)

If you multiply each side by 8 (the least common multiple of 8 and 4), then the equation becomes $4p + 3 = 2(p + 2)$. (The solution is $p = \frac{1}{2}$, for those who go the extra mile.)

1. Jayden has \$11 and begins saving \$5 each week towards buying a new phone. At the same time that Jayden begins saving, Aditi has \$60 and begins spending \$2 per week on supplies for her art class.

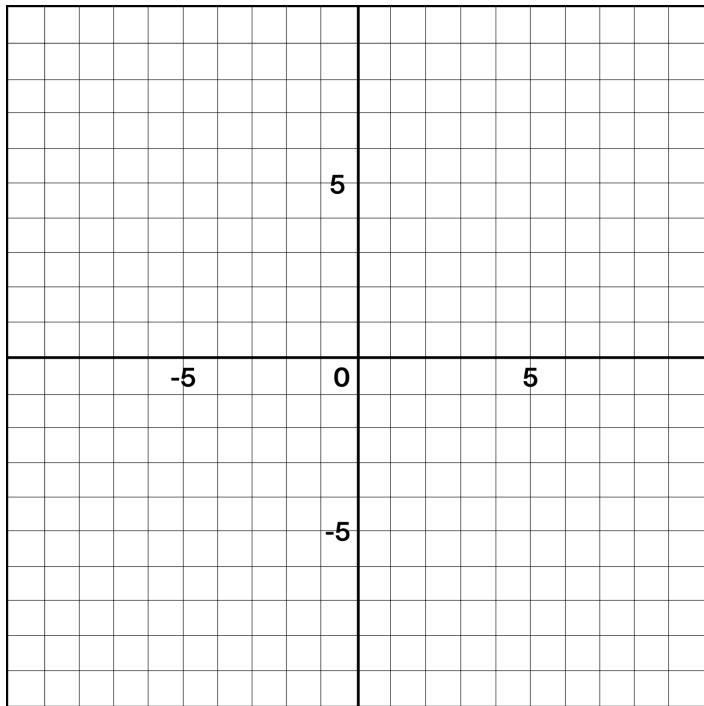
Is there a week when they have the same amount of money? How much do they have at that time?

2. Find x - and y -values that make both $y = -\frac{2}{3}x + 3$ and $y = 2x - 5$ true.

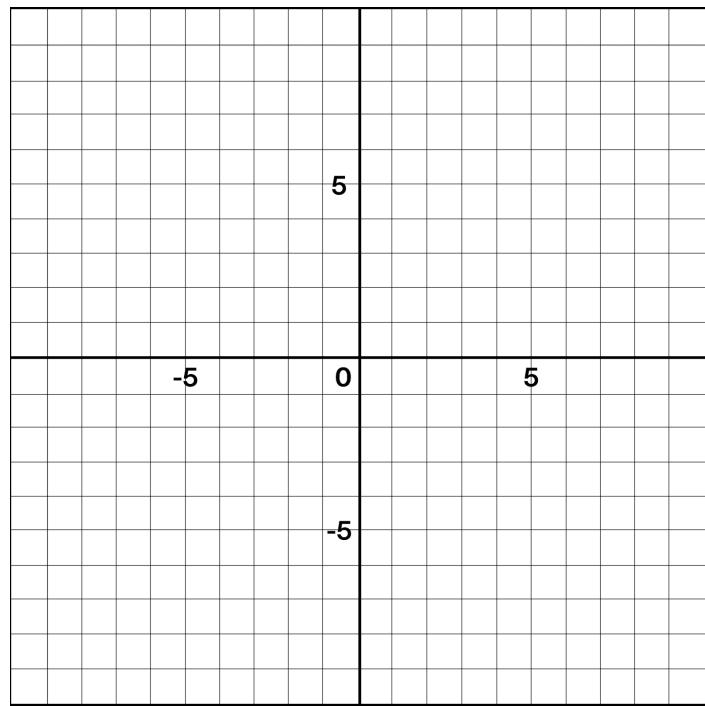
3. The point where the graphs of two equations intersect has y -coordinate 2. One equation is $y = -3x + 5$.

Find the other equation if its graph has a slope of 1.

Use the graph if it helps you with your thinking.



Use the graph if it helps you with your thinking.



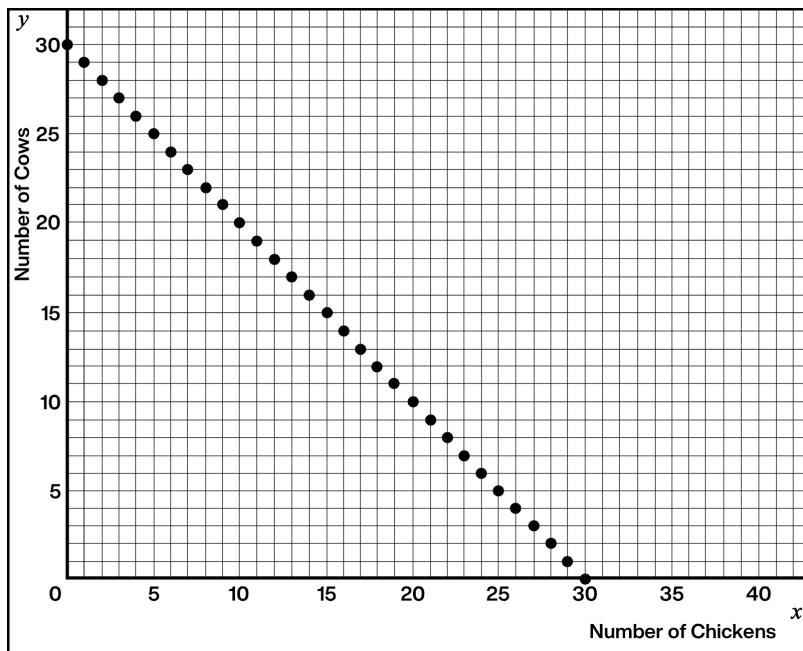
Unit 8.4, Lesson 10: Practice Problems

A farm has chickens and cows. All the cows have 4 legs and all the chickens have 2 legs. Altogether, there are 82 cow and chicken legs on the farm.

- 4.1 Complete the table to show some possible combinations of chickens and cows to get 82 total legs.

Number of Chickens (x)	Number of Cows (y)
35	
7	
	10
19	
	5

Here is a graph that shows possible combinations of chickens and cows that add up to 30 animals:



- 4.2 If the farm has 30 chickens and cows, and there are 82 cow and chicken legs altogether, then how many chickens and how many cows could the farm have?

5. Explain what you would do first to each side of the equation so that there would be no fractions. You do not have to solve the equations (unless you want more practice).

$$\frac{2(a-7)}{15} = \frac{a+4}{6}$$

6. Solve this equation:

$$3d + 16 = -2(5 - 3d)$$

1. Yes. After 7 weeks, \$46.

2. (3, 1)

3. $y = x + 1$

4.1

Number of Chickens (x)	Number of Cows (y)
35	3
7	17
21	10
19	11
31	5

4.2 The farm could have 19 chickens and 11 cows.

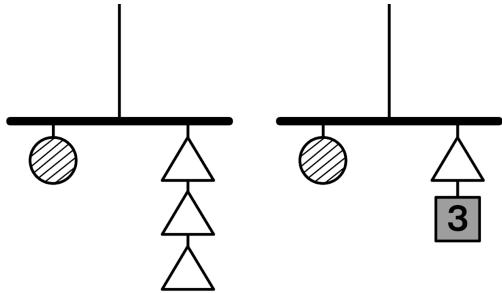
5. (Unit 4, Lesson 6)

If you multiply each side by 30 (the least common multiple of 6 and 15), then the equation becomes $4(a - 7) = 5(a + 4)$. (The solution is $a = -48$, for those who go the extra mile.)

6. (Unit 4, Lesson 6)

$$d = \frac{26}{3}$$

The hangers and the graph represent the same system of equations.

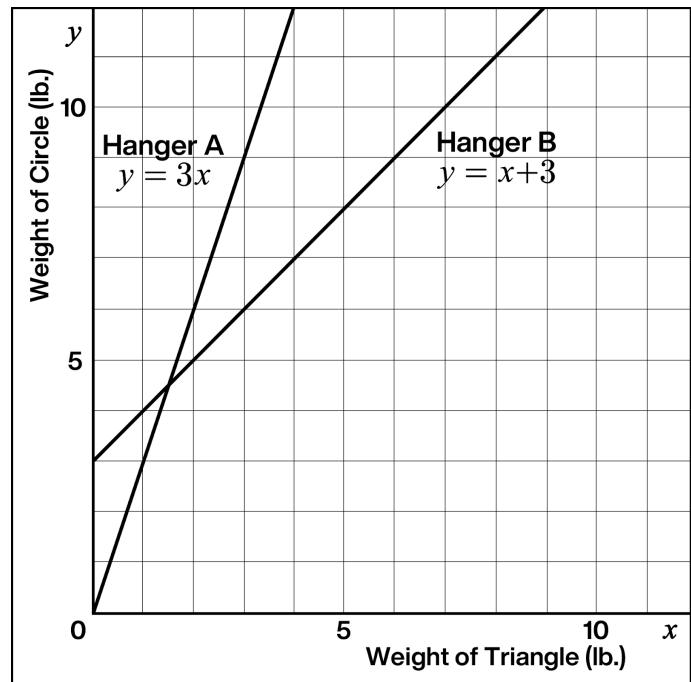


Hanger A

$$y = 3x$$

Hanger B

$$y = x + 3$$

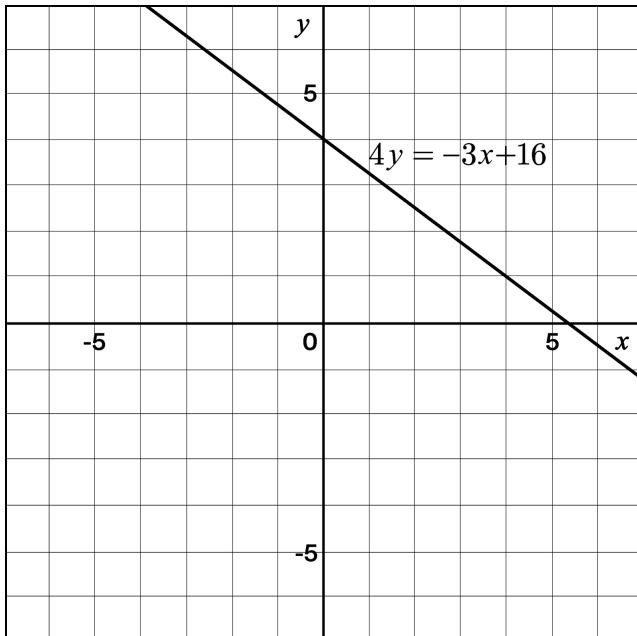


- 1.1 Find the solution to the system of equations.

- 1.2 What does the solution tell you about the weight of a triangle and the weight of a circle to balance the hanger?

Unit 8.4, Lesson 11: Practice Problems

Here is the equation and graph for one equation in a system of equations.



- 2.1 Write a second equation for the system so that it has infinitely many solutions.

- 2.2 Write a second equation whose graph goes through $(0, 1)$ so that the system has no solutions.

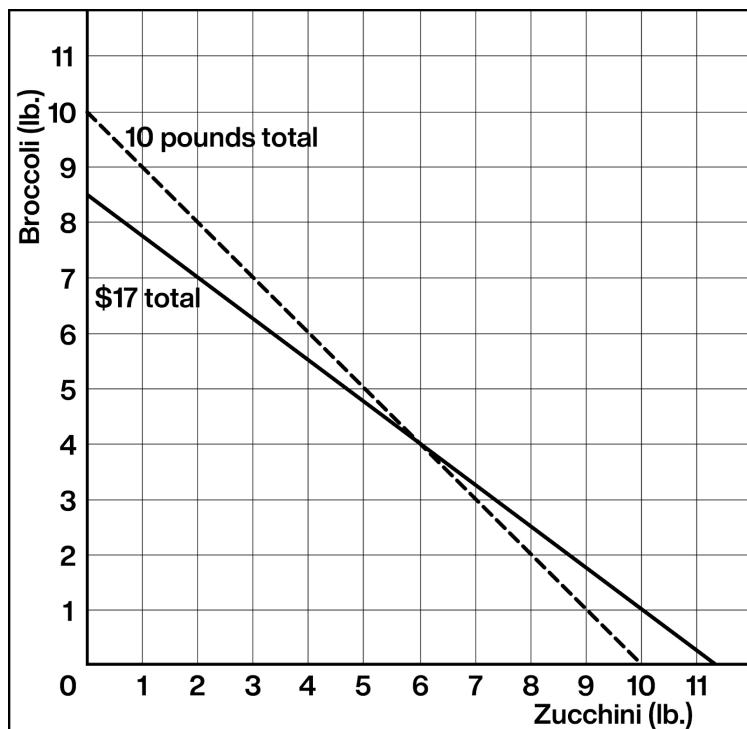
- 2.3 Write a second equation whose graph goes through $(0, 2)$ and $(4, 1)$ so that the system has one solution.

Vincente is in charge of cooking broccoli and zucchini for a large group. He has to spend all \$17 he has and can carry 10 pounds of veggies. Zucchini costs \$1.50 per pound and broccoli costs \$2 per pound.

- 3.1 Name one combination of veggies that weighs 10 pounds but does not cost \$17.

- 3.2 Name one combination of veggies that costs \$17 but does not weigh 10 pounds.

- 3.3 How many pounds each of zucchini and broccoli can Vincente get so that he spends all \$17 and gets 10 pounds of veggies?



1.1 (1.5, 4.5)

1.2 Triangles must weigh 1.5 pounds. Circles must weight 4.5 pounds.

2.1 $y = -\frac{3}{4}x + 4$ (or equivalent)

2.2 $y = -\frac{3}{4}x + 1$

2.3 $y = -\frac{1}{4}x + 2$

3.1 (Unit 4, Lesson 9)

4 pounds of zucchini and 6 pounds of broccoli weigh 10 pounds, but do not cost \$17 because (4, 6) is not on the line of combinations that cost \$17.

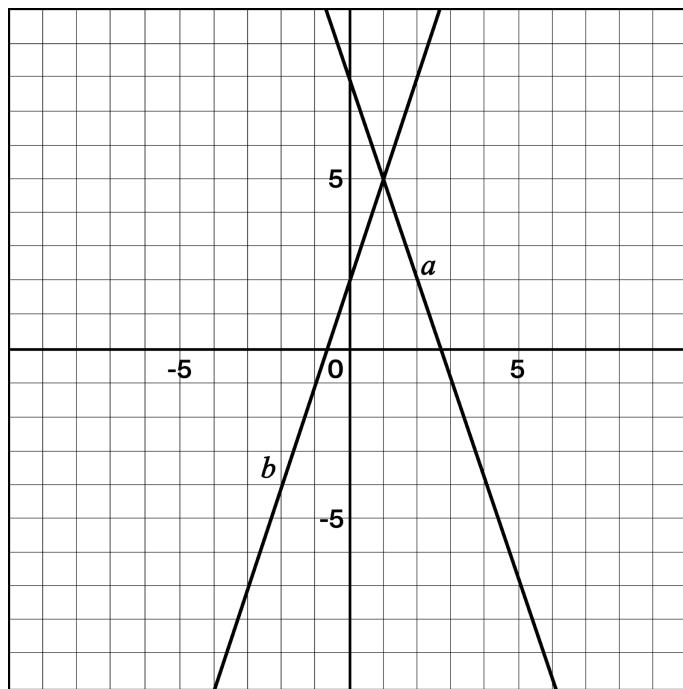
3.2 (Unit 4, Lesson 9)

2 pounds of zucchini and 7 pounds of broccoli cost \$17 because (2, 7) is on the \$17 line, but they only weigh 9 pounds.

3.3 (Unit 4, Lesson 9)

6 pounds of zucchini and 4 pounds of broccoli.

Here is a graph of a system of equations.



- 1.1 Describe how to find the solution to the corresponding system of equations for the two lines by looking at the graph.

- 1.2 Write an equation for each line.

- 1.3 Describe how to find the solution to the corresponding system by using the equations.

Unit 8.4, Lesson 12: Practice Problems

2. The solution to a system of equations is (1, 5). Choose two equations that might make up the system. Use the graph if it helps you with your thinking.

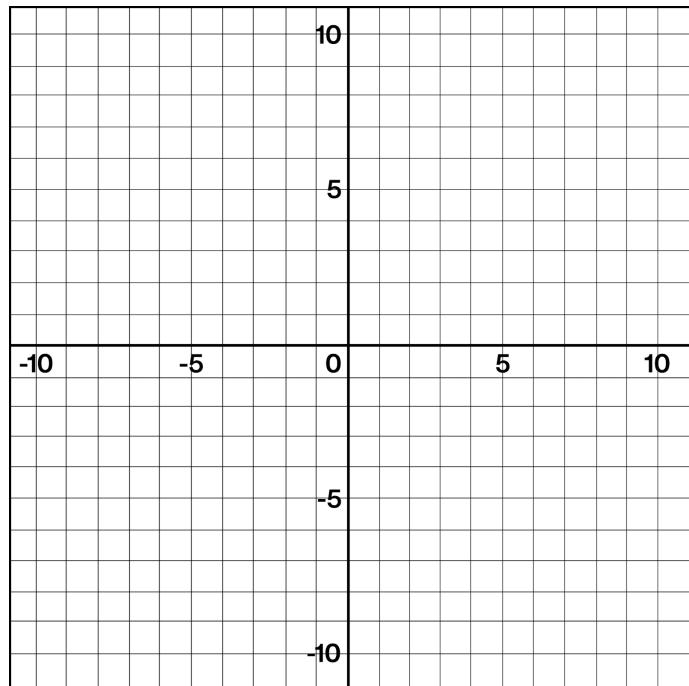
$y = -3x - 6$

$y = 2x + 3$

$y = -7x + 1$

$y = x + 4$

$y = -2x - 9$



3. Solve this system of equations:

$$y = 4x - 3$$

$$y = -2x + 9$$

4. Solve this system of equations:

$$y = \frac{5}{4}x - 2$$

$$y = -\frac{1}{4}x + 19$$

5. Solve this equation:

$$\frac{15(x-3)}{5} = 3(2x - 3)$$

- 1.1 You can solve a system of equations by finding the point where the lines intersect: (1, 5).
- 1.2 Line a : $y = 8 - 3x$
Line b : $y = 3x + 2$
- 1.3 *Responses vary.*

Set the two expressions equal to each other and solve for x .

2. ✓ $y = x + 4$
✓ $y = 2x + 3$

3. (2, 5)

4. $(14, 15\frac{1}{2})$

5. $x = 0$

1. Solve this system of equations:

$$\begin{cases} y=6x \\ 4x+y=7 \end{cases}$$

2. Solve this system of equations:

$$\begin{cases} y=3x \\ x=-2y+70 \end{cases}$$

3. Which equation, together with $y = -1.5x + 3$, makes a system with one solution?

- $y = -1.5x + 6$
- $y = -1.5x$
- $2y = -3x + 6$
- $y = -2x + 3$

This system of equations has no solution:

$$\begin{cases} x-6y=4 \\ 3x-18y=4 \end{cases}$$

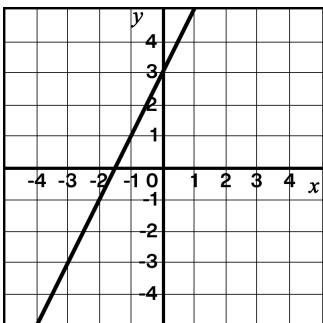
4.1 Change one number to make a new system with one solution.

4.2 Change one number to make a new system with an infinite number of solutions.

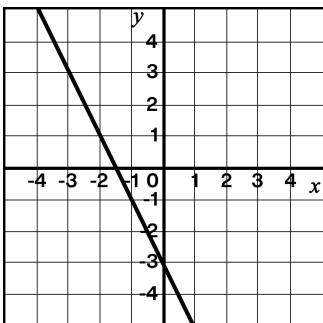
Unit 8.4, Lesson 13: Practice Problems

5. Draw a line to match each graph to its equation.

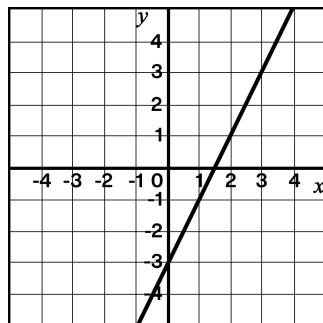
A.



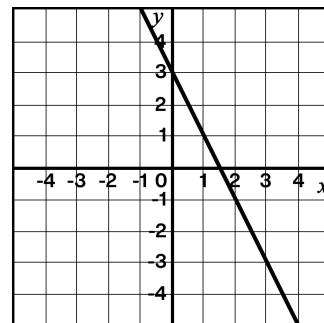
B.



C.



D.



$$y = -2x + 3$$

$$y = 2x + 3$$

$$y = 2x - 3$$

$$y = -2x - 3$$

6. Here are two points: $(-3, 4)$ and $(1, 7)$.

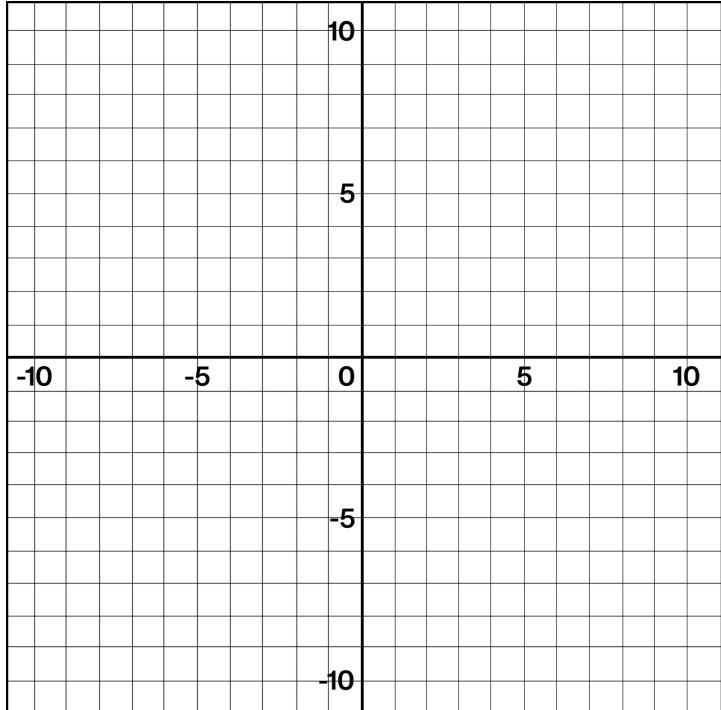
What is the slope of the line between the two points?

$\frac{4}{3}$

$\frac{3}{4}$

$\frac{1}{6}$

$\frac{2}{3}$



1. $\left(\frac{7}{10}, \frac{21}{5}\right)$

2. $(10, 30)$

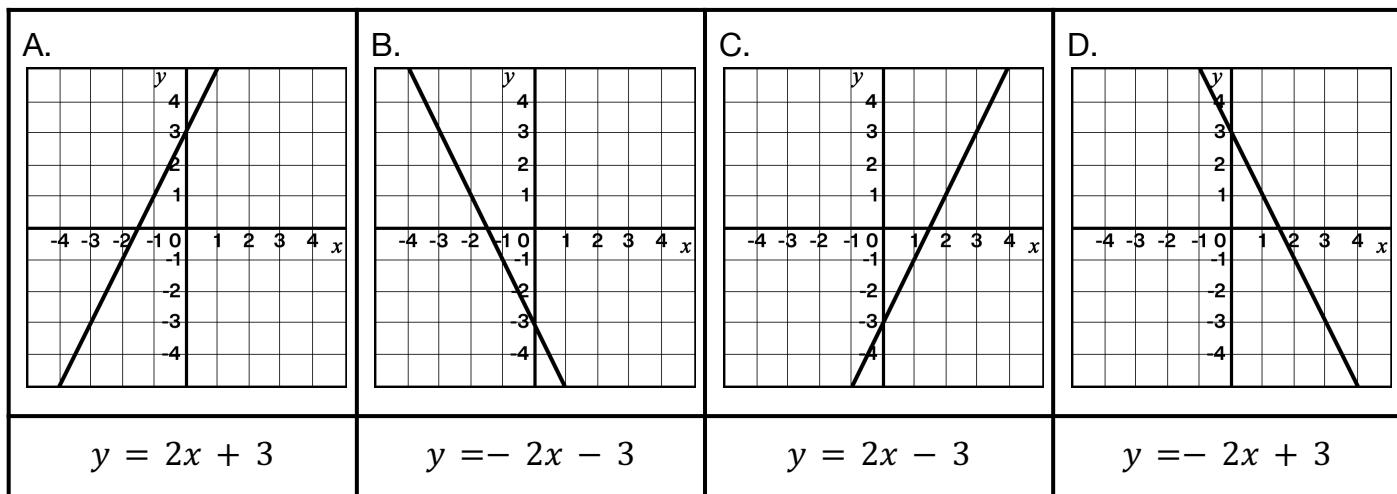
3. $y = -2x + 3$

4.1 Responses vary.

$$2x - 6y = 4$$

4.2 $3x - 18y = 12$

5. (Unit 3, Lesson 9)



6. (Unit 3, Lesson 8)

✓ $\frac{3}{4}$

1. Circle the story that can be represented by the system of equations below? Explain your reasoning.

$$\begin{cases} y = x + 6 \\ x + y = 100 \end{cases}$$

Story A

Evan and his younger cousin measure their heights.

They notice that Evan is 6 inches taller, and their heights add up to exactly 100 inches.

Story B

Angel's teacher writes a test worth 100 points.

There are 6 more multiple choice questions than short answer questions.

Yolanda and Neel play a game in which they earn the same number of points for each goal and lose the same number of points for each penalty.

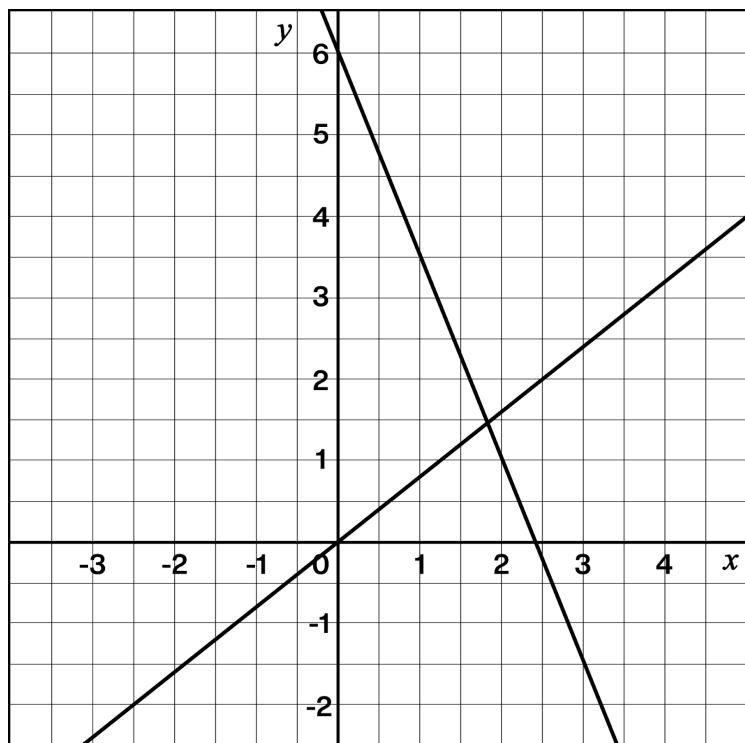
- Yolanda makes 6 goals and 3 penalties, ending the game with 6 points.
 - Neel earns 8 goals and 9 penalties, and ends the game with -22 points.
- 2.1 Write a system of equations that describes Yolanda's and Neel's outcomes. Use x to represent the number of points for a goal and y to represent the number of points for a penalty.
- 2.2 Solve the system to determine the number of points each goal and each penalty are worth.

Unit 8.4, Lesson 14: Practice Problems

3. Solve this system of equations:

$$\begin{cases} y = 6x - 8 \\ y = -3x + 10 \end{cases}$$

- 4.1 Estimate the coordinates of the point where the two lines meet.
- 4.2 Choose two equations that make up the system represented by the graph.
- $y = \frac{5}{4}x$
- $y = 6 - 2.5x$
- $y = 2.5x + 6$
- $y = 6 - 3x$
- $y = 0.8x$
- 4.3 Solve the system of equations and confirm the accuracy of your estimate.



1. Story A

Responses vary. In Story B, $y = x + 6$ can be written where x and y represent the number of questions of each type, but the other fact is about points, so $x + y = 100$ does not make sense. In Story A, Evan's height can be represented by y , and his younger cousin's height can be represented by x .

2.1 Yolanda: $6x + 3y = 6$

Neel: $8x + 9y = -22$

or

Yolanda: $6x - 3y = 6$

Neel: $8x - 9y = -22$

2.2 (4, -6) or (4, 6)

A goal earns 4 points and a penalty earns -6 points.

3. (2, 4)

4.1 (Unit 4, Lesson 12)

Responses vary.

(1.8, 1.4)

4.2 (Unit 4, Lesson 12)

✓ $y = 6 - 2.5x$

✓ $y = 0.8x$

4.3 (Unit 4, Lesson 12)

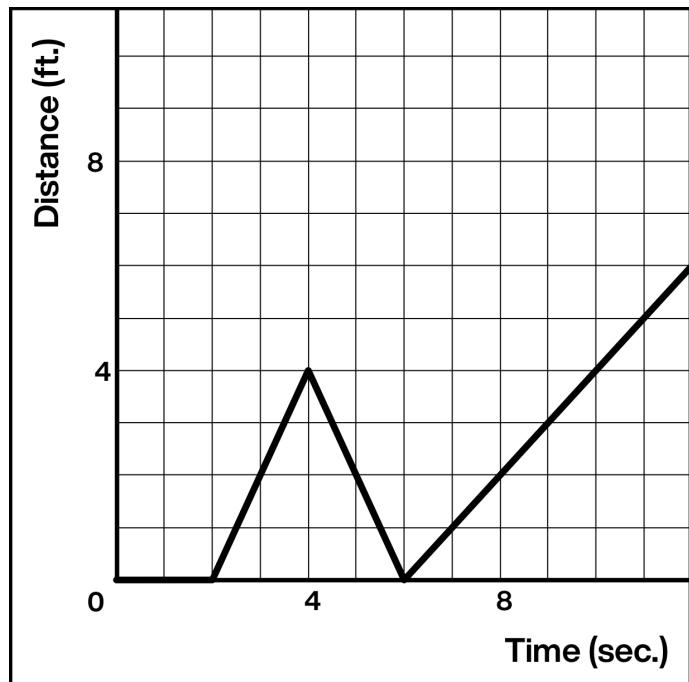
$$x = \frac{20}{11} \text{ and } y = \frac{16}{11}$$

This graph represents a turtle walking across the sand.

- 1.1 What story does the graph tell about the turtle's journey?

- 1.2 How far was the turtle from the water after 8 seconds?

- 1.3 After how many seconds is the turtle's distance 2 feet from the water?



2. For what value of x do the expressions $2x + 3$ and $3x - 6$ have the same value?

3. Solve this system of equations:

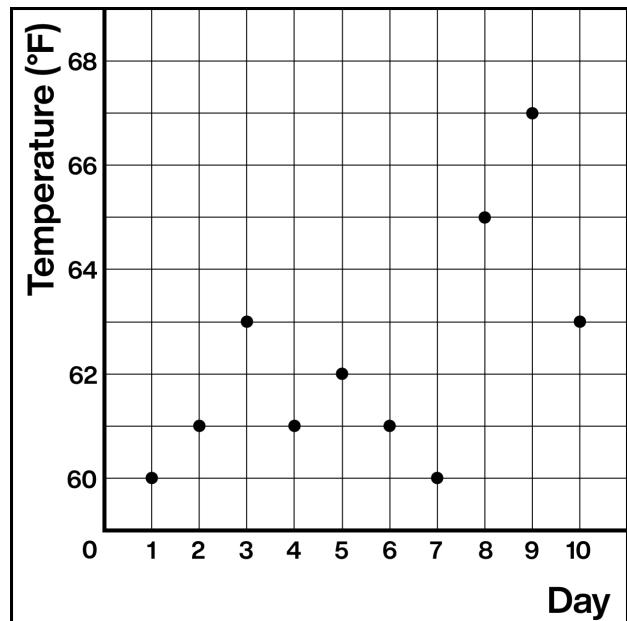
$$\begin{cases} y = x - 4 \\ y = 6x - 10 \end{cases}$$

Unit 8.5, Lesson 1: Practice Problems

This graph represents the high temperatures in a city over a 10-day period.

4.1 What was the high temperature on day 7?

4.2 On which days was the high temperature 61°F ?



1.1 *Responses vary.*

- The turtle stays still, then walks away, then walks back, and then walks away again.
- The turtle begins with its nose at the edge of the water. It stays at the water for 2 seconds. Then it walks away from the water for 2 seconds. It then turns around and heads back to the water for 2 seconds. Then the turtle walks away from the water again, but slower than its original walk.

1.2 2 feet

Responses vary. At 8 seconds, the y -value of the graph is 2. This means the turtle's distance from the water is 2 feet.

1.3 3, 5, and 8 seconds

2. (From IM 8.4.9, Desmos 8.4.07)

$$x = 9$$

3. (From IM 8.4.14, Desmos 8.4.12)

$$\left(\frac{6}{5}, -\frac{14}{5}\right)$$

4.1 60 °F

4.2 Days 2, 4, and 6



Unit 8.5, Lesson 2: Practice Problems

1. Complete the table based on the following rule:
Divide by 4. Add 2.

Input	Output
0	
2	
4	
6	
8	
10	

Name _____

2. Complete the table based on the following rule:
If odd, write 1. If even, write 0.

Input	Output
1	
2	
3	
7	
12	
73	

3. Use -6 as the input for each of the rules below.

Rule	Input	Output
Square the input	-6	
Divide by 3	-6	
Write π	-6	

4. Recall this image from today's lesson.

What makes a rule a function or not?

Rule #1: Function	
Input	Output
35	25
723	713
-4	-14
53	43
723	713

Rule #2: Function	
Input	Output
15	7
18	7
262	7
-3	7
82.3	7

Rule #3: Function	
Input	Output
hi	J
my	Z
name	F
is	T
Arturo	P

Rule #4: Not a Function	
Input	Output
H	Hailey
J	Jada
M	Mai
H	Hamza
M	Madison



Unit 8.5, Lesson 2: Practice Problems

- 5.1 Could this table represent a function?

Input	Output
-2	4
-1	1
0	0
1	1
2	4

Explain your thinking.

- 5.2 Could this table represent a function?

Input	Output
4	-2
1	-1
0	0
1	1
4	2

Explain your thinking.

- 5.3 Could this table represent a function?

Input	Output
0	6
5	6
8	6
17	6
43	5

Explain your thinking.

6. Ada's history teacher wrote a test for the class.

The test is 26 questions long and is worth 123 points.

Ada wrote two equations, where m represents the number of multiple choice questions on the test, and s represents the number of essay questions on the test.

$$\begin{aligned}m + s &= 26 \\3m + 8s &= 123\end{aligned}$$

How many essay questions are on the test?

Show or explain your thinking.

1. 2, 2.5, 3, 3.5, 4, 4.5
2. 1, 0, 1, 1, 0, 1
3. $36, -2, \pi$
4. *Responses vary.*
 - A rule is a function if every input has only one possible output. A rule is not a function if there is at least one input that corresponds to multiple outputs.
 - A rule is a function if, for every input, there is only one output (like "hi" outputs "J" and no other letter in Rule #3). A rule is not a function if there is more than one possibility for the output (like "H" outputs "Hailey" and "Hamza" in Rule #4).
- 5.1 Yes. *Responses vary.* Every input in the table has exactly one corresponding output.
- 5.2 No. *Responses vary.* This table has multiple outputs for the same input.
- 5.3 Yes. *Responses vary.* Every input in the table has exactly one corresponding output.
6. 9 essay questions. *Responses vary.* Solve the system by substituting $m = 26 - s$ into the second equation.

A group of students are timed while sprinting 100 meters.

1.1 Consider the table.

Time (sec.)	Speed (m/s)
13. 8	7. 246
15. 9	6. 289
16. 3	6. 135
17. 1	5. 848
18. 2	5. 495
18. 3	5. 464

1.2 Consider the table.

Time (sec.)	Distance (m)
13. 8	100
15. 9	100
16. 3	100
17. 1	100
18. 2	100
18. 3	100

1.3 Consider the table.

Distance (m)	Time (sec.)
100	13. 8
100	15. 9
100	16. 3
100	17. 1
100	18. 2
100	18. 3

Is speed a function of time?

Is distance a function of time?

Is time a function of distance?

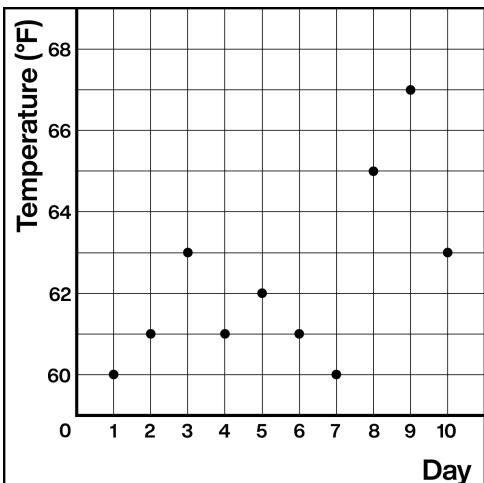
1.4 How did you decide which relationships were functions?

2. This graph represents the high temperatures in a city over a 10-day period.

Consider the graph on the right.

Is temperature a function of day?

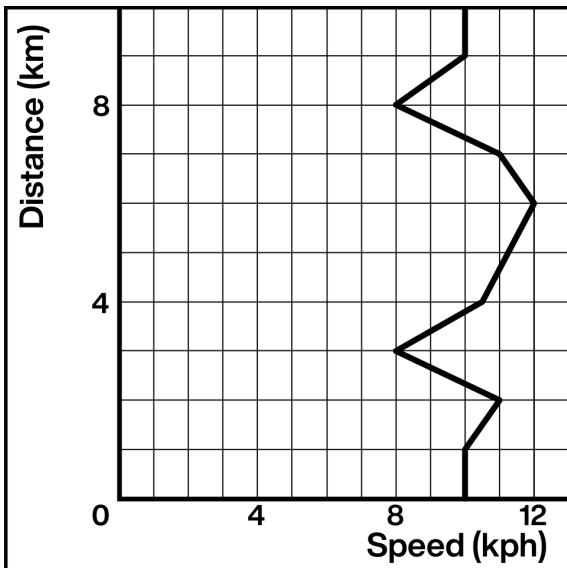
Explain your thinking.



Unit 8.5, Lesson 3: Practice Problems

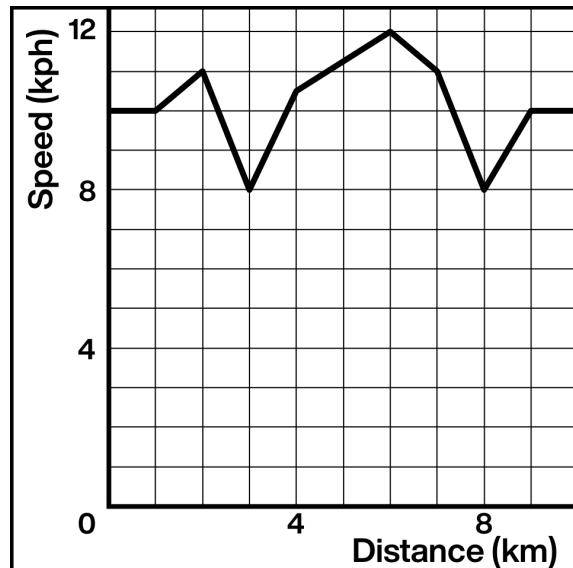
Diego runs a 10-kilometer race and keeps track of his speed.

- 3.1 Consider the graph.



Is distance a function of speed?

- 3.2 Consider the graph.



Is speed a function of distance?

- 3.3 How did you decide which relationships were functions?

- 4.1 Solve this equation. Check your answer.

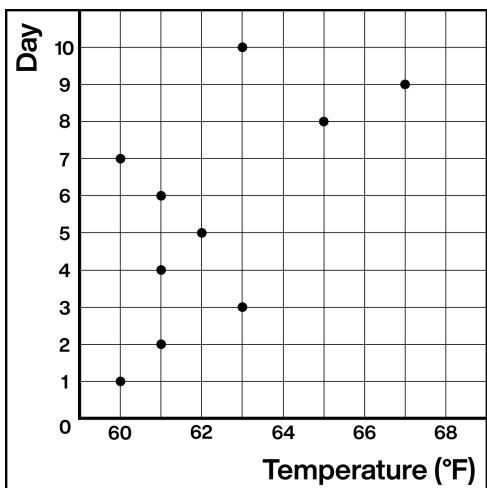
$$4z + 5 = -3z - 8$$

- 4.2 Solve this equation. Check your answer.

$$2x + 4(3 - 2x) = \frac{3(2x+2)}{6} + 4$$

- 1.1 Yes. For each time, there is only one possible speed over 100 meters.
- 1.2 Yes. For each time, there is only one possible distance (100 m).
- 1.3 No. For the distance (100 m), there are many possible times.
- 1.4 *Responses vary.* If there was only one possible output for each input, then the relationship was a function.
2. Yes. For each day, there is exactly one corresponding temperature.
- 3.1 No. For some values of speed, there is more than one corresponding distance.
- 3.2 Yes. For every value of distance, there is exactly one corresponding speed.
- 3.3 *Responses vary.* If there was only one y -value for each x -value on the graph, then the relationship was a function.
- 4.1 (From IM 8.4.6, Desmos 8.4.06)
$$z = -\frac{13}{7}$$
- 4.2 (From IM 8.4.6, Desmos 8.4.06)
$$x = 1$$

1. The graph and the table show the high temperatures in a city over a 10-day period.



Temperature (°F)	60	60	61	61	61	62	63	63	65	67
Day	1	7	2	4	6	5	3	10	8	9

Is the day a function of the high temperature?

Explain your thinking.

Rafael earns \$10.50 per hour helping his neighbor with their chores.

- 2.1 Is the amount he earns a function of the number of hours he works? Explain your thinking.
- 2.2 Is the number of hours he works a function of the amount he earns? Explain your thinking.
- 2.3 Write an equation that describes the situation. Use x to represent the independent variable and y to represent the dependent variable.
- 2.4 How much will Rafael earn if he works 3 hours each weekday next week?



Unit 8.5, Lesson 4: Practice Problems

3. The solution to a system of equations is $(6, -3)$.

Select two equations that might make up the system.

$y = -3x + 6$

$y = 2x - 9$

$y = -5x + 27$

$y = 2x - 15$

$y = -4x + 27$

4. Here is an equation that represents a function:

$$72x + 12y = 60$$

Select the equation that most closely represents x as the independent variable.

$120y + 720x = 600$

$y = 5 - 6x$

$2y + 12x = 10$

$x = \frac{60-12y}{6}$

Explain your thinking.

5. Solve this system of equations:

$$\begin{cases} y=7x+10 \\ y=-4x-23 \end{cases}$$

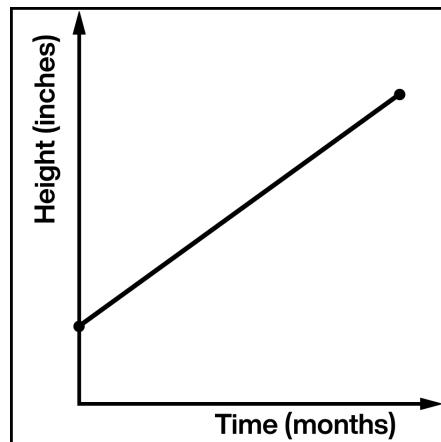
1. No. *Responses vary.* The day cannot be a function of the high temperature because a certain temperature may be the high for multiple days, which produces multiple outputs for the same input. A function needs to have exactly one corresponding output for every input.
- 2.1 Yes. *Responses vary.* The amount he earns is a function of number of hours worked because there is only one possible dollar amount for each number of hours worked.
- 2.2 Yes. *Responses vary.* The number of hours worked is a function of the amount earned because every dollar amount he earns corresponds with one number of hours worked.
- 2.3 $y = 10.5x$, where x is number of hours worked and y is amount earned in dollars.
- 2.4 $\$10.50 \cdot 3 \cdot 5 = \157.50
3. $y = -5x + 27$ and $y = 2x - 15$
4. $y = 5 - 6x$

Responses vary. In this equation, y is isolated and equals an expression in terms of x . This means that y is the dependent variable and x is the independent variable.

5. (From IM 8.4.13, Desmos 8.4.12)
 $(-3, -11)$

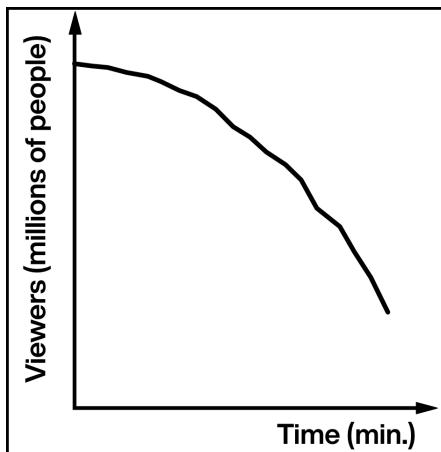
- 1.1 This graph represents the height of a plant over a period of one month.

Tell a story of the plant's height.



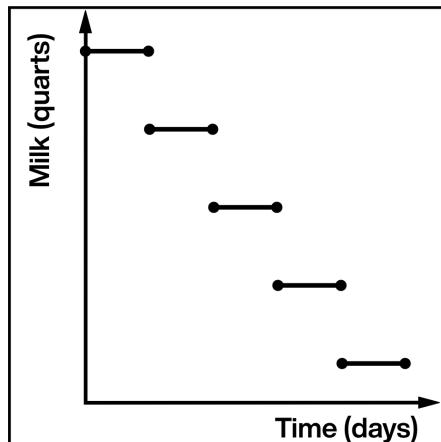
- 1.2 This graph represents the number of viewers of a short video vs. time.

Tell a story of the video's viewership.



- 1.3 This graph represents the amount of milk in a bottle in the fridge.

Tell a story of the amount of milk in the bottle.



Unit 8.5, Lesson 5: Practice Problems

This graph represents the height of an object that was shot upwards from a tower and then fell to the ground.

- 2.1 What is the independent variable? (Circle one)

Height Time

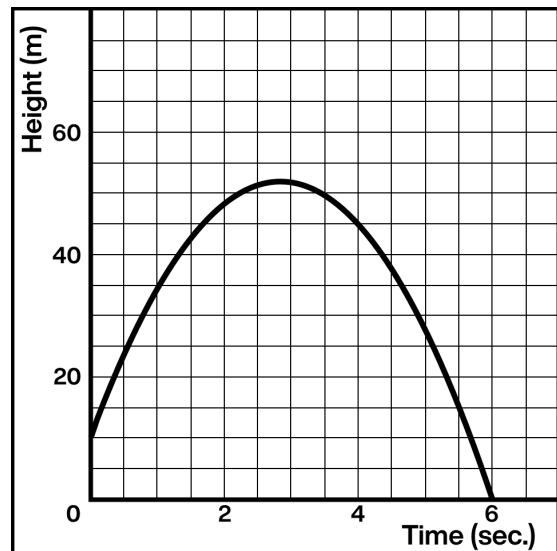
- What is the dependent variable? (Circle one)

Height Time

Explain your thinking.

- 2.2 About how tall is the tower from which the object was shot?

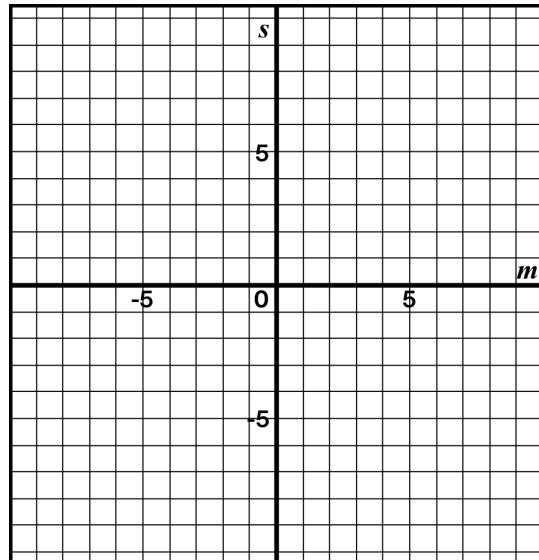
- 2.3 When did the object hit the ground?



- 3.1 Complete the table below using the equation $2m + 4s = 16$.

m	s
0	
	3
-2	
	0

- 3.2 Draw the line $2m + 4s = 16$. Use m as the independent variable and s as the dependent variable.



- 1.1 *Responses vary.* A plant is bought from a store and grows slowly but consistently.
- 1.2 *Responses vary.* At the beginning of the video, there are lots of viewers. The viewers get bored, so many of them turn the video off before finishing.
- 1.3 *Responses vary.* A person pours the same amount of milk from a carton for their coffee every morning.

2.1 Independent variable: Time Dependent variable: Height

Responses vary. Time is on the x -axis, which is where the independent variable is usually placed on a graph.

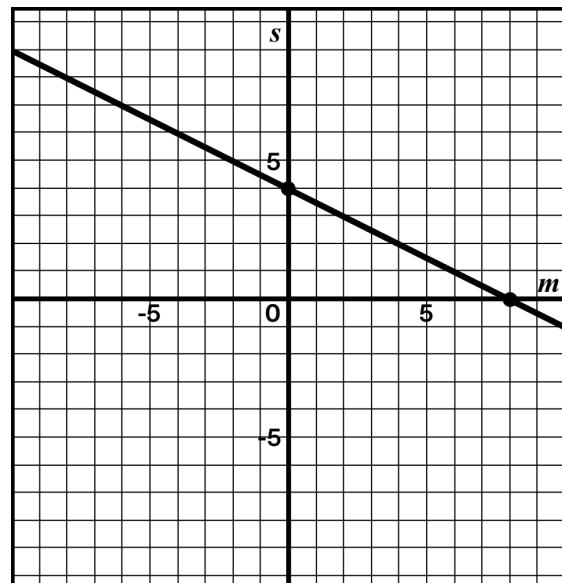
2.2 The tower is about 10 meters tall.

2.3 The object hit the ground about 6 seconds after it was shot.

3.1

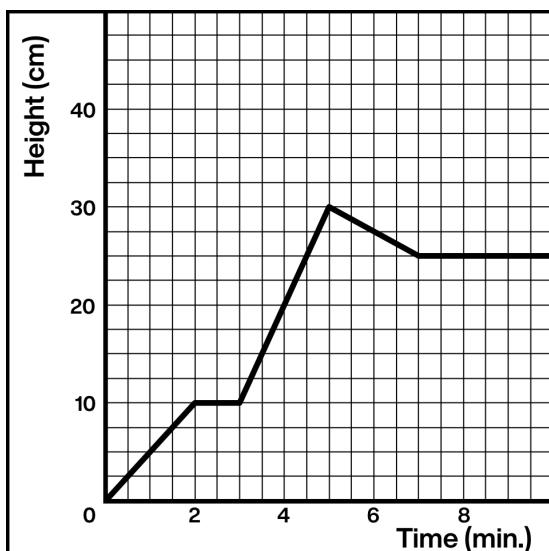
m	s
0	4
2	3
-2	5
8	0

3.2



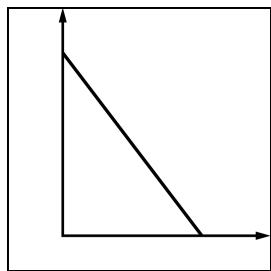
1. Koharu fills her aquarium with water. The graph shows the height of water in the aquarium vs. time.

Tell a story about how Koharu fills the aquarium based on what you see. Include specific heights and times.

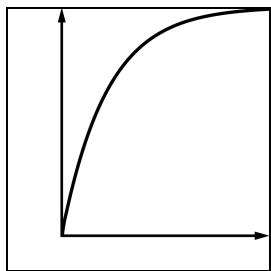


- 2.1 An ice cube has just fully melted in a glass. The temperature of the water in the glass is measured over time. Select the graph that best matches the story.

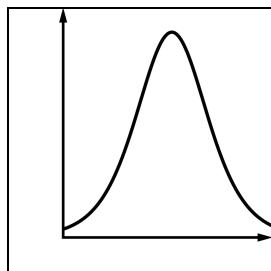
A.



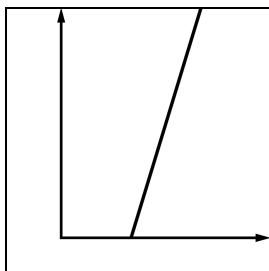
B.



C.

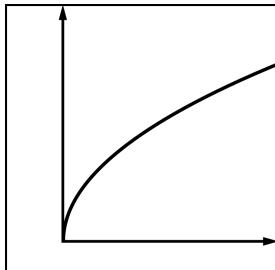


D.

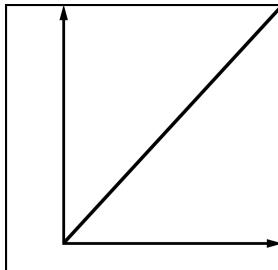


- 2.2 One person knows a secret. That person tells two people who each tell two people. The pattern continues. The number of people who know the secret is measured over time. Select the graph that best matches the story.

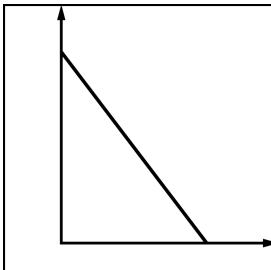
A.



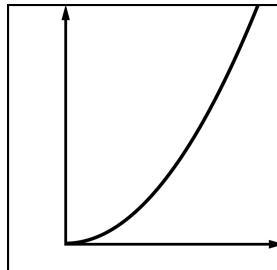
B.



C.

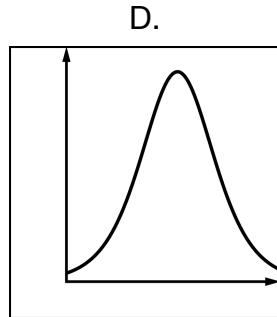
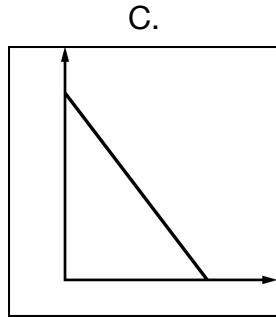
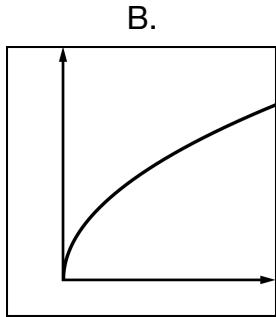
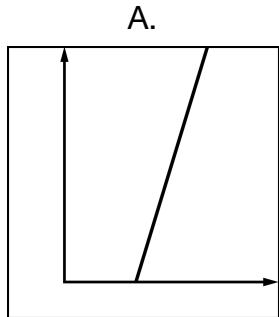


D.



Unit 8.5, Lesson 6: Practice Problems

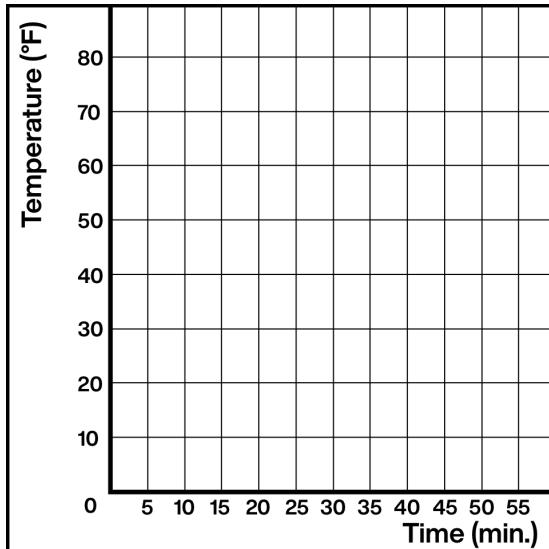
- 2.3 The amount of fuel left in a gas tank is measured based on the distance the car has traveled.
Select the graph that best matches the story.



3. Deven puts a batch of cookie dough in the fridge.

The dough takes 15 minutes to cool from 70 °F to 40 °F. Once it is cool, the dough stays in the fridge for another 30 minutes. Then Deven takes the cookie dough out and puts it into the oven. After 5 minutes in the oven, the cookies are 80 °F.

Sketch a graph that represents this situation.

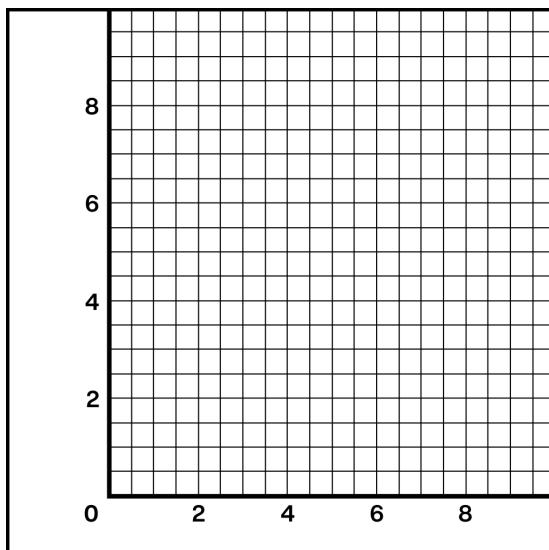


- 4.1 Draw two lines to form a system of linear equations with no solutions. Then write an equation for each line.

Line 1: _____

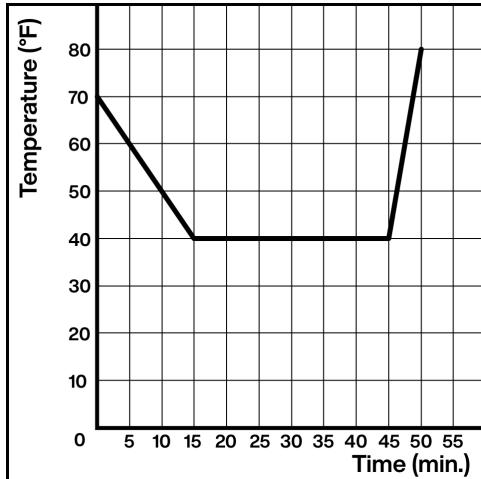
Line 2: _____

- 4.2 Label the axes of your graph with an independent and dependent variable. Then write a story that corresponds with the graph.



1. Responses vary. Koharu turns on the water faucet, and the water in the aquarium increases at a constant rate for the first two minutes to a height of 10 cm. Then Koharu's mom calls her to take out the trash, so she turns off the faucet for the minute it takes her to take out the trash. After she comes back, she turns on the water higher than before, and the water increases to a height of 30 cm in the next two minutes. This is high enough, and Koharu turns off the water. Unfortunately, there is a slow leak, and the water height decreases to 25 cm. After two minutes, Koharu notices the leak. She stops it, and the water stays constant after that.
- 2.1 B. Responses vary. The temperature approaches room temperature quickly at first and then slowly.
- 2.2 D. Responses vary. At first, the growth rate is slow because there are only a small number of people who know the secret. As more people know the secret, the number of people begins to grow faster and faster.
- 2.3 C. Responses vary. The amount of gas in a tank decreases steadily as you drive and use up gas.

3.



- 4.1 (From IM 8.4.13, Desmos 8.4.13)

Responses vary. The graph can be any two lines that are parallel.

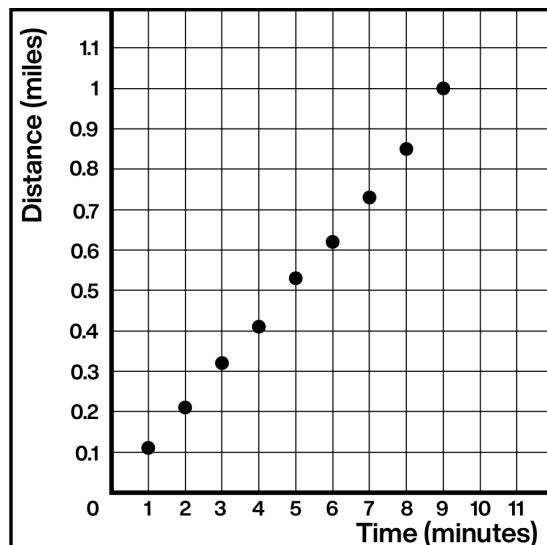
- 4.2 Responses vary. The independent variable is time (min.) and the dependent variable is distance along the track (m). Two friends race at the same speed. One of the two friends has a head start. The person who is behind will never catch up.

- 1.1 Yosef is training for a 1-mile race. Yosef's progress is shown by the graph.

Is Yosef's distance a function of time?
Explain your thinking.

- 1.2 Demetrius is training for the same 1-mile race. He ran at a constant speed of 7.5 miles per hour.

Who finished the mile first?



- 1.3 Draw a line on the graph to represent Demetrius's mile.

The table and equation below represent two different functions with independent variable a .

Equation: $b = 4a - 5$

- 2.1 When $a = 10$, what are the values of b and c ?

$b = \underline{\hspace{2cm}}$ $c = \underline{\hspace{2cm}}$

- 2.2 Which is larger when $a = -3$: b or c ?

Explain your answer or why there is not enough information.

a	c
-3	-20
0	7
2	3
5	21
10	19
12	45

- 2.3 Which is larger when $a = 6$: b or c ?

Explain your answer or why there is not enough information.



Unit 8.5, Lesson 7: Practice Problems

Recall the relationship between the radius of a circle, r , and its area, A .

3.1 Which of the following equations is true?

$A = \pi r$

$A = \pi r^2$

$A = 2\pi r$

$A = 2\pi r^2$

3.2 Is the area of a circle a function of its radius?

Is the radius of a circle a function of its area?

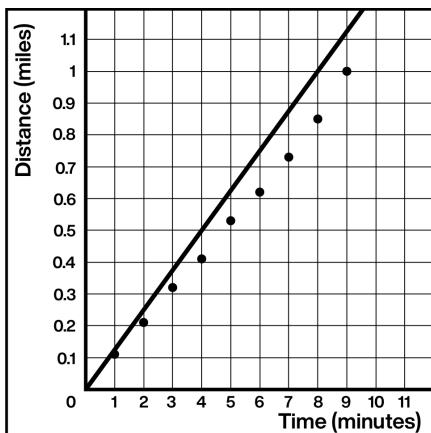
3.3 Use the relationship $A = \pi r^2$ to fill in the missing parts of the table below.

r	A
3	
	16π
$\frac{1}{2}$	
	100π

1.1 Yes. For each value of time, there is exactly one corresponding distance for each runner.

1.2 Demetrius finished the mile first.

1.3



2.1 $b = 35, c = 19$

2.2 b is larger. *Responses vary.* $4(-3) - 5 = -12 - 5 = -17$, which is larger than -20 .

2.3 Not enough information. *Responses vary.* There is not enough information because 6 is not an input in the table.

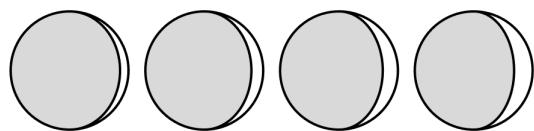
3.1 $A = \pi r^2$

3.2 Yes for both. Using, for example, 2 and -2 would produce the same output, but -2 is not a valid input in this situation since a radius cannot be negative.

3.3

r	A
3	9π
4	16π
$\frac{1}{2}$	$\frac{1}{4}\pi$
10	100π

On the first day after the new moon, 2% of the moon's surface is illuminated. On the second day, 6% of the moon's surface is illuminated.



- 1.1 Use a linear model to fill out the table below.

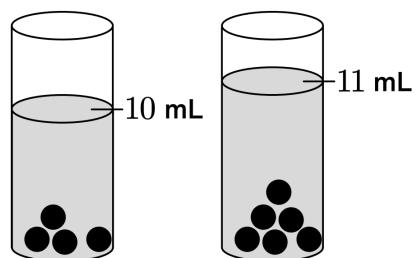
Day Number	Illumination
1	2%
2	6%
...	...
	50%
	100%

- 1.2 The moon's surface is actually 100% illuminated on day 14. How appropriate is it to use a linear model for this data?

In science class, Farah uses a graduated cylinder with water in it to measure the volume of some marbles.

After dropping in 4 marbles, the height is 10 mL.

After dropping in 6 marbles, the height is 11 mL.



- 2.1 How much does the height increase for each marble? _____

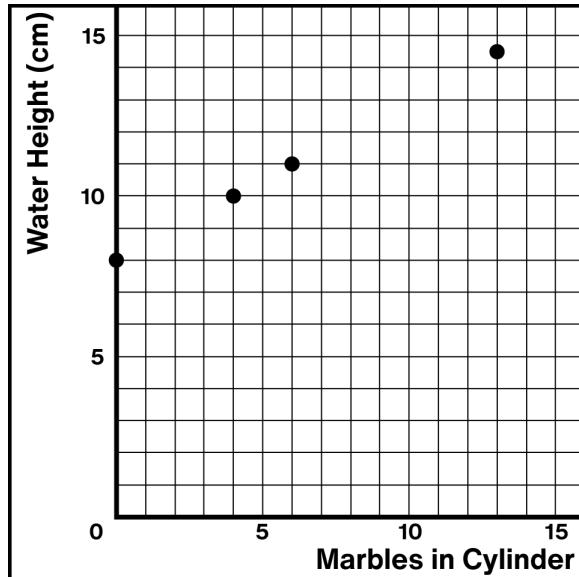
How much water was in the cylinder before any marbles were dropped in? _____

- 2.2 What should be the height of the water after 13 marbles are dropped in? _____

Unit 8.5, Lesson 9: Practice Problems

- 2.3 Is the relationship between the volume of water and number of marbles a linear relationship?

What does the slope of the line mean?



Solve each equation below.

3.1 $2(3x + 2) = 2x + 28$

3.2 $5y + 13 = -43 - 3y$

3.3 $4(2a + 2) = 8(2 - 3a)$

1.1

Day Number	Illumination
1	2%
2	6%
...	...
13	50%
26	100%

- 1.2 *Responses vary.* A linear model is not appropriate for this data because the illumination of the moon does not increase by the same percentage each day. The moon's surface is 100% illuminated on day 14, which does not match the prediction made from using a linear model of increasing 4% each day starting from 2% on the first day.

2.1 0.5 mL
8 mL

2.2 14.5 mL

2.3 Yes. The slope of the line means the volume per marble.

3.1 (From IM 8.4.5, Desmos 8.4.05)
 $x = 6$

3.2 (From IM 8.4.5, Desmos 8.4.05)
 $y = -7$

3.3 (From IM 8.4.5, Desmos 8.4.05)
 $a = \frac{1}{4}$

Here is data on the number of cases of whooping cough from 1939 to 1955.

Sorted by Year

Year	Number of Cases
1944	109 873
1945	133 792
1946	109 860
1947	156 517
1948	74 715
1949	64 479
1950	120 718
1951	68 687
1952	45 030
1953	37 129
1954	60 866
1955	62 786

Sorted by Number of Cases

Year	Number of Cases
1953	37 129
1952	45 030
1954	60 866
1955	62 786
1949	64 479
1951	68 687
1948	74 715
1946	109 860
1944	109 873
1950	120 718
1945	133 792
1947	156 517

- 1.1 Select a column you prefer the table to be sorted by. What is a question that could be asked when the table is sorted by this column?

- 1.2 Which years in this period of time had more than 100 000 cases of whooping cough?

- 1.3 Based on this data, would you expect 1956 to have closer to 50 000 cases or 100 000 cases? Explain your thinking.

Unit 8.6, Lesson 1: Practice Problems

2. In volleyball statistics, a block is recorded when a player deflects the ball hit from the opposing team.

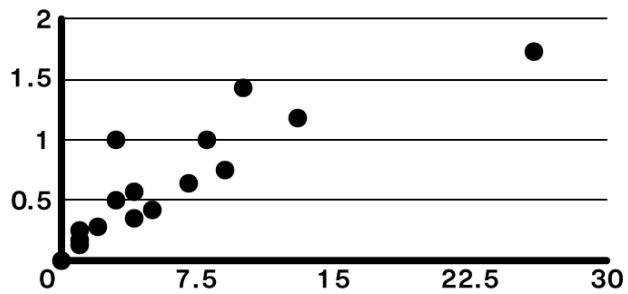
Additionally, scorekeepers often keep track of the average number of blocks a player records in a game.

Here is part of a table that records the number of blocks and blocks per game for each player in a women's volleyball tournament.

Below that is a scatter plot that goes with the table.

Label the axes of the scatter plot with the necessary information.

Blocks	Blocks per Game
13	1.18
1	0.17
5	0.42
...	...



Horizontal axis: _____

Vertical axis: _____

A cylinder has a radius of 4 centimeters and a height of 5 centimeters.

- 3.1 What is the volume of the cylinder?

- 3.2 What is the volume of the cylinder when its radius is tripled?

- 3.3 What is the volume of the cylinder when its radius is halved?

1.1 Responses vary.

Year: About how much did the number of cases increase or decrease from year to year?

Number of Cases: In which year were there the fewest number of cases?

1.2 The years 1946, 1944, 1950, 1945, and 1947 had more than 100,000 cases of whooping cough.

1.3 Closer to 50,000 cases.

This data seems to show the number of cases decreasing over time, so I would expect 1956 to have closer to 50,000 cases than 100,000.

2. **Horizontal Axis:** Blocks

Vertical Axis: Blocks per Game

3.1 (From IM 8.5.18, Desmos 8.5.12)

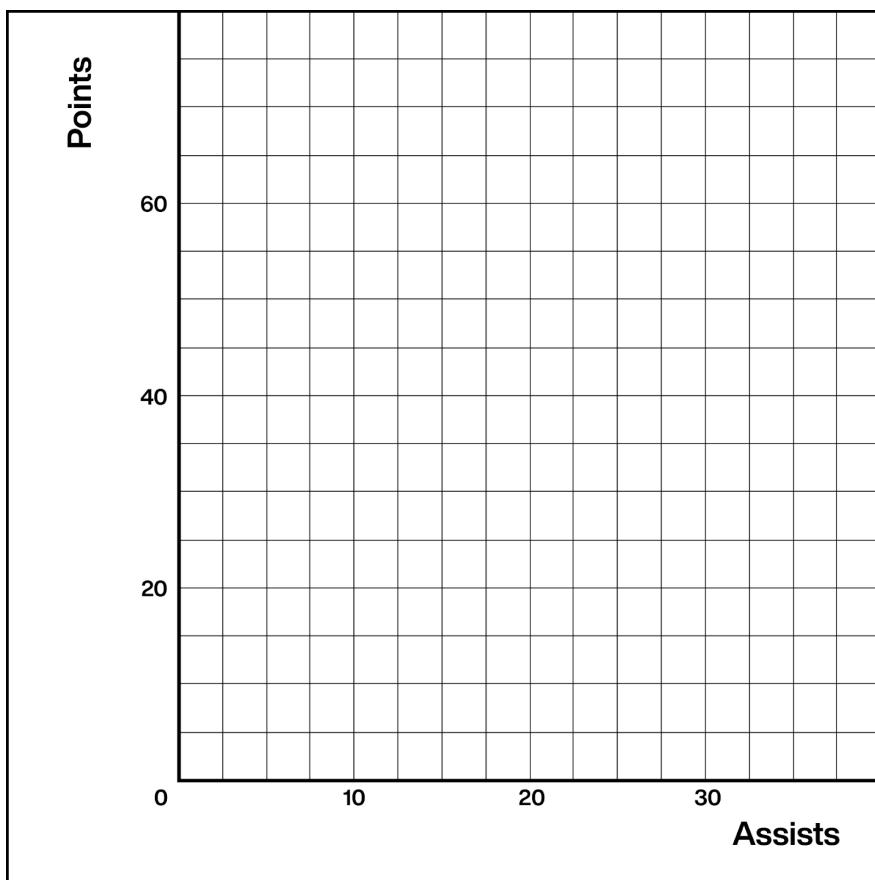
80π cubic centimeters

3.2 720π cubic centimeters

3.3 20π cubic centimeters

1. In hockey, a player gets credited with a "point" in their statistics when they get an assist or goal. The table shows the number of assists and the number of points for 14 hockey players after a season.

Create a scatter plot of the data.



Assists	Points
22	28
16	18
19	29
13	26
9	13
16	22
8	18
12	13
12	17
37	50
7	12
17	34
27	58
18	34

2. Select **all** the representations that are appropriate for comparing bite strength to weight for different carnivores.

- Histogram
- Scatter plot
- Dot plot
- Table
- Box plot

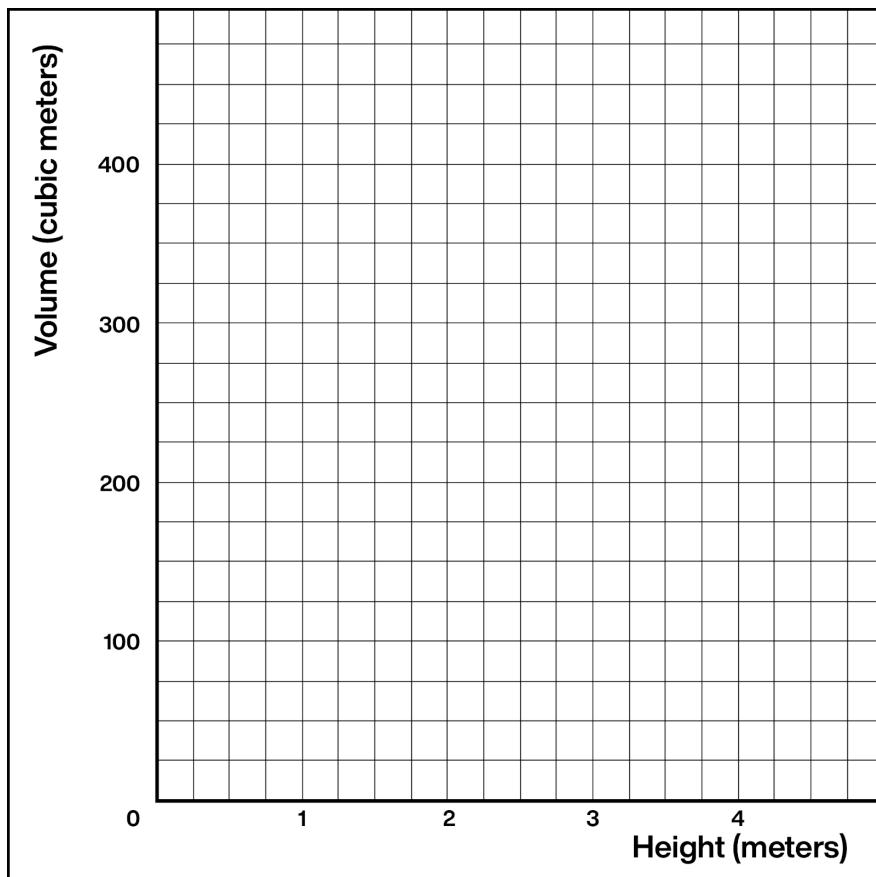
Unit 8.6, Lesson 2: Practice Problems

- 3.1 When is it better to use a table?
- 3.2 When is it better to use a scatter plot?

There are many cylinders with a radius of 6 meters. Let h represent the height in meters and V represent the volume in cubic meters.

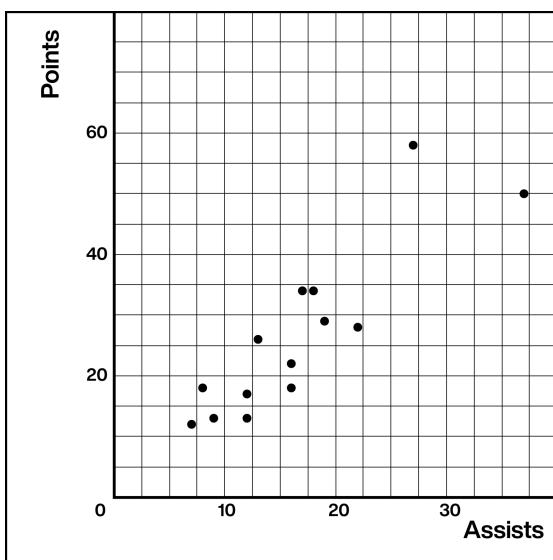
- 4.1 Write an equation that represents the volume, V , as a function of the height, h .
- 4.2 Sketch the graph of the equation using 3.14 as an approximation for π .
- 4.3 If you double the height of a cylinder, what happens to the volume?

Use the equation to help you explain your thinking.



- 4.4 If you multiply the height of a cylinder by $\frac{1}{3}$, what happens to the volume?
Use the graph to help explain your thinking.

1.



2. ✓ Scatter plot
✓ Table

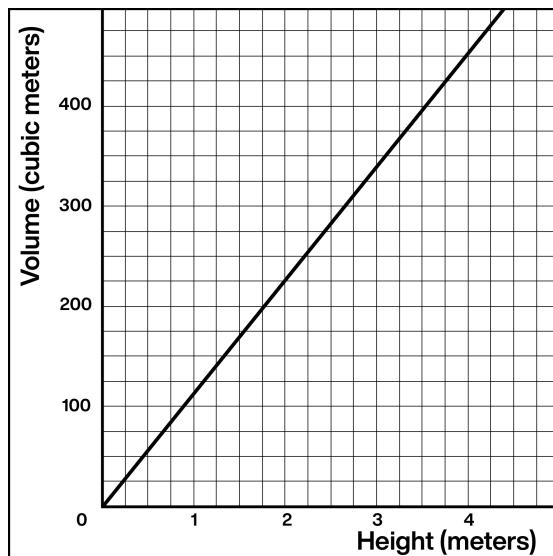
- 3.1 *Responses vary.* It is better to use a scatter plot when looking for an overall pattern (or lack of one).
- 3.2 *Responses vary.* It is better to use a table when looking for the precise details of the data.

4.1

(From IM 8.5.17, Desmos 8.5.12)

$$V = 36\pi h$$

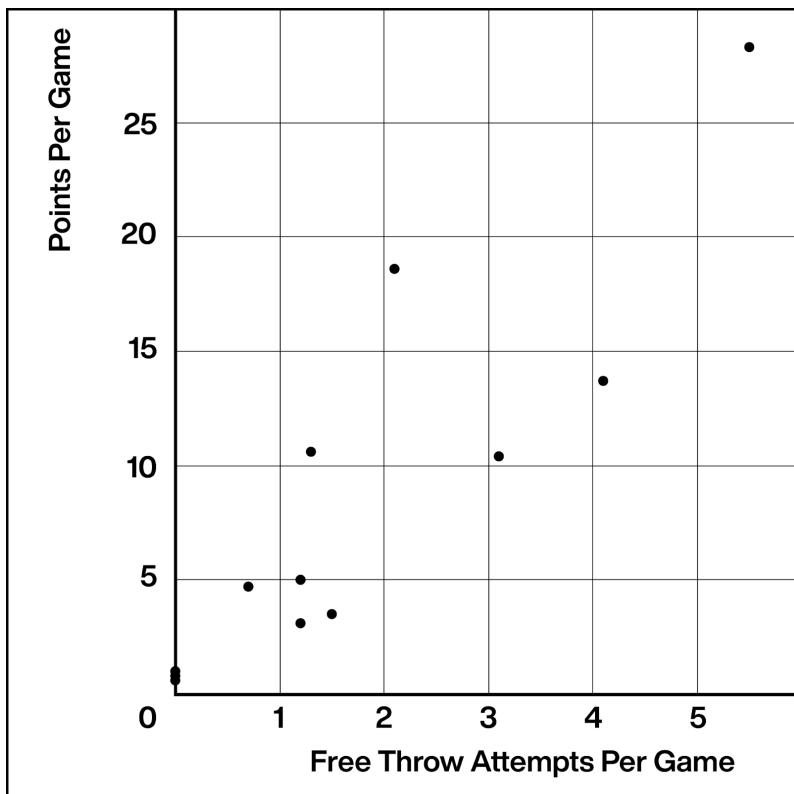
4.2



- 4.3 If you double the height, the volume doubles. Replacing h with $2h$ in the equation gives $V = 36\pi \cdot 2h = 2(36\pi h)$, which is double the original volume.
- 4.4 If you multiply the height by $\frac{1}{3}$, the volume is also multiplied by $\frac{1}{3}$. On the graph, this can be seen using similar triangles or by noting that the relationship is proportional.

Here is a table and a scatter plot that compares points per game to free throw attempts for a basketball team during a tournament.

- 1.1 Circle the point that represents the data for Player E.



Player	Free Throw Attempts	Points
Player A	5.5	28.3
Player B	2.1	18.6
Player C	4.1	13.7
Player D	1.6	10.6
Player E	3.1	10.4
Player F	1.2	5
Player G	0.7	4.7
Player H	1.5	3.5
Player I	1.2	3.1
Player J	0	1
Player K	0	0.8
Player L	0	0.6

- 1.2 What does the point (2.1, 18.6) represent?

- 1.3 In this same tournament, Player O from another team scored 14.3 points per game with 4.8 free throw attempts per game. Plot this point on the scatter plot above.



Unit 8.6, Lesson 3: Practice Problems

2. Select **all** the representations that are appropriate for comparing exam score to hours of sleep the night before the exam.

Histogram

Scatter plot

Dot plot

Table

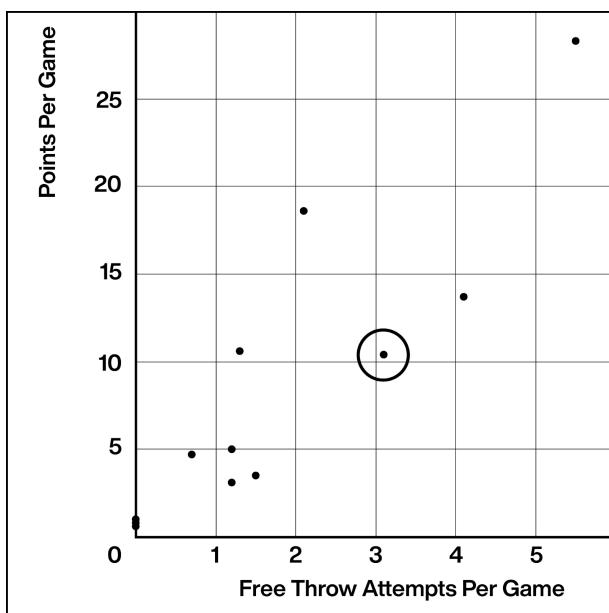
Box plot

3. A cylinder has a volume of 36π cubic centimeters and height h .

Complete this table for the volume of cylinders with the same radius but different heights.

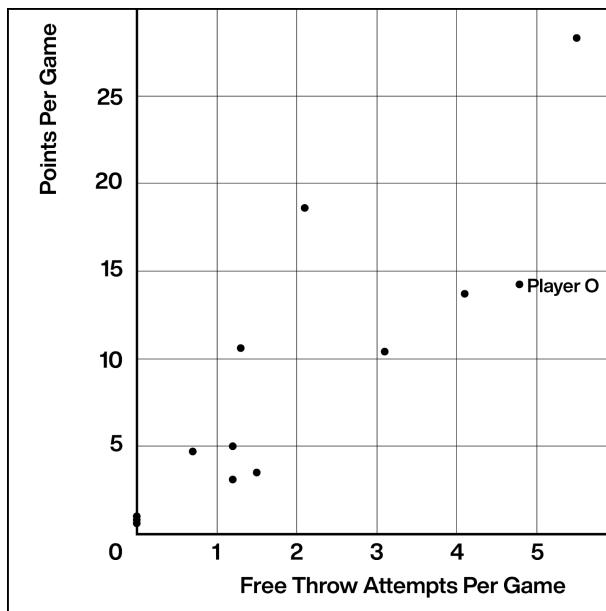
Height (cm)	Volume (cubic cm)
h	36π
$2h$	
$5h$	
$\frac{h}{2}$	
$\frac{h}{5}$	

1.1



- 1.2 The point $(2.1, 18.6)$ represents the free throw attempts and points per game for Player B.

1.3



2. (From IM 8.6.02, Desmos 8.6.02)

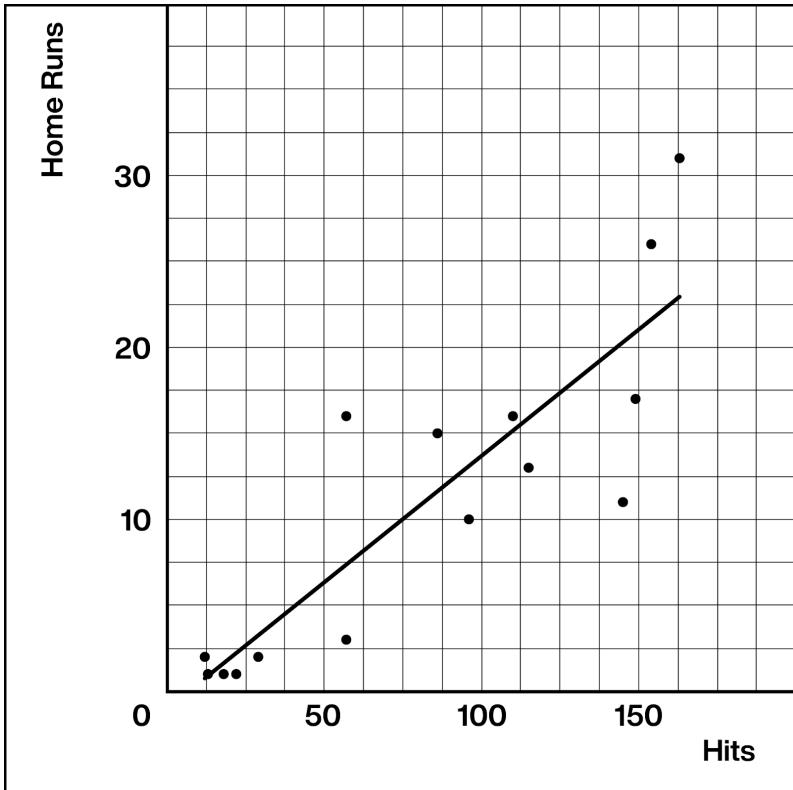
- ✓ Scatter plot
- ✓ Table

3. (From IM 8.5.17, Desmos 8.5.12)

Height (cm)	Volume (cubic cm)
h	36π
$2h$	72π
$5h$	180π
$\frac{h}{2}$	18π
$\frac{h}{5}$	$\frac{36}{5}\pi$

This scatter plot shows the number of hits and home runs for 15 baseball players last season.

The model $y = 0.15x - 1.5$ is also graphed.



Hits	Home Runs	Predicted Home Runs
12	2	0.3
22	1	1.8
154	26	21.6
145	11	20.3
110	16	15
57	3	7.1
149	17	20.9
29	2	2.9
13	1	0.5
18	1	1.2
86	15	11.4
163	31	23
115	13	15.8
57	16	7.1
96	10	12.9

- 1.1 How many home runs did the player with 154 hits have?

How many was he predicted to have?

- 1.2 One player most outperformed the predicted number of home runs.

How many hits did this player have?

- 1.3 A new player hit many fewer home runs than the model predicted.

Sketch or describe where his point could be on the graph.

Unit 8.6, Lesson 4: Practice Problems

This scatter plot shows points per game and free throw attempts for basketball players in a tournament.

The model $y = 4.413x + 0.377$ is also graphed.

- x represents free throw attempts per game.
- y represents points per game.

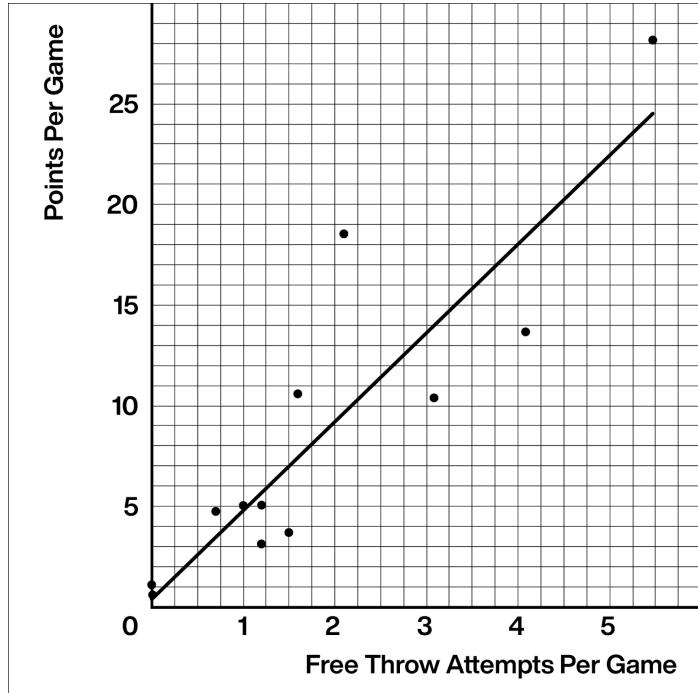
2.1 Circle the points that appear to be outliers.

2.2 What does it mean for a point to be far above the line in this situation?

2.3 Use the model to predict the number of points per game for a player who attempts 4.5 free throws per game. Round your answer to the nearest tenth.

2.4 One of the players scores 13.7 points per game with 4.1 free throw attempts.

How does this compare to what the model predicts for this player?



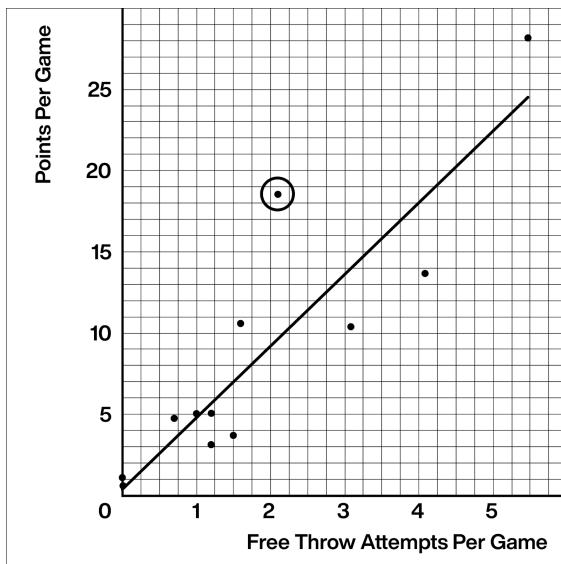
1.1 **Home runs:** 26

Predicted home runs: 21.6

1.2 57 hits

1.3 The point should be much lower on the graph than the line.

2.1



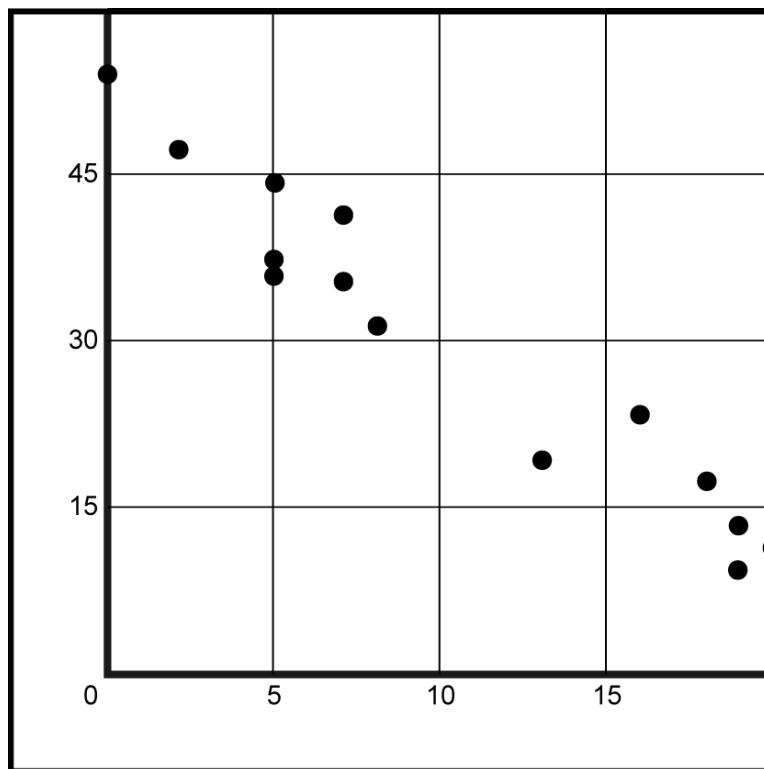
2.2 A point above the line represents a player who scores more points per game than predicted by their number of free throw attempts.

2.3 20.2 points per game because $4.413(4.5) + 0.377$ is roughly equal to 20.2.

2.4 The model predicts that with 4.1 free throw attempts per game, the player should score $4.413(4.1) + 0.377$, or about 18.5 points per game. That means the player is scoring 4.8 points less than the model predicts they should.

For this data, the inputs are the horizontal values and the outputs are the vertical values.

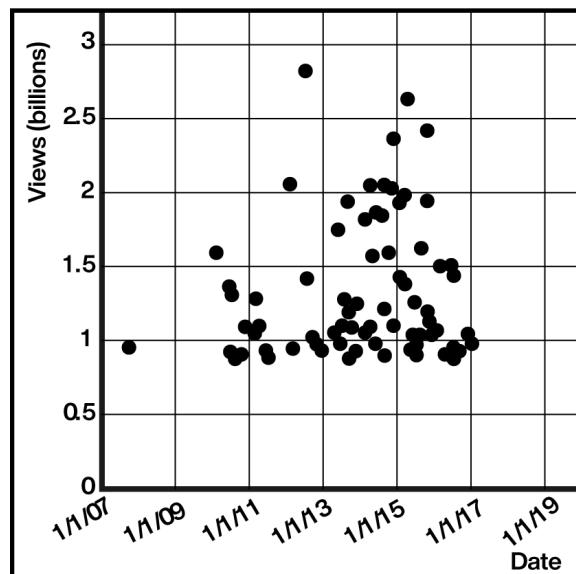
- 1.1 Use a ruler to draw a line of best fit.



- 1.2 Use your line of fit to estimate what you would expect the output value to be when the input is 10.

Here is a scatter plot that shows the most popular videos in a 10-year span.

- 2.1 Estimate the number of views for the most popular video in this 10-year span.
- 2.2 Estimate when the fourth most popular video was released.

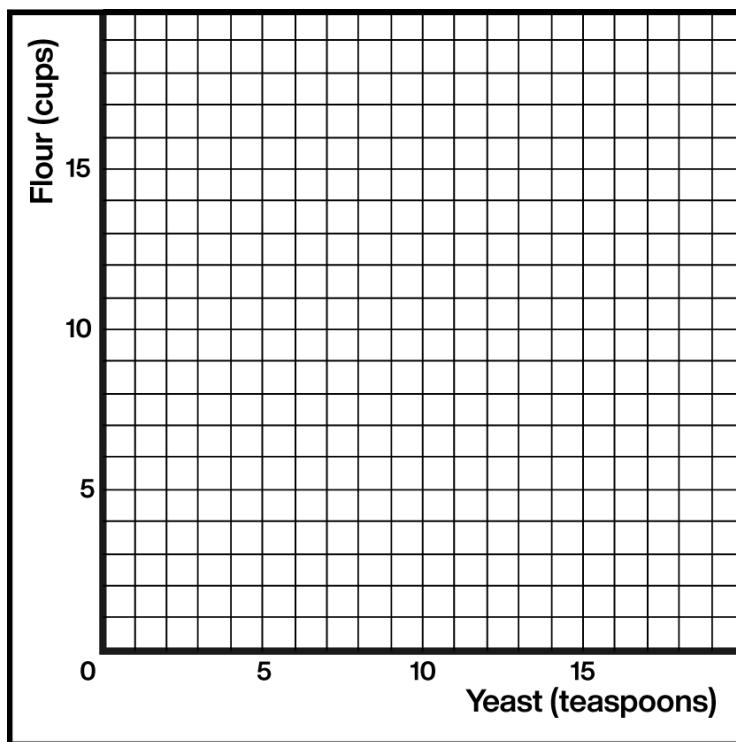




Unit 8.6, Lesson 5: Practice Problems

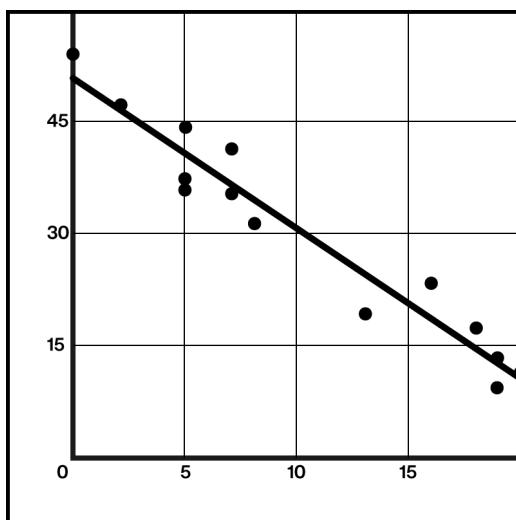
A bread recipe calls for 1 teaspoon of yeast for every 2 cups of flour.

- 3.1 Name two quantities in this scenario that are in a functional relationship.
- 3.2 Write an equation that represents the number of cups of flour, c , for every teaspoon of yeast, t .
- 3.3 Sketch the graph of the function.



- 3.4 Write the coordinates of two points on the line.

1.1



1.2 The output would be close to 30.

2.1 (From IM 8.6.03, Desmos 8.6.03)

The most popular video has roughly 2.8 billion views.

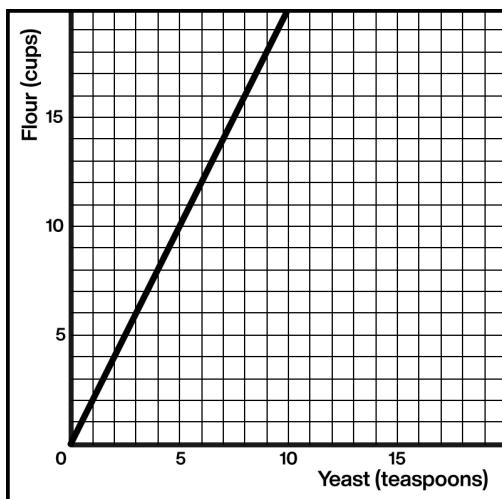
2.2 The fourth most popular video was released in late 2014.

3.1 (From IM 8.5.08, Desmos 8.5.07)

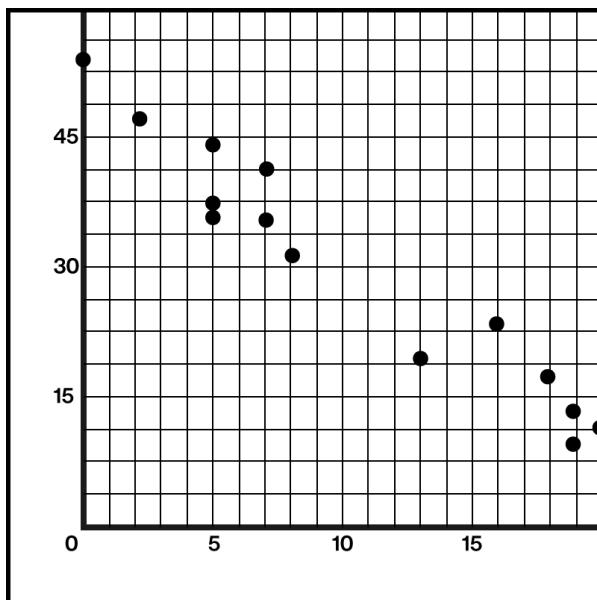
The amount of yeast and the amount of flour are in a functional relationship.

3.2 If the amount of flour is treated as a function of the amount of yeast, then the equation is $c = 2t$. If the amount of yeast is treated as a function of the amount of flour, then the equation is $t = \frac{1}{2}c$.

3.3

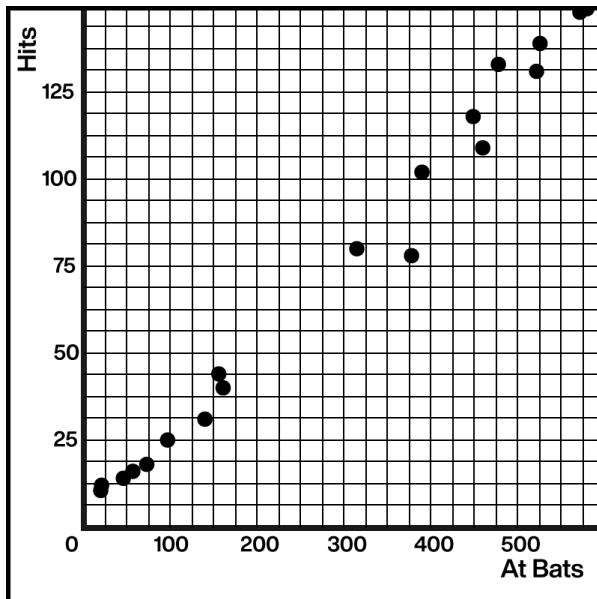
3.4 Responses vary.
(5, 10) and (10, 20)

1. Which statement is true about the data in the scatter plot?
- A. As x increases, y tends to increase.
 - B. As x increases, y tends to decrease.
 - C. As x increases, y tends to stay unchanged.
 - D. x and y are unrelated.



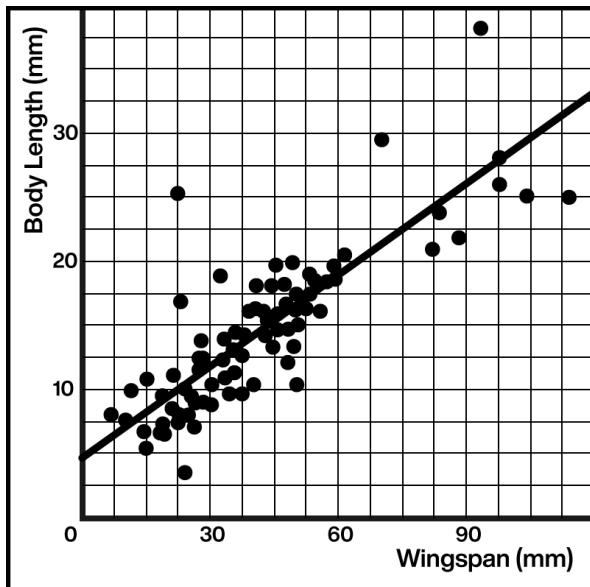
2. Here is a scatter plot that compares hits to at bats for players on a baseball team.

Describe the relationship between the number of at bats and the number of hits using the data in the scatter plot.



Unit 8.6, Lesson 6: Practice Problems

3. The linear model for some butterfly data is given by the equation $y = 0.238x + 4.642$. Which of the following best describes the slope of the model?
- A. For every 1 mm the wingspan increases, the length of the butterfly increases 0.238 mm.
 - B. For every 1 mm the wingspan increases, the length of the butterfly increases 4.642 mm.
 - C. For every 1 mm the length of the butterfly increases, the wingspan increases 0.238 mm.
 - D. For every 1 mm the length of the butterfly increases, the wingspan increases 4.642 mm.

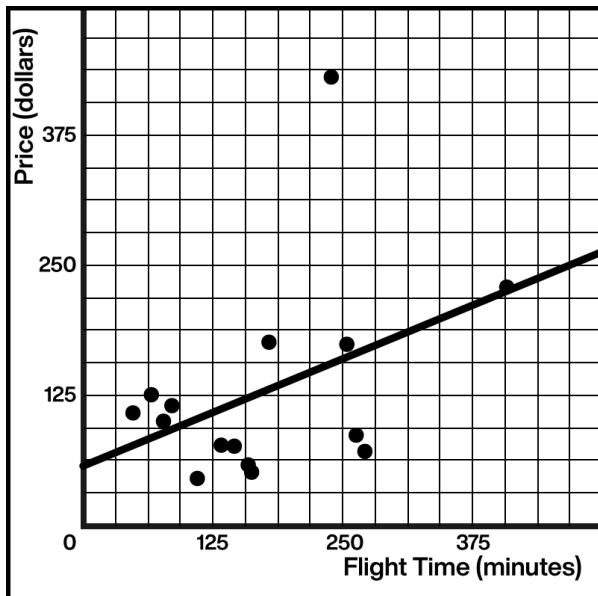


This scatter plot shows nonstop one-way flight times from O'Hare Airport in Chicago and prices of a one-way ticket.

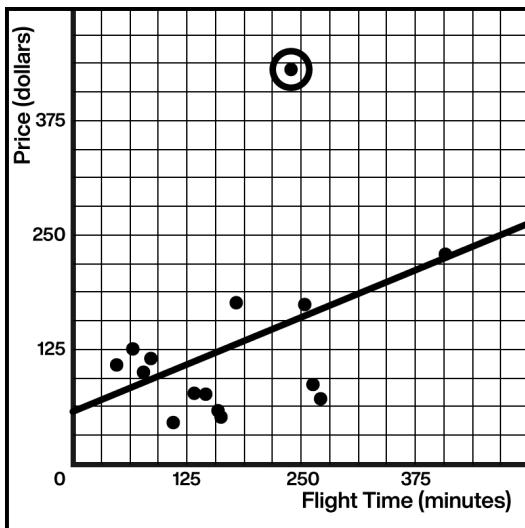
- 4.1 Circle any data that appear to be outliers.
 - 4.2 Use the graph to estimate the difference between any outliers and their predicted values. Write your findings below.
5. Solve this system of equations:

$$\begin{aligned}y &= -3x + 13 \\y &= -2x + 1\end{aligned}$$

Write your answer as an ordered pair (x, y) .



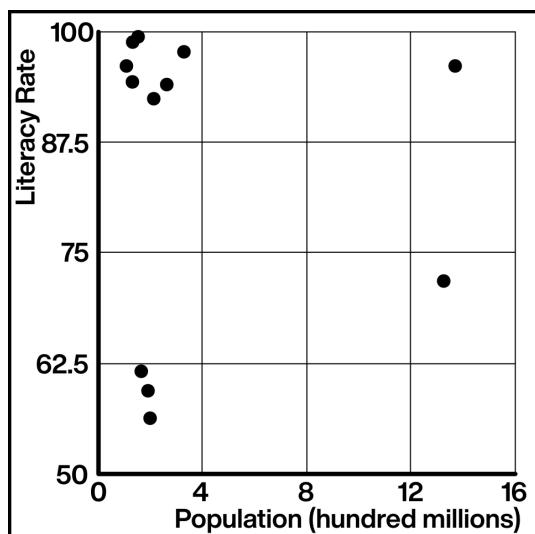
1. B. As x increases, y tends to decrease.
 2. Responses vary. As the number of at bats increases, the number of hits also increases.
 3. A. For every 1 mm the wingspan increases, the length of the butterfly increases 0.238 mm.
- 4.1 (From IM 8.6.04, Desmos 8.6.04)



- 4.2 This point represents a destination that costs around \$250 more than the model predicts for its flight time.
5. (From IM 8.4.14, Desmos 8.4.12)
(12, -23)

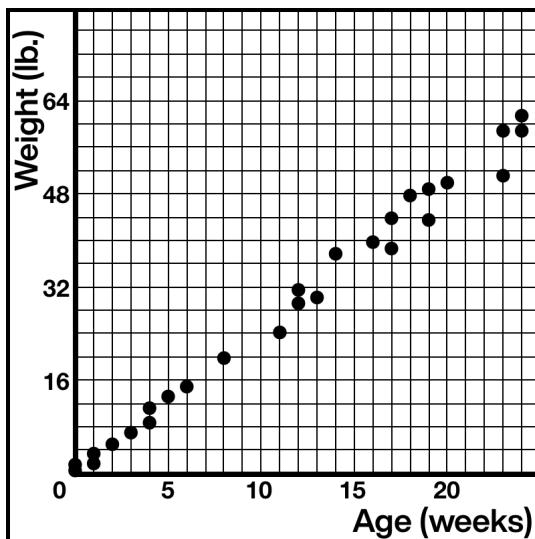
1. The literacy rate and population for 12 countries with more than 100 million people are shown in the scatter plot.

Circle any clusters in the data.



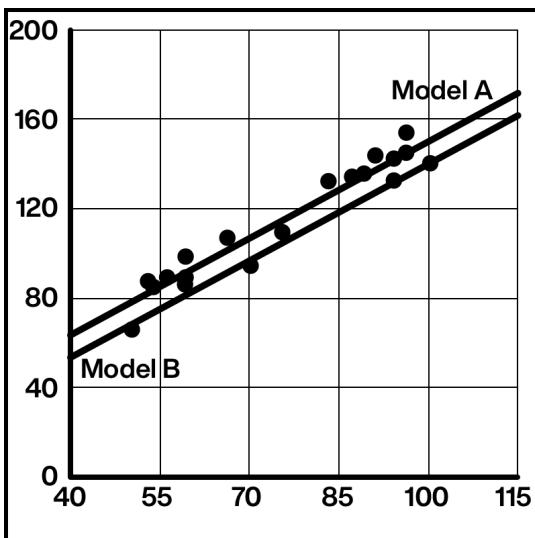
2. Select **all** of the following that describe the association in this scatter plot:

- Linear association
- Non-linear association
- Positive association
- Negative association
- No association



3. Two different models are graphed for the same data.

Which model more closely matches the data?
Explain your thinking.



Unit 8.6, Lesson 7: Practice Problems

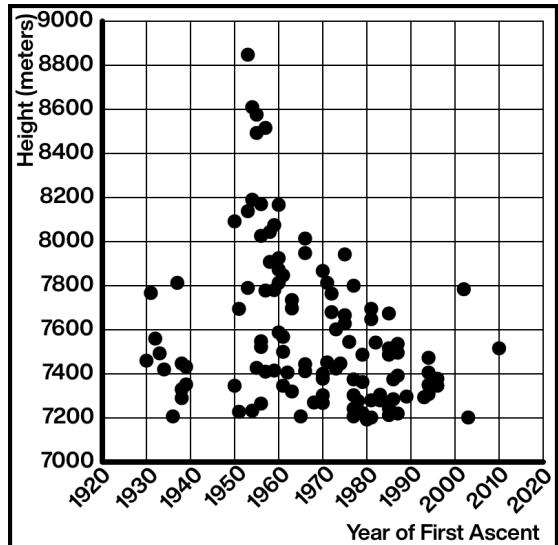
4. Here is a scatter plot of data for some of the tallest mountains on Earth.

The heights (in meters) and years of first recorded ascent are shown.

Mount Everest is the tallest mountain in this set of data.

Use the scatter plot to estimate the height and the year of first recorded ascent of Mount Everest.

Height (meters)	Year of First Ascent



A cone has volume V , radius r , and a height of 12 centimeters.

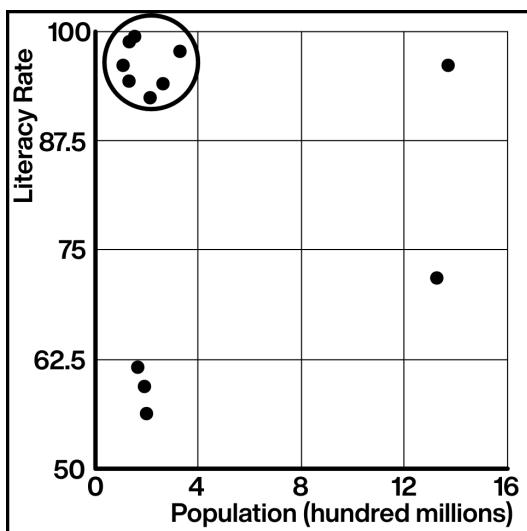
- 5.1 Another cone has the same height and $\frac{1}{3}$ of the radius of the original cone.

Write an expression for its volume.

- 5.2 Another cone has the same height and 3 times the radius of the original cone.

Write an expression for its volume.

1.



2. ✓ Linear association
✓ Positive association
3. (From IM 8.6.05, Desmos 8.6.05)
Model A more closely matches the data. In Model B, most of the points are above the line in the graph. In Model A, the points are more evenly arranged around the line.
4. (From IM 8.6.03, Desmos 8.6.03)

Height (meters)	Year of First Ascent
8,848	1953

- 5.1 (From IM 8.5.18, Desmos 8.5.12)

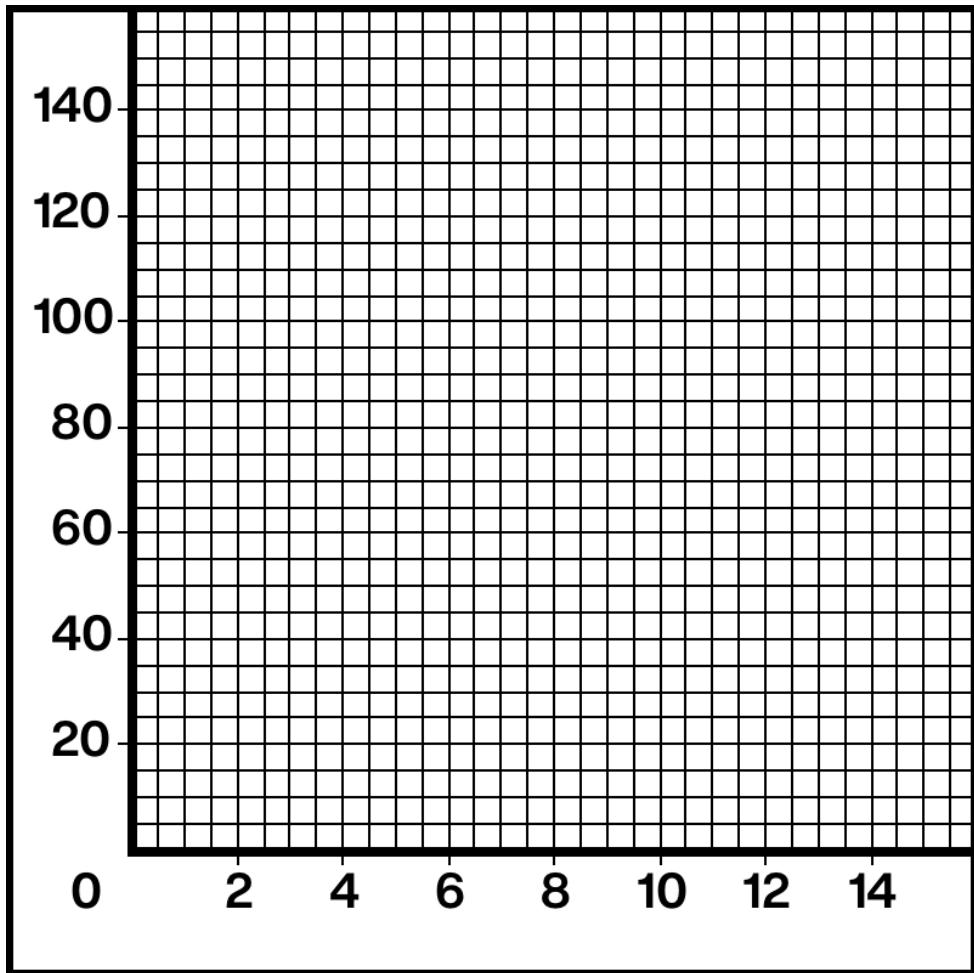
$$\frac{V}{9}$$

- 5.2 $9V$

Different stores across the country sell a book for different prices.

The table shows the price of the book (in dollars) and the number of books sold at that price.

- 1.1 Draw a scatter plot of this data.



Price (dollars)	Number Sold
11.25	53
10.50	60
12.10	30
8.45	81
9.25	70
9.75	80
7.25	120
12	37
9.99	130
7.99	100
8.75	90

- 1.2 Label the horizontal and vertical axes on the graph above.

- 1.3 Are there any outliers? Explain your thinking.

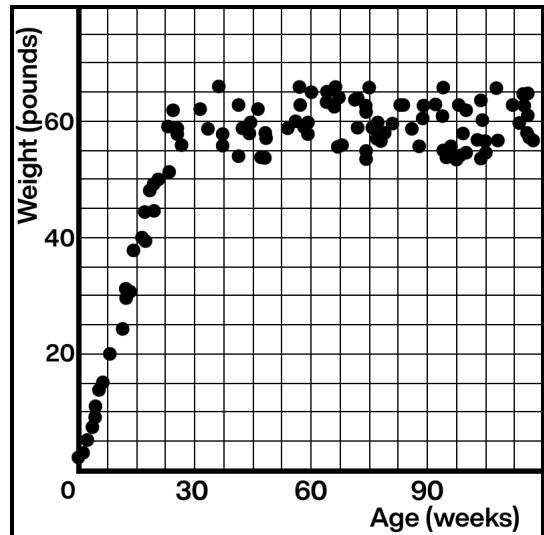
- 1.4 Is there a relationship between the variables? Explain your thinking.

- 1.5 Draw an "X" over any outliers. Then draw a line that you think is a good fit for the data.

Unit 8.6, Lesson 8: Practice Problems

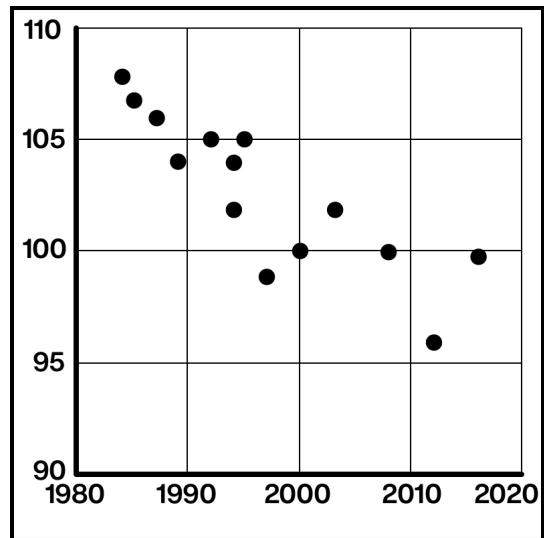
2. Select **all** of the following that describe the association in this scatter plot:

- Linear association
- Non-linear association
- Positive association
- Negative association
- No association

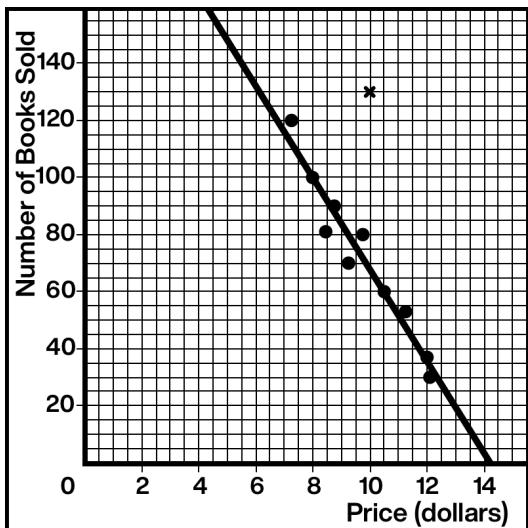


3. Using the data in the scatter plot, what can you tell about the slope of a good model?

- A. The slope is positive.
- B. The slope is zero.
- C. The slope is negative.
- D. There is no association.



1.1, 1.2, and 1.5



- 1.3 Yes, at $(9.99, 130)$. This point is much higher than expected on the scatter plot.
- 1.4 There is a negative linear relationship between the variables. When the price increases, the number of books sold decreases.
2. (From IM 8.6.07, Desmos 8.6.07)
 - ✓ Non-linear association
 - ✓ Positive association
3. (From IM 8.6.06, Desmos 8.6.06)
 - C. The slope is negative.

Here is some data from the result of a survey about who watches the news on a daily basis.

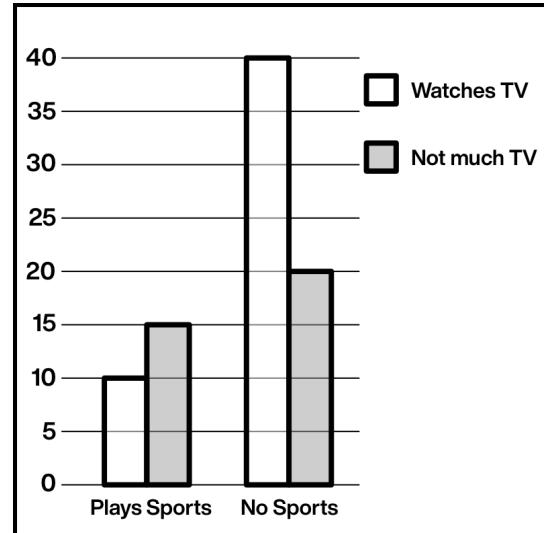
	Watches the News Daily	Does Not Watch the News Daily
Younger Than 18	30	80
18 or Older	10	5

1.1 What do you notice and wonder?

1.2 In total, how many people responded that they watch the news daily?

2.1 Complete the two-way table below based on the information in the bar graph.

	Watches TV	Not Much TV	Total
Plays Sports			
No Sports			
Total			



2.2 Select **all** of the true statements that can be made about the data shown in the bar graph.

- More people do not play sports than do.
- More people watch TV than watch not much TV.
- 10 people watch TV but don't play sports.
- There are no people who watch TV and play sports.

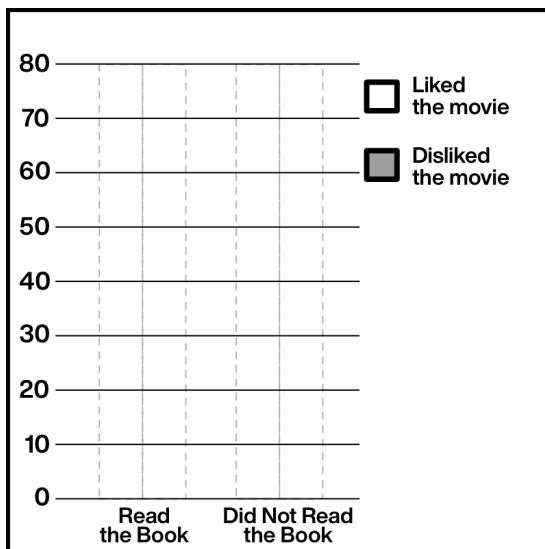
Unit 8.6, Lesson 9: Practice Problems

180 people were surveyed about a movie they watched that was based on a book.

Some people had already read the book and some people had not.

	Liked the Movie	Disliked the Movie	Total
Read the Book	65	15	80
Did Not Read the Book	50	50	100
Total	115	65	180

- 3.1 Create a bar graph based on the information in the table.



- 3.2 What claim might a person make based on this data? What evidence would they give?

4. In a class of 25 students, some students play a sport, some play a musical instrument, some do both, and some do neither. Complete the two-way table to show the data for the class.

	Plays an Instrument	Does Not Play an Instrument	Total
Plays a Sport		11	
Does Not Play a Sport	9		13
Total	10		25

Unit 8.6, Lesson 9: Practice Problems

Answer Key

1.1 Responses vary.

- I notice that more people who are 18 years or older watch the news daily than they don't.
- I wonder if people who don't watch the news daily get the news from some other form of media, like online articles, newspapers, or the radio.

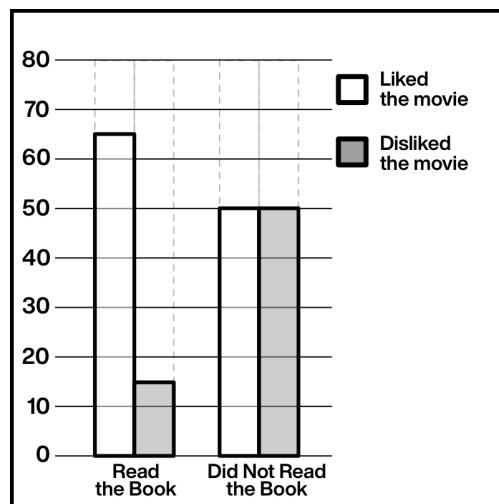
1.2 40 people

2.1

	Watches TV	Not Much TV	Total
Plays Sports	10	15	25
No Sports	40	20	60
Total	50	35	85

- 2.2 ✓ More people do not play sports than do.
✓ More people watch TV than watch not much TV.

3.1



3.2 Responses vary. People who read the book before watching the movie enjoy it less than those who have not read the book.

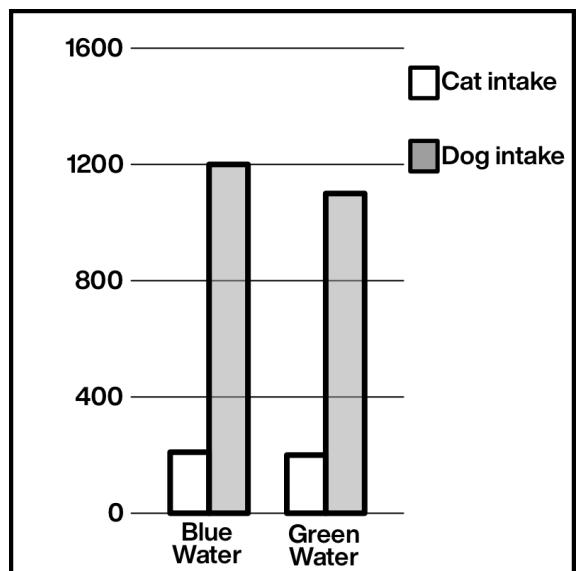
3.3

	Plays an Instrument	Does Not Play an Instrument	Total
Plays a Sport	1	11	12
Does Not Play a Sport	9	4	13
Total	10	15	25

1. A scientist wants to know if the color of water affects how much animals drink.

The average amount of water each animal drinks was recorded in milliliters for a week and then graphed.

	Cat Intake (mL)	Dog Intake (mL)	Total (mL)
Blue Water	210	1200	1410
Green Water	200	1100	1300
Total	410	2300	2710



Is there evidence to suggest an association between water color and how much animals drink? Explain your thinking.

2. A farmer brings produce to the farmer's market and records whether people buy lettuce, apples, both, or something else.

Complete the table to show the relative frequencies for each row.

Use this table to decide if there is an association between buying lettuce and buying apples.

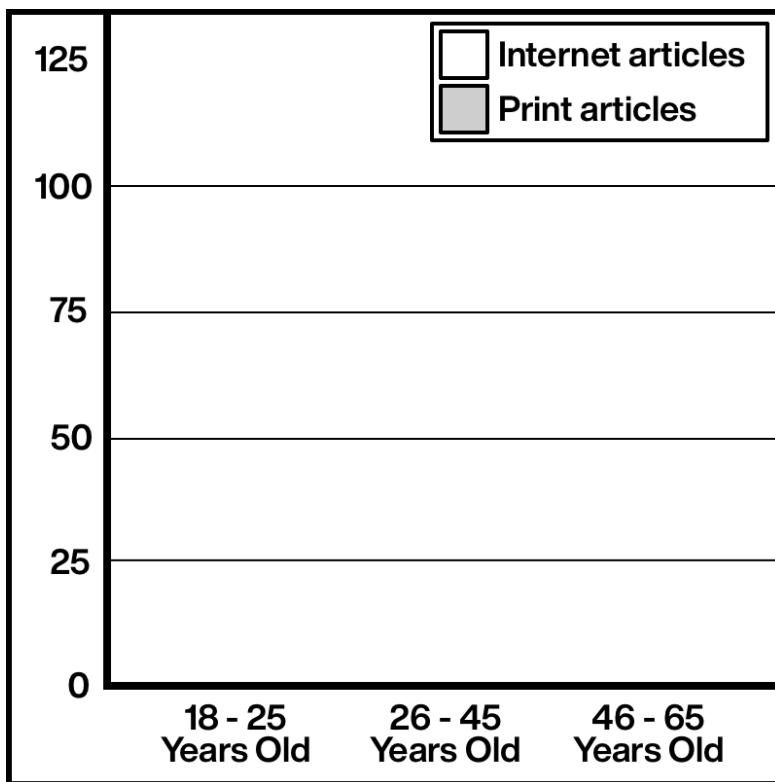
	Bought Apples	Did Not Buy Apples
Bought Lettuce	14	58
Did Not Buy Lettuce	8	29

	Bought Apples	Did Not Buy Apples	Total
Bought Lettuce	%	%	%
Did Not Buy Lettuce	%	%	%

Unit 8.6, Lesson 10: Practice Problems

Researchers at a media company want to study news-reading habits among different age groups. They tracked print and online subscription data and made a two-way table.

- 3.1 Create a segmented bar graph using one bar for each row of the table.

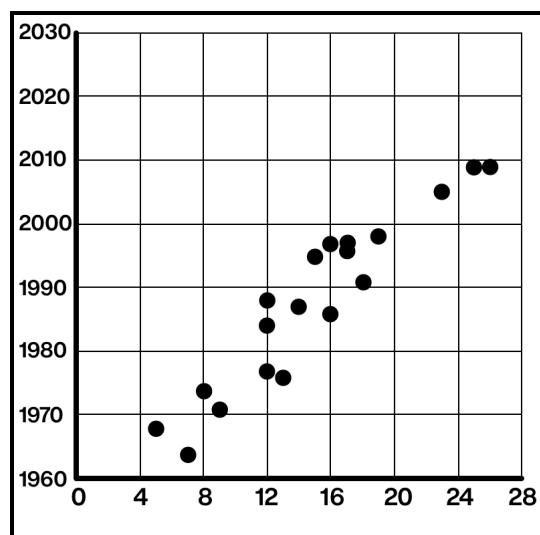


	Internet Articles	Print Articles
18–25 Years Old	151	28
26–45 Years Old	132	72
46–65 Years Old	48	165

- 3.2 Is there an association between age groups and the method they use to read articles?

Explain your thinking.

4. Using the data in the scatter plot, what is a reasonable slope of a model that fits this data?
- A. -2.5
 - B. -1
 - C. 1
 - D. 2.5

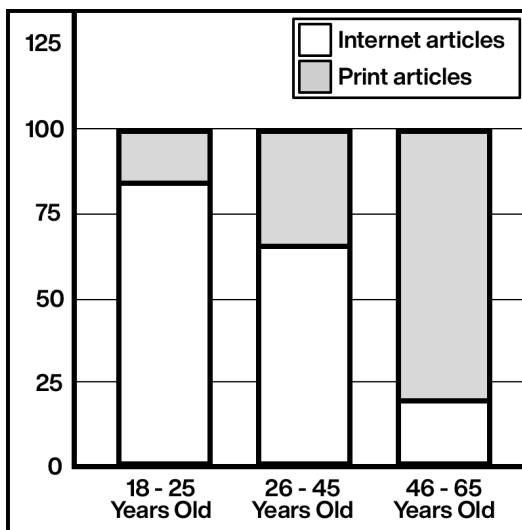


1. No, the relative frequencies of the animals drinking each color of water are about the same, so there is no evidence of association.

2.

	Bought Apples	Did Not Buy Apples	Total
Bought Lettuce	19%	81%	100%
Did Not Buy Lettuce	22%	78%	100%

3.1



- 3.2 Yes. The segments of the bars are not very close to being the same size. Younger age groups read internet articles much more than they read print articles, while the oldest age group reverses that pattern.
4. (From IM 8.6.06, Desmos 8.6.06)
D. 2.5

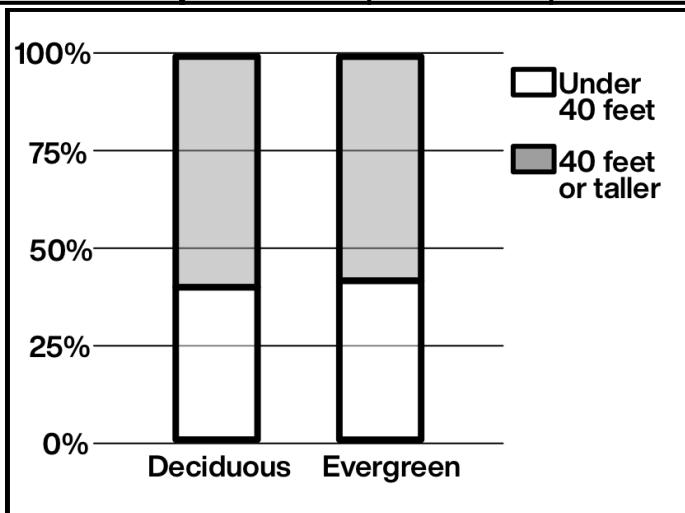
Unit 8.6, Lesson 11: Practice Problems

1. An ecologist is studying a forest with a mixture of tree types. Since the average tree height in the area is 40 feet, he measures the height of the tree against that. He also records the type of tree. The results are shown in the table and the segmented bar graph.

Is there evidence of an association between tree height and tree type? Explain your thinking.

Name _____

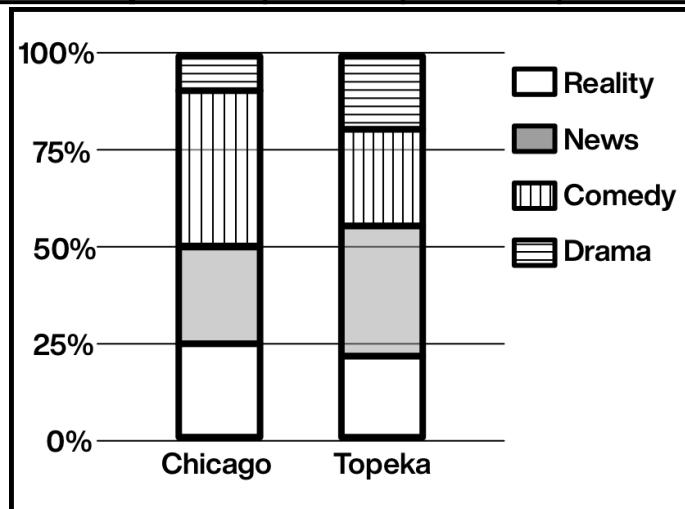
	Under 40 Feet	40 Feet or Taller	Total
Deciduous	45	30	75
Evergreen	14	10	24
Total	59	40	99



2. Workers at an advertising agency are interested in people's TV-viewing habits. They take a survey of people in two cities to try to find patterns in the types of shows they watch. The results are recorded in the table and shown in the segmented bar graph.

Is there evidence of different viewing habits? Explain your thinking

	Reality	News	Comedy	Drama
Chicago	50	40	90	20
Topeka	45	70	40	45



Unit 8.6, Lesson 11: Practice Problems

3. A scientist is interested in whether certain species of butterflies like certain types of local flowers.

The scientist captures butterflies in two zones containing different flower types, and records the number of butterflies caught for each zone.

	Zone 1	Zone 2
Eastern Tiger Swallowtail	16	34
Monarch	24	46

Does the data show an association between butterfly type and zone? Explain your thinking.

1. No. 60% of the deciduous trees are under 40 feet, and 40% are at least 40 feet. Similarly, 58% of evergreens are under 40 feet, and 42% are at least 40% feet. From the data recorded, there is not a clear association.
2. Yes, there are differences. Chicagoans watch news and dramas much more than Topekans. Topekans watch more comedies.
3. No, there is no association. 32% of Eastern Tiger Swallowtails and 34% of Monarchs were found in Zone 1, so there is not a large difference in type of butterfly.

Warm-Up

Select all the expressions that are equivalent to $3x - 4 + 2x - 6$.

$x - 2$

$5x - 2$

$5(x - 2)$

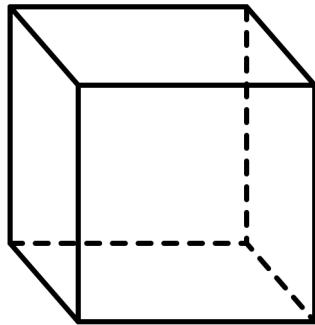
$5x + 10$

$5x - 10$

Practice

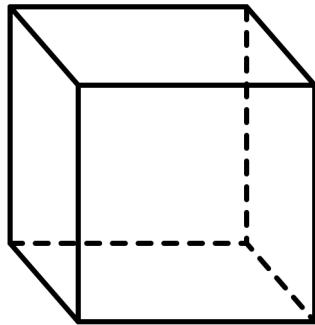
Explain or show how to slice each cube in order to make the described cross section.

- 1.1 Cross section: **Square**



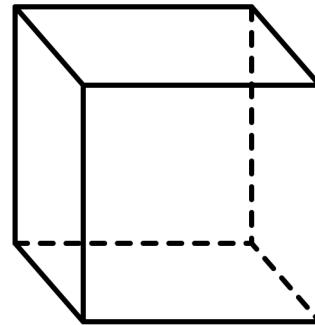
Explain or show your thinking.

- 1.2 Cross section: **Triangle**



Explain or show your thinking.

- 1.3 Cross section: **Rectangle**

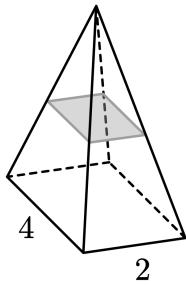


Explain or show your thinking.

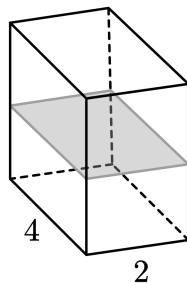
Here is a pyramid and a rectangular prism with the same base and the same height.

Each figure is sliced parallel to the base.

- 2.1 What will happen to the area of the cross section as you slice the pyramid closer to the base?



- 2.2 What will happen to the area of the cross section as you slice the prism closer to the base?

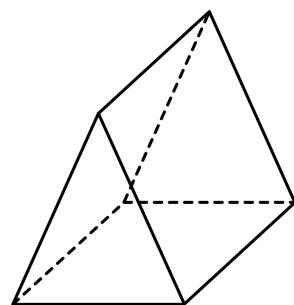


Unit 7.7, Lesson 9: Practice Problems

3. Rebecca says, “No matter which way you slice this triangular prism, the cross section will be a triangle.”

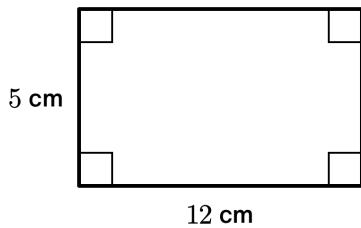
Sydney says, “I’m not so sure.”

Describe or show a slice that Sydney might be thinking of.



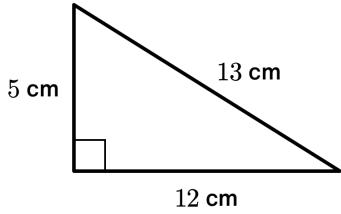
Determine the area of each shape.

4.1



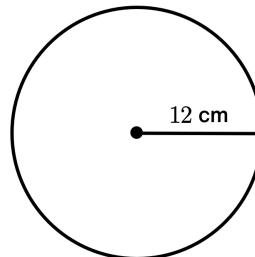
Area =

4.2



Area =

4.3

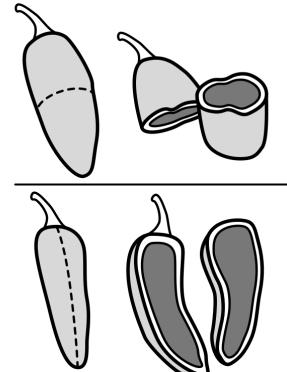


Area =

Explore

Here are two peppers. One is sliced horizontally, and the other is sliced vertically, producing different cross sections.

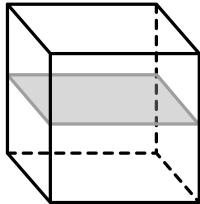
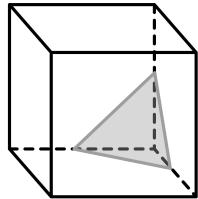
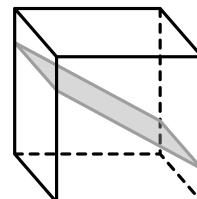
Find or imagine an object. Sketch that object and at least two cross sections that are different shapes.

**Reflect**

1. Star a question you are still wondering about.
2. Use the space below to ask one question you have or to share something you are proud of.

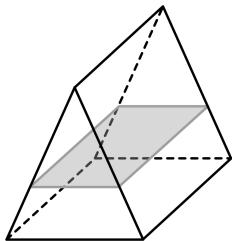
Warm-Up

- ✓ $5(x - 2)$
- ✓ $5x - 10$

Practice1.1 *Responses vary.*1.2 *Responses vary.*1.3 *Responses vary.*

2.1 The area will increase.

2.2 The area will stay the same.

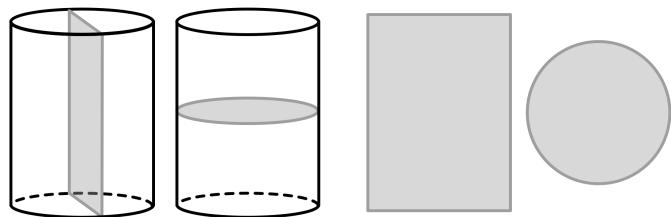
3. *Responses vary.* Sydney might be thinking of slicing the prism parallel to a rectangular face.

4.1 60 square centimeters

4.2 30 square centimeters

4.3 144π square centimeters**Explore***Responses vary.*

You can slice a can to have a cross section that is a rectangle or a circle.



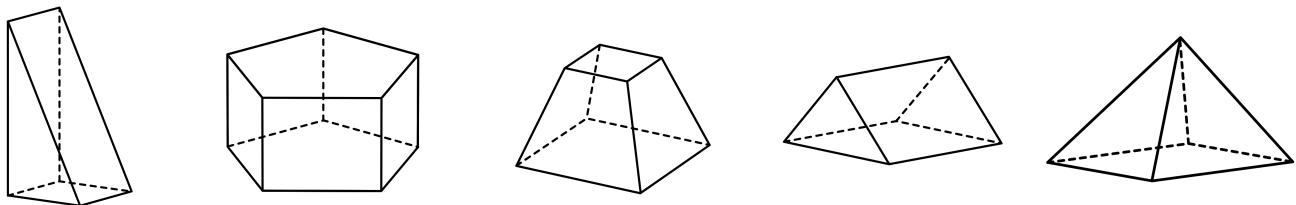
Warm-Up

Select **all** of the expressions that are equivalent to $3(x - 2) + 5$.

- $3x + 3$ $3(x - 1)$ $3x - 1$ $-1 + 3x$ $1 - 3x$

Practice

1.1 Circle all the prisms.

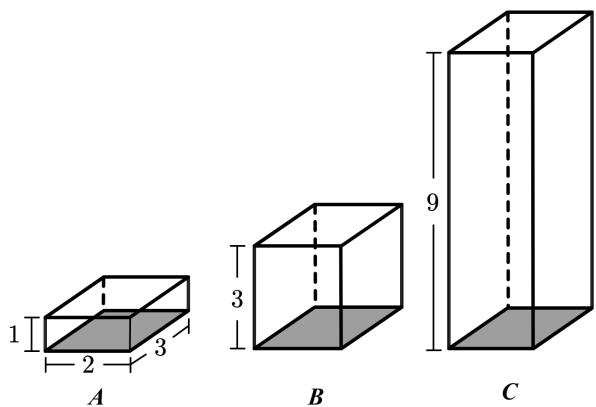


1.2 For each prism, shade one of the bases.

2. Here are three prisms with the same base.

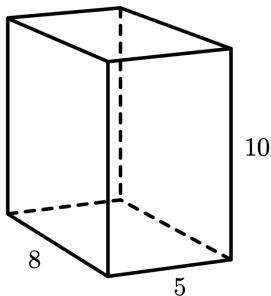
Determine the volume of each prism.

Prism	Volume (cubic units)
A	
B	
C	

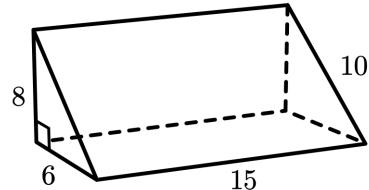


Determine the volume of each prism. Explain or show your thinking.

3.1



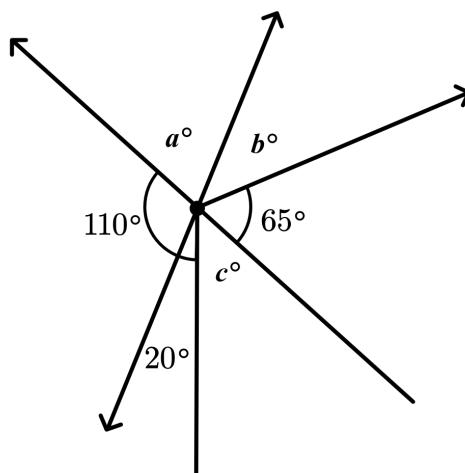
3.2



Unit 7.7, Lesson 10: Practice Problems

4. Determine the measure of each angle.

a	
b	
c	

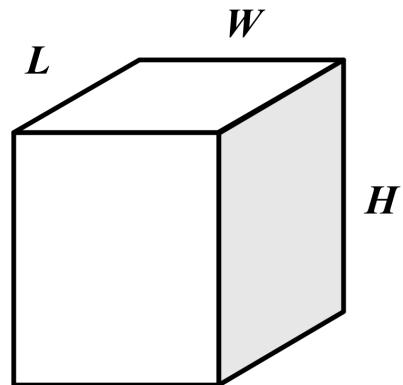


5. Melissa wants to buy a \$25 hat. The sales tax in her state is 6.25%. How much will Melissa spend on the hat, including the tax?

Explore

Use whole numbers between 1 and 9, without repeating, to create two prisms with the same volume.

	Prism 1 (units)	Prism 2 (units)
L		
W		
H		

**Reflect**

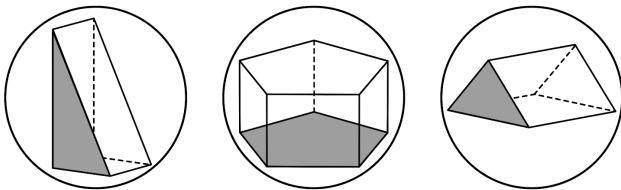
1. Circle one question that you are still wondering about.
2. Use the space below to ask one question you have or to share something you are proud of.

Warm-Up

✓ $3x - 1$
 ✓ $-1 + 3x$

Practice

1.



2.

Prism	Volume (cubic units)
A	6
B	18
C	54

3.1 400 cubic units

Explanations vary. This shape is a prism, so the volume is the area of the base multiplied by the height. $40 \cdot 10 = 400$ cubic units.

3.2 360 cubic units

Explanations vary. This shape is a prism, so the volume is the area of the base multiplied by the height. $24 \cdot 15 = 360$ cubic units.

4.

Angle	Measure (degrees)
a	70
b	45
c	50

5. \$26.56

Explore

Responses vary.

	Prism 1 (units)	Prism 2 (units)
L	1	3
W	8	4
H	9	6

Warm-Up

Write each fraction as a decimal.

$\frac{1}{2} =$

$\frac{1}{4} =$

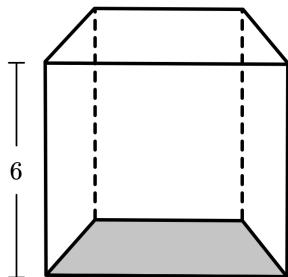
$\frac{3}{4} =$

$\frac{1}{5} =$

Practice

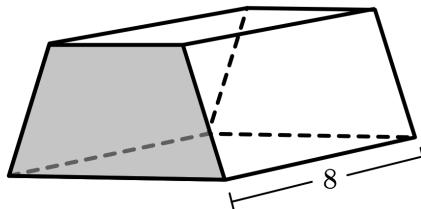
1. The volume of each of these trapezoidal prisms is 24 cubic units.

What is the area each prism's base?

Prism 1

Volume: 24 cubic units

Area of the base:

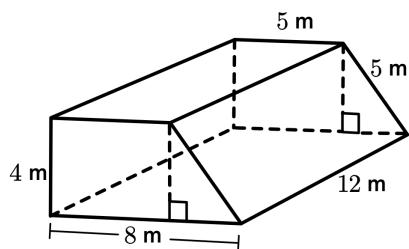
Prism 2

Volume: 24 cubic units

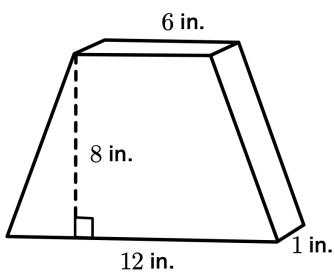
Area of the base:

Determine the volume of each prism. Explain your thinking.

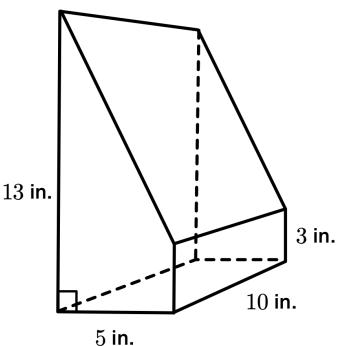
2.1



2.2

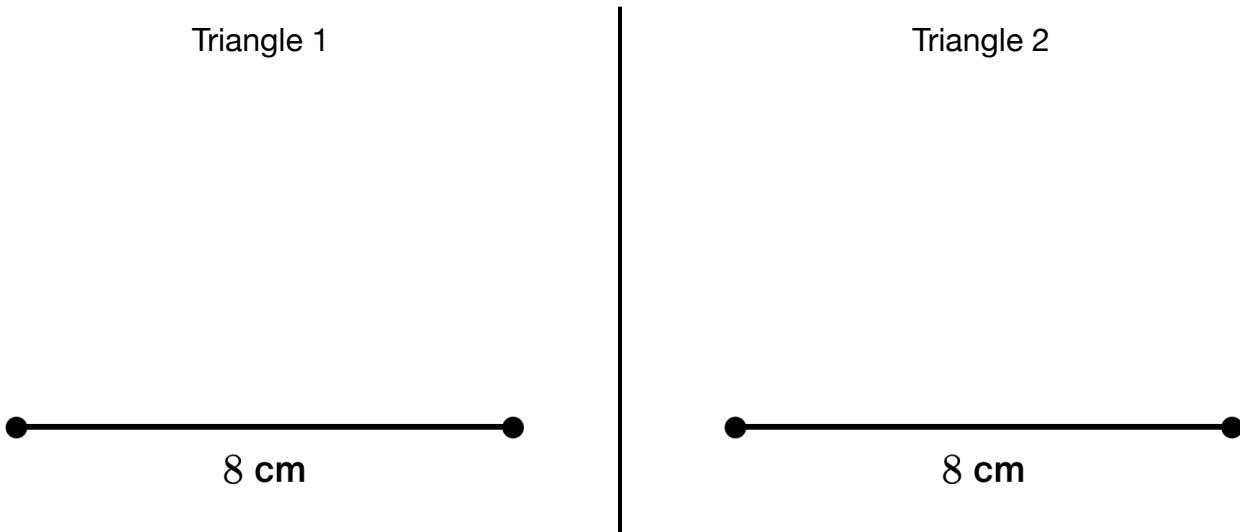


2.3



Unit 7.7, Lesson 11: Practice Problems

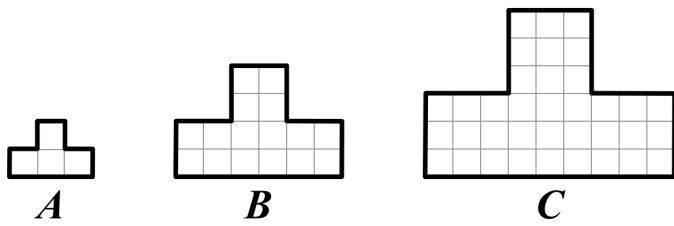
- 3.1 Sketch two different triangles in which one side is 8 cm long and one side is 4 cm long.



- 3.2 Explain how you can tell that your two triangles are not identical.

Explore

Here are the bases of three different prisms. They each have the same volume.
How tall could each prism be?

**Reflect**

1. Mark the question you spent the most time on.
2. Use the space below to ask one question you have or to share something you are proud of.

Warm-Up

0.5, 0.25, 0.75, 0.2

Practice

- 1.
- Prism 1:**
- 4 square units

Prism 2: 3 square units

- 2.1 312 cubic meters

Explanations vary. The base of the pyramid is a trapezoid. The area of the base can be split into a rectangle and a triangle. The area of the rectangle is 20 square meters. The area of the triangle is 6 square meters. $26 \cdot 12 = 312$ cubic meters.

- 2.2 72 cubic inches

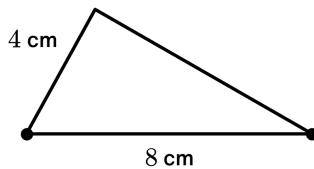
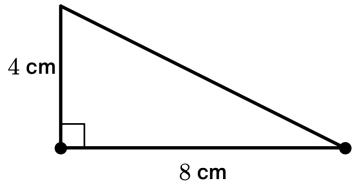
Explanations vary. The base of this prism is a trapezoid. The area of the base can be found by rearranging the trapezoid into an 8-by-9-inch rectangle. $72 \cdot 1 = 72$ cubic inches.

- 2.3 400 cubic inches

Explanations vary. The area of the base can be split into a rectangle and a triangle. The area of the rectangle is 15 square inches and the area of the triangle is 25 square inches.

$$40 \cdot 10 = 400 \text{ cubic inches.}$$

- 3.1
- Responses vary.*



- 3.2
- Explanations vary.*
- For one of the triangles, the 8 cm side is the longest side. For the other triangle, it is the second-longest side.

Explore

Responses vary. The area of $A = 4$ square units, $B = 16$ square units, and $C = 36$ square units. If

A were 36 units high, its volume would be $36 \cdot 4 = 144$ cubic units. Then B could be $\frac{144}{16} = 9$ units high and C could be $\frac{144}{36} = 4$ units high.

Warm-Up

Write each fraction as a percentage.

$\frac{1}{4} =$

$\frac{1}{5} =$

$\frac{3}{5} =$

$\frac{3}{10} =$

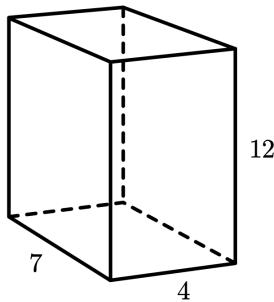
Practice

1. Select **all** the situations where knowing the surface area of an object would be useful.

- The amount of paint needed to paint a room
- The amount of water needed to fill an aquarium
- How much wrapping paper a gift will need
- How many watermelons fit in a box for shipping
- The amount of gasoline left in the tank of a vehicle

Determine the surface area and volume of each prism. Show all of your thinking.

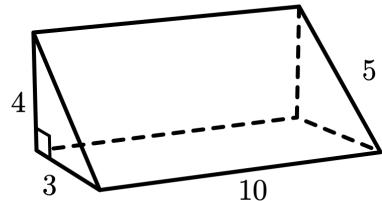
2.1



Volume:

Surface area:

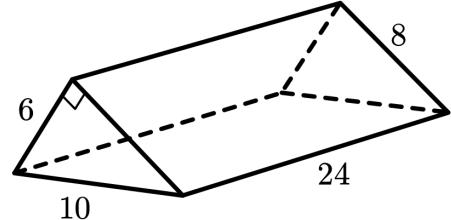
2.2



Volume:

Surface area:

2.3



Volume:

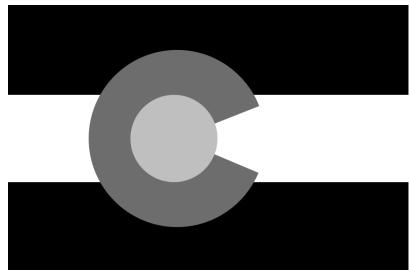
Surface area:

Unit 7.7, Lesson 12: Practice Problems

3. Draw one or more diagrams that show complementary and supplementary angles.

In a 4-by-6-foot Colorado state flag, the gold-colored disk has a 1-foot radius.

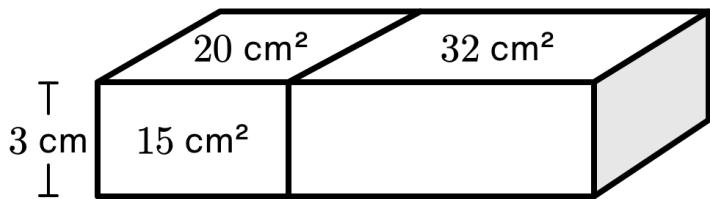
- 4.1 How much gold fabric do you need to create the flag?



- 4.2 What percentage of the flag is gold?

Explore

Determine the surface area and volume of the shape below.



Surface area:

Volume:

Reflect

1. Mark the question you felt most proud of.
2. Use the space below to ask one question you have or to share something you are proud of.

Warm-Up

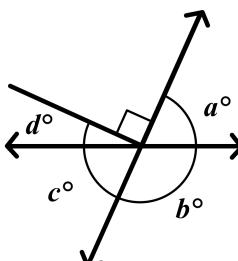
25%, 20%, 60%, 30%

Practice

1. ✓ The amount of paint needed to paint a room
✓ How much wrapping paper a gift will need

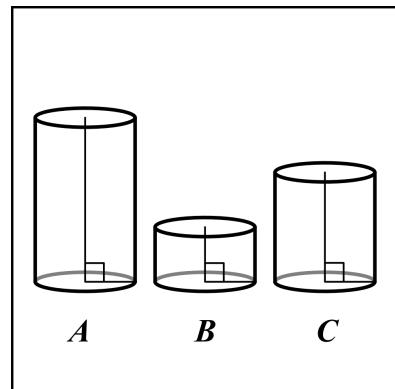
2.1 Volume: 336 cubic units*Explanations vary.* $28 \cdot 12 = 336$ cubic units.**Surface area:** 320 square units*Explanations vary.* The prism has six faces. The areas of the three unique faces are 28 square units, 48 square units, and 84 square units. $2(28 + 48 + 84) = 360$ square units.**2.2 Volume:** 60 cubic units*Explanations vary.* $\frac{1}{2} \cdot 4 \cdot 3 \cdot 10 = 60$ cubic units.**Surface area:** 132 square units*Explanations vary.* The prism has five faces. $30 + 40 + 50 + 2 \cdot 6 = 132$ square units.**2.3 Volume:** 576 cubic units*Explanations vary.* $24 \cdot 24 = 576$ cubic units.**Surface area:** 624 square units*Explanations vary.* The prism has five faces. The areas of the base is 24 square units. $144 + 192 + 240 + 2 \cdot 24 = 624$ square units.

3. Responses vary.

Supplementary: a and b , b and c **Complementary:** c and d , a and d **4.1** π square feet**4.2** About 13%**Explore****Surface area:** 206 square centimeters**Volume:** 156 cubic centimeters

1. Cylinder A , B , and C have the same radius.

Order the cylinders from least volume to greatest volume.

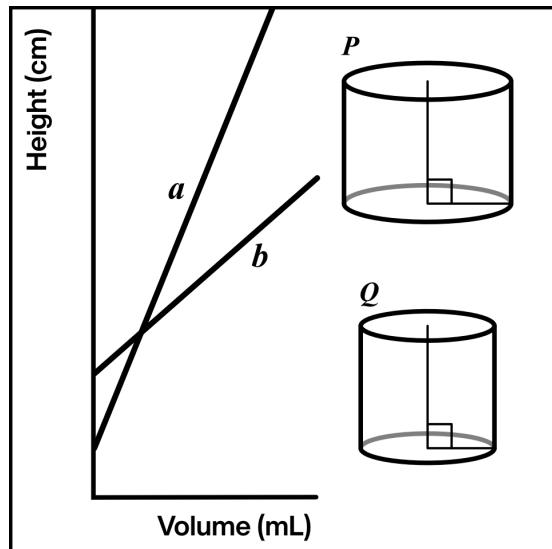


2. Two cylinders, P and Q , each started with different amounts of water.

The graph shows the height of the water as the volume of water in each cylinder increased.

Match lines a and b to cylinders P and Q .

Cylinder	Line
P	
Q	



3. Write the letter of the circle described next to the area of that circle.

- Circle A has a radius of 4 units.
- Circle B has a radius of 10 units.
- Circle C has a diameter of 16 units.

Area: About 314 square units Circle: _____

Area: 64π square units Circle: _____

Area: 16π square units Circle: _____

Unit 8.5, Lesson 10: Practice Problems

4. The volume of liquid after t seconds in two different containers is represented by the expressions below.

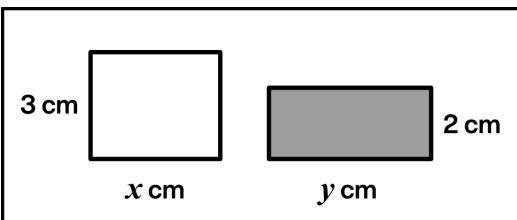
The volume of liquid in container A is represented by $1250 - 25t$.

The volume of liquid in container B is represented by $50t + 250$.

What does the equation $1250 - 25t = 50t + 250$ mean in this situation?

Here are two rectangles.

The table on the right represents some values for x and y such that the areas of the rectangles sum to 30 cm^2 .



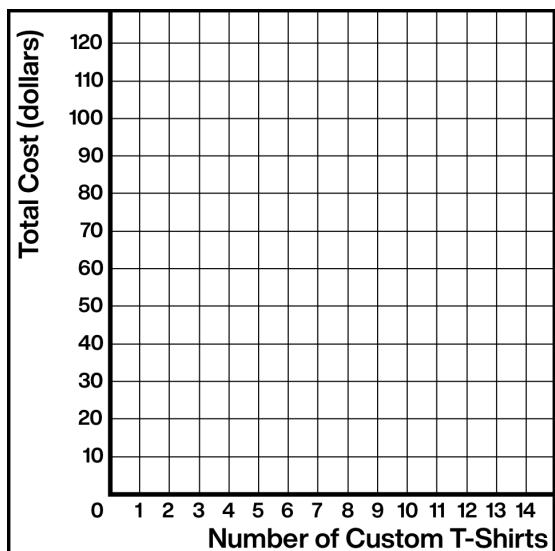
- 5.1 Complete the table.

- 5.2 Write an equation to represent this situation.

x	y
6	
	9
9	
	15

Faaria wants to get some custom T-shirts printed for her basketball team. Shirts cost \$10 each for the first 6 shirts and \$5 each for every shirt over 6.

- 6.1 Sketch a piecewise linear model that shows the total cost of buying shirts for 0 through 15 shirts.
- 6.2 What is the slope of the graph between 7 and 15 shirts?



1. From least to greatest: Cylinder B , Cylinder C , Cylinder A
2. Cylinder P matches line b . Cylinder Q matches line a .
- 3.

Area: About 314 square units Circle: B
Area: 64π square units Circle: C
Area: 16π square units Circle: A

4. Responses vary. The equation says that the volume in one container is equal to the volume in the other container. This equation can be solved for t to find the time at which both containers have the same volume.
- 5.1 (From IM 8.5.3, From Desmos 8.3.11)

x	y
6	6
4	9
9	1.5
0	15

- 5.2 (From IM 8.5.3, From Desmos 8.3.11)

$$3x + 2y = 30$$

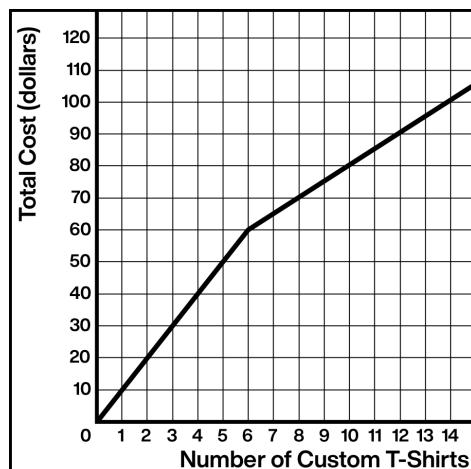
- 6.1 (From IM 8.5.10, From Desmos 8.5.09)

See the image on the right.

- 6.2 (From IM 8.5.10, From Desmos 8.5.09)

The slope is 5.

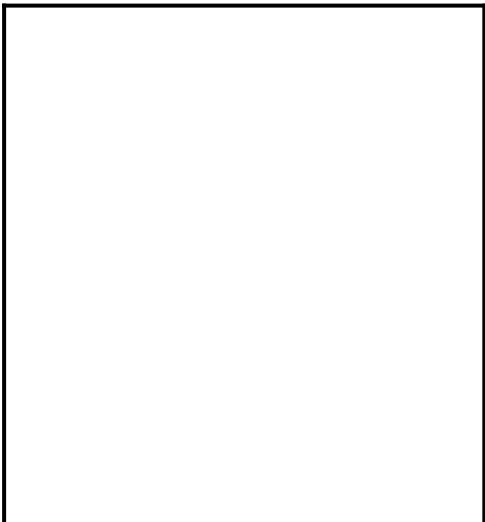
This represents the price per shirt when you buy 7 or more.



- 1.1 Sketch a cylinder in the space on the right.

Label the radius of the cylinder 3 and the height 10.

Then shade the base shape of the cylinder.



- 1.2 Calculate the volume of the cylinder.

Express your answer in terms of π .

Here are two containers that hold oatmeal.

Container A is a rectangular prism.

Container B is a cylinder.

- 2.1 The diameter of container B is 5 inches.

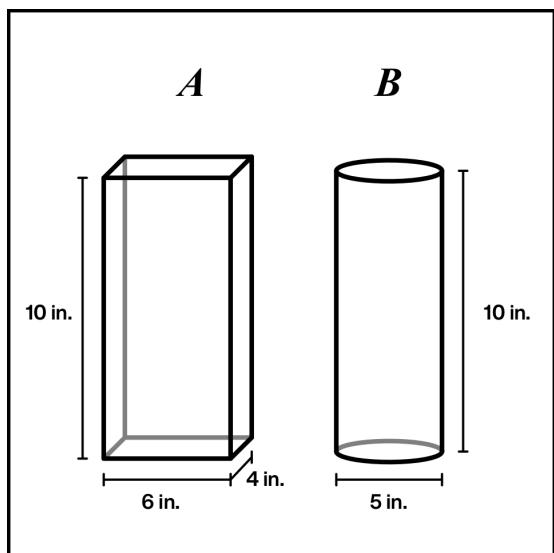
What is the radius of the container?

- 2.2 Which container's base has a larger area?

Explain your thinking.

- 2.3 Which has a larger volume, container A or B?

Explain your thinking.



Unit 8.5, Lesson 11: Practice Problems

3. Three cylinders have a height of 8 centimeters.

Find the volume of each cylinder.

Express your answers in terms of π .

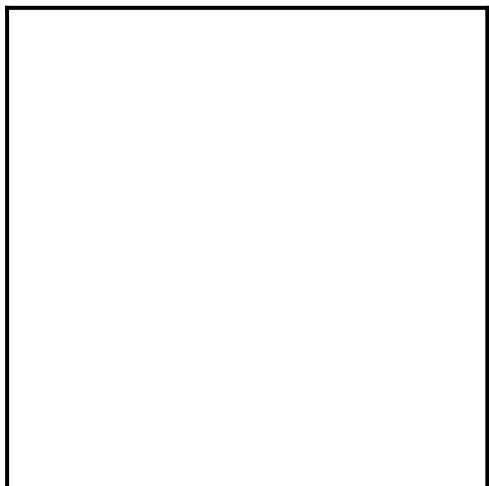
Radius (cm)	Volume (cubic cm)
1	
2	
3	

4. A gas company's delivery truck has a cylindrical tank that is 14 feet in diameter and 40 feet long.

Sketch the tank in the space on the right.

Label its radius and height.

How much gas can fit in the tank?

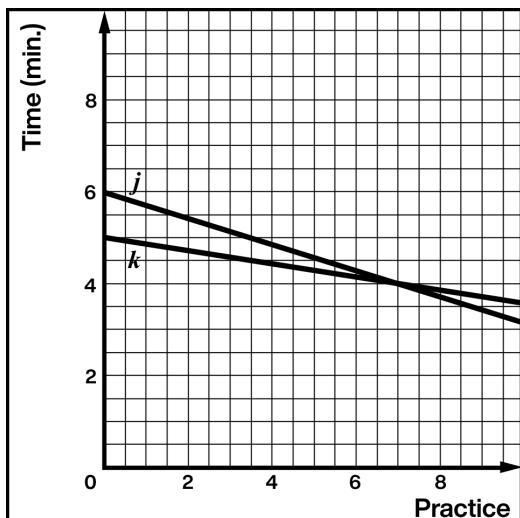


Two students join a puzzle-solving club. As they practice, they get faster at finishing the puzzles. DeShawn improves his times faster than Riku.

- 5.1 Which line represents DeShawn's performance?

- 5.2 Based on the graphs, which student was faster at puzzle solving before practicing?

Explain your thinking.



- 1.1 See the image on the right.

- 1.2 90π cubic units

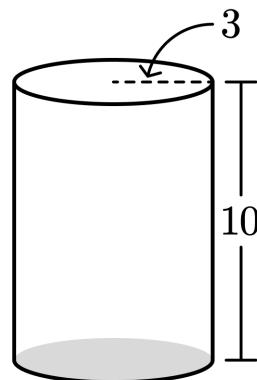
- 2.1 2.5 inches

- 2.2 Base of container A. The area of the container A's base is 24 square inches. The area of the container B's base is about 19.6 square inches because $\pi(2.5)^2 \approx 19.63$.

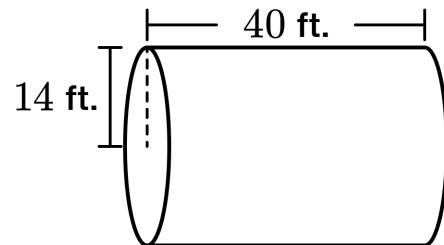
- 2.3 Container A. The two containers have the same height, but container A's base area is larger, therefore the volume is larger.

3.

Radius (cm)	Volume (cubic cm)
1	$8\pi \approx 25.12 \text{ cm}^3$
2	$32\pi \approx 100.48 \text{ cm}^3$
3	$72\pi \approx 226.08 \text{ cm}^3$



4. The tank can hold about 6154 cubic feet. (Using 3.14 as an approximation of π gives a volume of 6154.4 cubic feet.)



- 5.1 Line j

- 5.2 Riku. The y -intercept of Riku's time is less than the y -intercept of DeShawn's line, indicating that before they started practicing, Riku's time was shorter than DeShawn's.

- 1.1 A cylinder has a radius of 3 centimeters and a height of 5 centimeters.

What is the volume of the cylinder? Express your answer in terms of π .

- 1.2 What is the volume of the cylinder from problem 1.1 with three times the height?

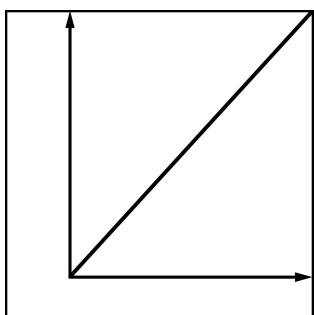
Express your answer in terms of π .

- 1.3 What is the volume of the cylinder from problem 1.1 with three times the radius?

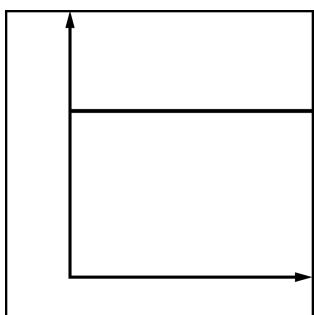
Express your answer in terms of π .

2. Which graph could represent the volume of water in a cylinder as a function of its height?

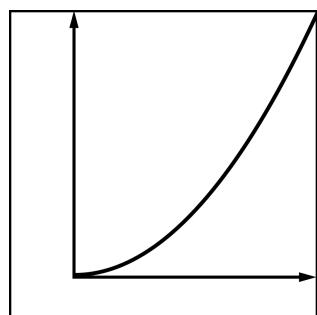
A.



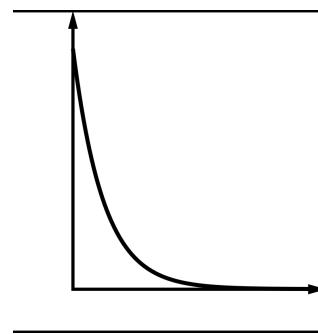
B.



C.



D.



Explain your choice.

Unit 8.5, Lesson 12: Practice Problems

This function represents the relationship between the radius and volume of cylinders with a height of 4 feet.

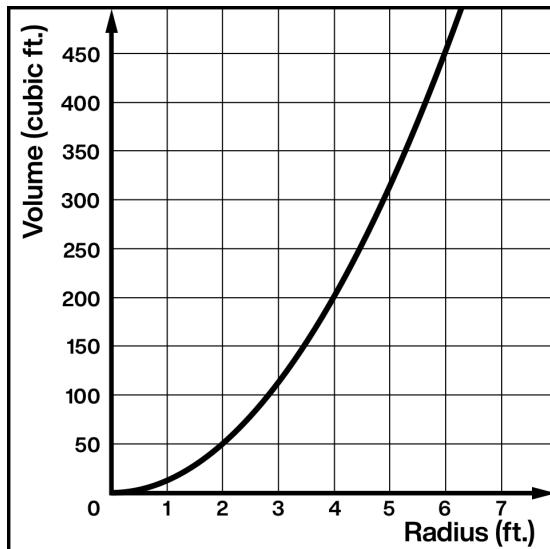
- 3.1 Based on the graph, what is the volume of a cylinder with a radius of 2 feet?

- 3.2 Why is this relationship between radius and volume nonlinear?

4. A cylinder has a volume of $48\pi \text{ cm}^3$ and height h .

Complete this table for volume of cylinders with the same radius but different heights.

Express your answer in terms of π .

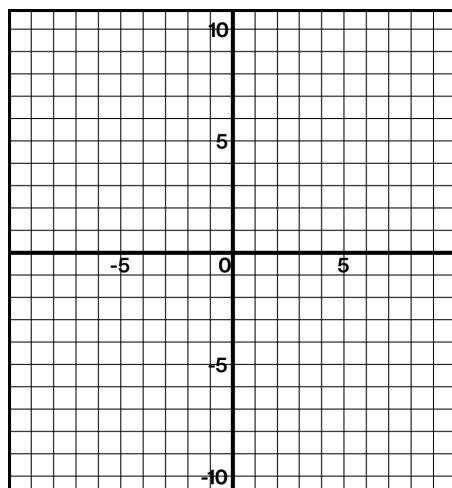


Height (cm)	Volume (cubic cm)
h	48π
$2h$	
$5h$	
$\frac{h}{2}$	
$\frac{h}{5}$	

5. Select **all** the points that are on a line with a slope of 2 that also contains the point $(2, -1)$.

Use the graph if it helps you with your thinking.

- (3, 1)
- (1, 1)
- (1, -3)
- (4, 0)
- (6, 7)



- 1.1 45π cubic centimeters
- 1.2 135π cubic centimeters
- 1.3 405π cubic centimeters
2. Graph A. As the height of water in a cylinder increases, the volume increases by the same scale factor.
- 3.1 16π (about 50) cubic feet
- 3.2 Responses vary. The volume of a cylinder is calculated by finding the area of the base multiplied by the height. It increases in a nonlinear manner because the radius is squared to calculate the area of the base.

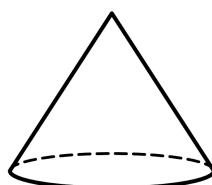
4.

Height (cm)	Volume (cubic cm)
h	48π
$2h$	96π
$5h$	240π
$\frac{h}{2}$	24π
$\frac{h}{5}$	$\frac{48}{5}\pi$

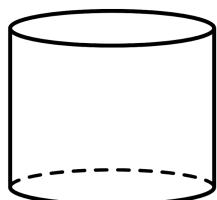
5. (From IM 8.3.10, From Desmos 8.3.10)
- (3, 1)
 - (1, -3)
 - (6, 7)

- 1.1 The volume of this cone is 36π cubic units.

What is the volume of a cylinder with the same radius and the same height? Express your answer in terms of π .



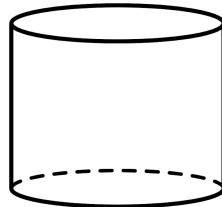
$$V = 36\pi$$



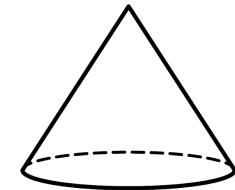
$$V = ?$$

- 1.2 The volume of this cylinder is 175π cubic units.

What is the volume of a cone with the same radius and the same height? Express your answer in terms of π .



$$V = 175\pi$$



$$V = ?$$

2. A cylinder and a cone have the same height and radius. The height of each is 5 centimeters, and the radius is 2 centimeters.

Calculate the volume of the cylinder **and** the cone (rounded to the nearest tenth). Use 3.14 as an approximation for π .

Cylinder volume: _____

Cone volume: _____

Unit 8.5, Lesson 13: Practice Problems

There are many cones with a height of 18 meters.

- 3.1 Fill out the table with the volume of each cone.
Express your answer in terms of π .

- 3.2 Based on your table, if the radius of a cone doubles, does the volume also double?

Explain your thinking.

Radius (m)	Volume (cu. m)
1	
2	
3	
4	

- 3.3 Based on your table, is the relationship between the radius of a cone and its volume linear?
Explain your thinking.

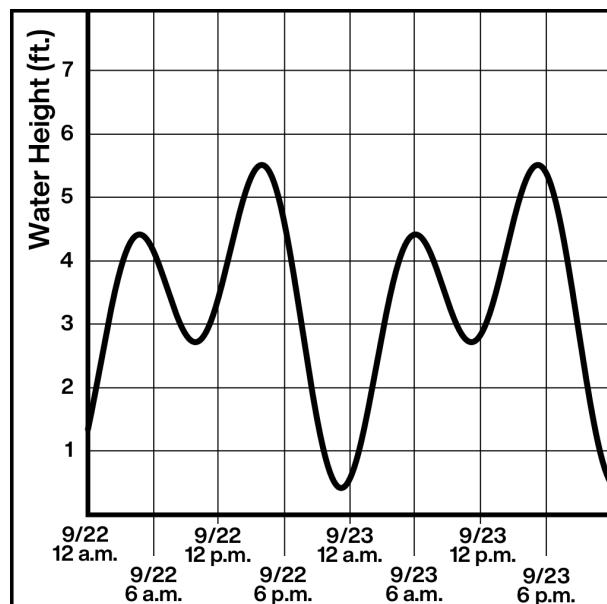
This graph shows the height of the ocean water in Bodega Bay, CA, between September 22 and September 24, 2016.

- 4.1 Estimate the water height at 12 p.m. on September 22.
- 4.2 How many times was the water height 5 feet?

Write two times when the water was 5 feet high.

- 4.3 Is water height a function of time?

Explain your thinking.



- 1.1 108π cubic units. (The volume of the cylinder is exactly three times the volume of the corresponding cone.)
- 1.2 $\frac{175}{3}\pi$ cubic units. The volume of the cone is exactly one-third the volume of the corresponding cylinder.)
2. Cylinder: 62.8 cm^3
Cone: 20.9 cm^3

3.1

Radius (m)	Volume (cu. m)
1	6π
2	24π
3	54π
4	96π

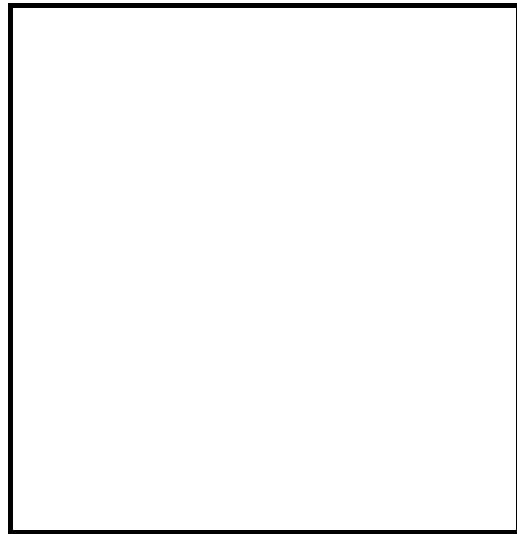
- 3.2 No. Responses vary. The volume does not double; it is multiplied by four.
- 3.3 No. Responses vary. It is not a line. The four points in the table do not lie on a straight line.
- 4.1 (From IM 8.5.5, Desmos 8.5.05)
About 3.5 feet
- 4.2 (From IM 8.5.5, Desmos 8.5.05)
4 times. Approximately 2 p.m. and 5 p.m. on September 22 and 3 p.m. and 7 p.m. on September 23.
- 4.3 (From IM 8.5.5, Desmos 8.5.03)
Yes. For each value of time, there is exactly one corresponding value for water height.

1. Complete the table with all of the missing information for three different cylinders.

Diameter (units)	Radius (units)	Base Area (square units)	Height (units)	Cylinder Volume (cubic units)
4			10	
6				63π
		25π	6	

2. Sketch a cylinder with a diameter of 6 centimeters and a volume of 36π cubic centimeters.

Then find its radius and height. Label your sketch with the cylinder's radius and height.



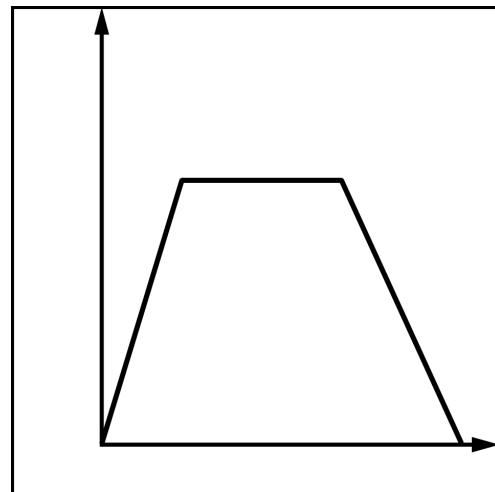
3. A cylinder has a diameter of 14 centimeters and a volume of 1000 cubic centimeters.

What is the height of this cylinder? Express your answer to the nearest tenth of a centimeter.

Unit 8.5, Lesson 14: Practice Problems

4. Here is a graph. The horizontal axis represents time and the vertical axis represents distance from school.

Write a possible story for the graph.



5. Fill in the missing information in the table below. The cylinder and cone in each row have the same dimensions.

Diameter (units)	Radius (units)	Base Area (square units)	Height (units)	Cylinder Volume (cubic units)	Cone Volume (cubic units)
	5		7		
6					40π
		36π			48π

6. An ice cream shop offers two types of ice cream cones.

The waffle cone holds 12 ounces and is 5 inches tall.

The sugar cone holds 12 ounces and is 8 inches tall.

Which cone has a larger radius?

Explain your thinking.

1.

Diameter (units)	Radius (units)	Base Area (square units)	Height (units)	Cylinder Volume (cubic units)
4	2	4π	10	40π
6	3	9π	7	63π
10	5	25π	6	150π

2. The radius of the cylinder is 3 centimeters because it is half the measure of the diameter.

The height of the cylinder is 4 centimeters because $\frac{36\pi}{\pi(3)^2} = 4$.

3. Approximately 6.5 centimeters

4. (From IM 8.5.6, Desmos 8.5.06)

Responses vary. An athlete leaves school to go home. She stays at home for a while, then returns to school for a game later in the evening.

5.

Diameter (units)	Radius (units)	Base Area (square units)	Height (units)	Cylinder Volume (cubic units)	Cone Volume (cubic units)
10	5	25π	7	175π	$\frac{175}{3}\pi$
6	3	9π	$\frac{40}{3}$	120π	40π
12	6	36π	4	144π	48π

6. Waffle cone. Since its height is smaller, the radius must be larger in order to have the same volume as the sugar cone.

1. Write the letter of the sphere described next to the volume of that sphere.

- Sphere A : Radius of 4 cm
- Sphere B : Diameter of 6 cm
- Sphere C : Radius of 6 cm

Volume: $288\pi \text{ cm}^3$ Sphere: _____

Volume: $36\pi \text{ cm}^3$ Sphere: _____

Volume: $\frac{256}{3}\pi \text{ cm}^3$ Sphere: _____

- 2.1 Calculate the volume of a **sphere** with a diameter of 6 inches.

Give your answer both in terms of π and by using 3.14 to approximate π .

In terms of π : _____

Using 3.14 as an approximation: _____

- 2.2 Calculate the volume of a **cylinder** with a height of 6 inches and a diameter of 6 inches.

Give your answer both in terms of π and by using 3.14 to approximate π .

In terms of π : _____

Using 3.14 as an approximation: _____

- 2.3 Calculate the volume of a **cone** with a height of 6 inches and a diameter of 6 inches.

Give your answer both in terms of π and by using 3.14 to approximate π .

In terms of π : _____

Using 3.14 as an approximation: _____

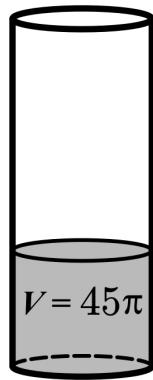
- 2.4 On the previous three problems, you found the volumes of three shapes with the same height and diameter. How are these three volumes related?

Unit 8.5, Lesson 15: Practice Problems

- 3.1 A cylinder has a volume of 45π cubic units and a radius of 3 units. What is its height?

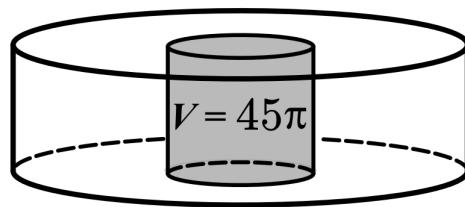
- 3.2 What is the volume of the cylinder when its height is tripled?

Express your answer in terms of π .



- 3.3 What is the volume of the cylinder when its radius is tripled?

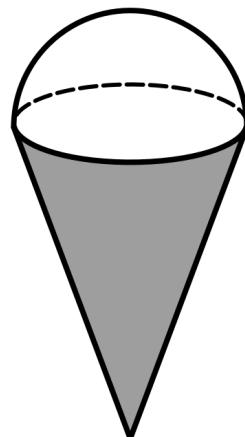
Express your answer in terms of π .



4. A giant scoop of ice cream has a 3-centimeter radius and is served in a cone of the same radius.

The scoop of ice cream is a sphere.

How tall does the cone need to be in order to contain all of the ice cream if it completely melts?



1.

$$\text{Volume: } 288\pi \text{ cm}^3$$

 $\text{Sphere: } C$

$$\text{Volume: } 36\pi \text{ cm}^3$$

 $\text{Sphere: } B$

$$\text{Volume: } \frac{256}{3}\pi \text{ cm}^3$$

 $\text{Sphere: } A$ 2.1 36π cubic inches

113.04 cubic inches

2.2 54π cubic inches

169.56 cubic inches

2.3 18π cubic inches

56.52 cubic inches

2.4 *Responses vary.* The volume of the cone plus the volume of the sphere equals the volume of the cylinder.

3.1 5 units

3.2 135π cubic centimeters3.3 405π cubic centimeters

4. 12 centimeters

Warm-Up

Write each decimal or percentage as a fraction.

$$0.25 =$$

$$40\% =$$

$$1\% =$$

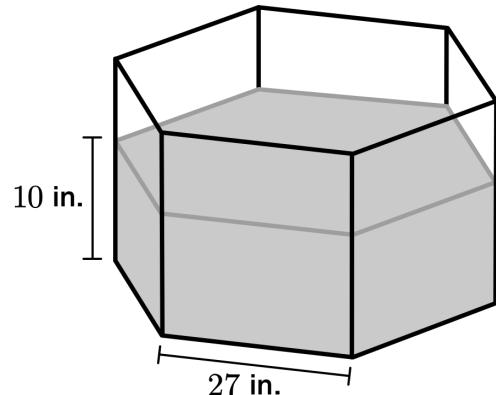
$$0.8 =$$

Practice

Polina is designing a new sandbox for her local playground.

- 1.1 Polina knows she needs 1,894 cubic inches of sand to fill the sandbox up 10 inches.

What is the area of the sandbox's base?



- 1.2 If Polina wanted to fill the sandbox up 3 more inches to the top, how much more sand would she need?

- 1.3 How many pieces of wood does Polina need to construct the sandbox? Describe or draw the shape of each piece of wood. Assume all the walls are the same shape and size, and the sandbox has no cover.

- 1.4 Polina wants to paint the sandbox blue. Determine which sides she should paint and how many square inches of paint she will need for those sides.

Unit 7.7, Lesson 13: Practice Problems

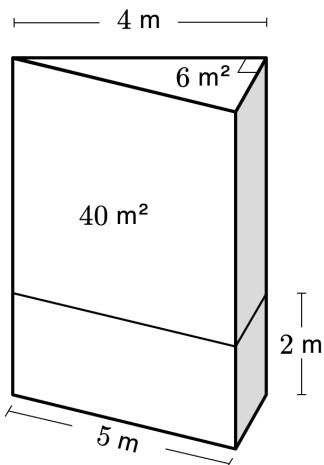
- 2.1 Dalia buys a winter jacket at a used clothing store that costs \$30. She lives in Idaho, where the sales tax is 6%. How much does Dalia pay in total?
- 2.2 Write an equation that represents the total cost, c , of any item bought in Idaho whose price is p if you include sales tax.
- 2.3 Dalia buys a backpack at a different store in Idaho. It is on sale for 30% off. Dalia pays \$33.39 total (including sales tax). What was the original price of the backpack?

Explore

Determine the surface area and volume of the shape below.

Surface area:

Volume:

**Reflect**

1. Circle the question you think will help you most on the end of unit assessment.
2. Use the space below to ask one question you have or to share something you are proud of.

Warm-Up

$$\frac{1}{4}, \frac{2}{5}, \frac{1}{100}, \frac{4}{5}$$

Practice

1.1 189.4 square inches

1.2 568.2 cubic inches

1.3 7 pieces of wood

Explanations vary. Assuming she can get the wood cut to size, she would need 6 rectangular pieces for each side of the sandbox and 1 hexagonal piece for the bottom base.

1.4 *Responses vary.* 2106 square inches

Explanations vary. Assuming she wants to only paint the outside parts of the sandbox, she will need $13 \cdot 27 = 351$ square inches for each side, or $351 \cdot 6 = 2106$ square inches in total. If she also wanted to paint the bottom, she would need to add the area of the hexagon, so $2106 + 189.4 = 2295.4$ square inches.

2.1 \$31.80

2.2 $c = 1.06p$

2.3 \$45

Explore

Surface area: 132 square meters

Volume: 60 cubic meters

**Unit 8.7, Lesson 1: Practice Problems**

Name _____

1. Write each expression using an exponent.

Expression	Expression With Exponent
$3 \cdot 3 \cdot 3 \cdot 3$	3^4
$7 \cdot 7 \cdot 7 \cdot 7 \cdot 7$	
$\left(\frac{4}{5}\right) \cdot \left(\frac{4}{5}\right) \cdot \left(\frac{4}{5}\right) \cdot \left(\frac{4}{5}\right) \cdot \left(\frac{4}{5}\right)$	
$9.3 \cdot 9.3 \cdot 9.3 \cdot 9.3 \cdot 9.3 \cdot 9.3 \cdot 9.3 \cdot 9.3$	

2. Evaluate each expression.

Expression	Value
2^5	
3^3	
4^3	
6^2	
$\left(\frac{1}{2}\right)^4$	
$\left(\frac{1}{3}\right)^2$	

3. Write an expression using an exponent to represent the following:

Adnan starts with two coins on Day 1. The number of coins doubles every day.

How many coins will he have on Day 8?

Unit 8.7, Lesson 1: Practice Problems

4. The equation $y = 5280x$ gives the number of feet, y , in x miles.

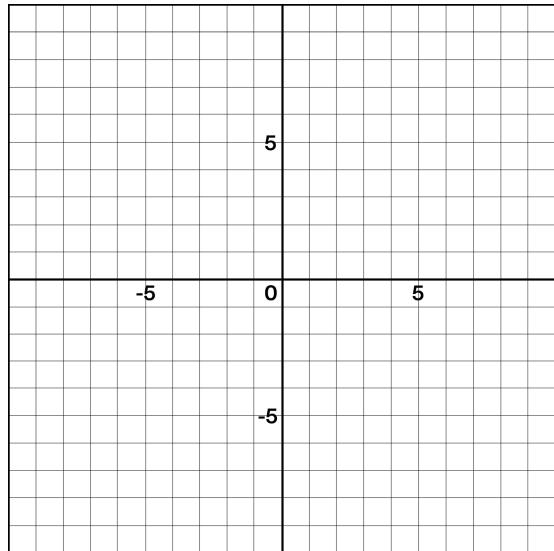
What does the number 5280 represent in this relationship?

5. The points $(2, 4)$ and $(6, 7)$ lie on a line.

What is the slope of the line?

Use the coordinate plane if it helps you with your thinking.

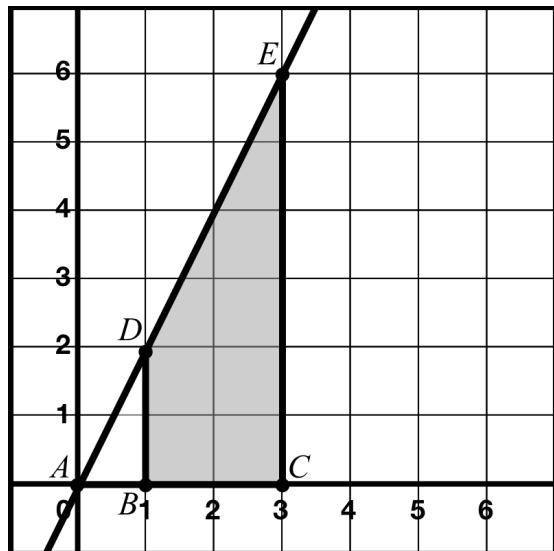
- A. 2
- B. 1
- C. $\frac{4}{3}$
- D. $\frac{3}{4}$



6. The diagram shows a pair of similar figures.

What do the center and the scale factor need to be in order to transform triangle ACE to triangle ABD ?

Center	Scale Factor



1.

Expression	Expression With Exponent
$3 \cdot 3 \cdot 3 \cdot 3$	3^4
$7 \cdot 7 \cdot 7 \cdot 7 \cdot 7$	7^5
$\left(\frac{4}{5}\right) \cdot \left(\frac{4}{5}\right) \cdot \left(\frac{4}{5}\right) \cdot \left(\frac{4}{5}\right) \cdot \left(\frac{4}{5}\right)$	$\left(\frac{4}{5}\right)^5$
$9.3 \cdot 9.3 \cdot 9.3 \cdot 9.3 \cdot 9.3 \cdot 9.3 \cdot 9.3 \cdot 9.3$	9.3^8

2.

Expression	Value
2^5	32
3^3	27
4^3	64
6^2	36
$\left(\frac{1}{2}\right)^4$	$\frac{1}{16}$
$\left(\frac{1}{3}\right)^2$	$\frac{1}{9}$

3. 2^8

4. There are 5 280 feet in every mile. For example, each additional mile that someone travels is equivalent to traveling an additional 5 280 feet.

 $\frac{3}{4}$

6.

Center	Scale Factor
A	$\frac{1}{3}$

1. Rewrite each expression as a single power.

Expression	Single Power
$6^3 \cdot 6^9$	
$2 \cdot 2^4$	
$3^{10} \cdot 3^7$	
$5^3 \cdot 5^3$	
$12^5 \cdot 12^{12}$	
$7^6 \cdot 7^6 \cdot 7^6$	

2. Write each expression as a single power.

Expression	Single Power
$(3^7)^2$	
$(2^9)^3$	
$(7^6)^3$	
$(11^2)^3$	
$(5^3)^2$	
$(6^5)^7$	

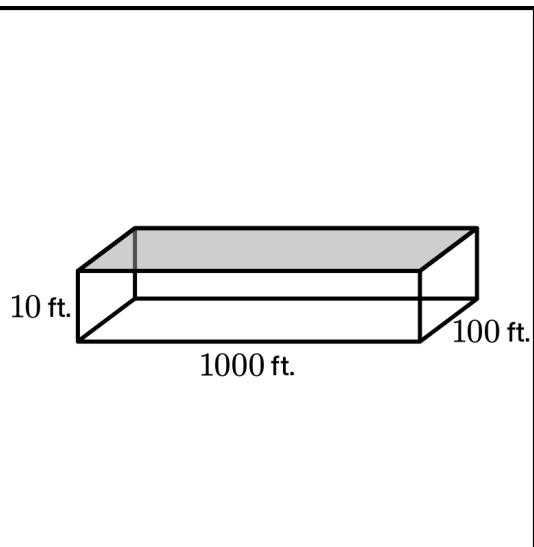
Unit 8.7, Lesson 2: Practice Problems

3. A large rectangular swimming pool is 1 000 feet long, 100 feet wide, and 10 feet deep.

The pool is filled to the top with water.

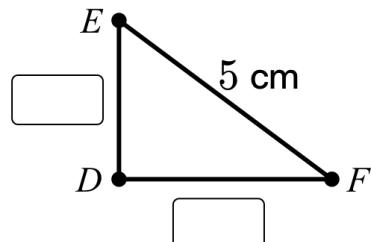
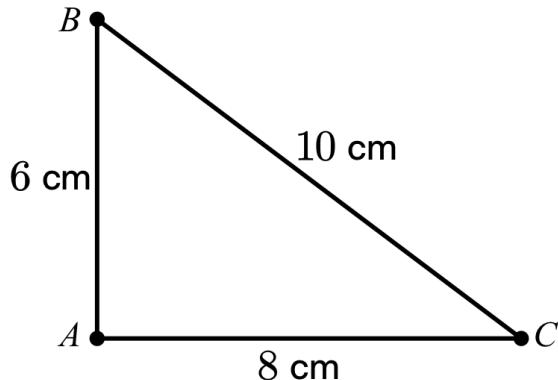
- 3.1 What is the area of the surface of the water in the pool?

- 3.2 How much water does the pool hold?



- 3.3 Express your answers to the previous two questions as a single power.

4. Triangle DEF is similar to triangle ABC . Label the side lengths DE and DF .



1.

Expression	Single Power
$6^3 \cdot 6^9$	6^{12}
$2 \cdot 2^4$	2^5
$3^{10} \cdot 3^7$	3^{17}
$5^3 \cdot 5^3$	5^6
$12^5 \cdot 12^{12}$	12^{17}
$7^6 \cdot 7^6 \cdot 7^6$	7^{18}

2.

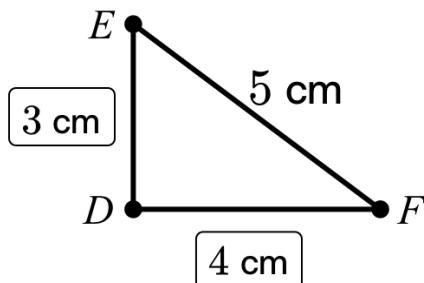
Expression	Single Power
$(3^7)^2$	3^{14}
$(2^9)^3$	2^{27}
$(7^6)^3$	7^{18}
$(11^2)^3$	11^6
$(5^3)^2$	5^6
$(6^5)^7$	6^{35}

3.1 100 000 square feet

3.2 1 000 000 cubic feet

3.3 100 000 square feet = 10^5 square feet
1 000 000 cubic feet = 10^6 cubic feet

4.



1. Rewrite each expression as a single power.

Expression	Single Power
$3^7 \cdot 3^2$	
$(3^7)^2$	
$5^3 \cdot 5^2$	
$(5^3)^2$	
$(5^2)^3$	

2. There is an amoeba (a single-celled animal) on a dish. After one hour, the amoeba divides to form two amoebas. One hour later, each amoeba divides to form two more. Every hour, each amoeba divides to form two more.

2.1 How many amoebas are there after 2 hours?

2.2 Write an expression for the number of amoebas after 6 hours.

2.3 Write an expression for the number of amoebas after 24 hours.

2.4 Why might exponential notation, like 2^6 , be useful for answering these questions?



Unit 8.7, Lesson 3: Practice Problems

3. Nine years ago, Katie was twice as old as Elena was then.

Elena realizes, "In four years, I'll be as old as Katie is now!"

Elena writes these equations to help her make sense of the situation:

$$\begin{aligned}k - 9 &= 2(e - 9) \\ e + 4 &= k\end{aligned}$$

If Elena is currently e years old and Katie is k years old, how old is Katie now?

1.

Expression	Single Power
$3^7 \cdot 3^2$	3^9
$(3^7)^2$	3^{14}
$5^3 \cdot 5^2$	5^5
$(5^3)^2$	5^6
$(5^2)^3$	5^6

2.1 (From IM 8.7.1, Desmos 8.7.01)

4 amoebas

2.2 2^6 (or 64) amoebas2.3 2^{24} (or 16 777 216) amoebas2.4 Writing exponential notation is simpler than writing very large or very small numbers, and the expression 2^{24} visibly includes the information that the amoebas have divided 24 times.

3. (From IM 8.4.15, Desmos 8.4.11)

17 years old

1. Rewrite each expression as a single power.

Expression	Single Power
$\frac{5^6}{5^3}$	
$(14^3)^6$	
$8^3 \cdot 8^6$	
$\frac{16^6}{2^6}$	
$\frac{21^3 \cdot 21^5}{21^2}$	

2. Rewrite each expression as a single power.

Expression	Single Power
$4^4 \cdot 5^4$	
$6 \cdot 6^8$	
$(12^2)^7 \cdot 12$	
$\frac{3^{10}}{3}$	
$(0.173)^9 \cdot (0.173)^2$	
$\frac{0.87^5}{0.87^3}$	



Unit 8.7, Lesson 4: Practice Problems

3. Find x , y , and z if the following is true:

$$(3 \cdot 5)^4 \cdot (2 \cdot 3)^5 \cdot (2 \cdot 5)^7 = 2^x \cdot 3^y \cdot 5^z$$

Record your answers in the table.

Variable	Value
x	
y	
z	

4. Bananas cost \$1.50 per pound, and guavas cost \$3.00 per pound.
Kiran spends \$12 on fruit for a breakfast his family is hosting.
He buys b pounds of bananas and g pounds of guavas.

- 4.1 Write an equation relating the two variables.

- 4.2 If he buys 4 pounds of bananas, how many pounds of guavas can he buy?

- 4.3 If Kiran buys b pounds of bananas and is interested in how many pounds of guavas he can buy, what is the independent variable?

- A. Number of pounds of bananas
- B. Number of pounds of guavas
- C. Total cost of fruit

Explain your thinking.

1.

Expression	Single Power
$\frac{5^6}{5^3}$	5^3
$(14^3)^6$	14^{18}
$8^3 \cdot 8^6$	8^9
$\frac{16^6}{2^6}$	8^6
$\frac{21^3 \cdot 21^5}{21^2}$	21^6

2.

Expression	Single Power
$4^4 \cdot 5^4$	20^4
$6 \cdot 6^8$	6^9
$(12^2)^7 \cdot 12$	12^{15}
$\frac{3^{10}}{3}$	3^9
$(0.173)^9 \cdot (0.173)$	0.173^{11}
$\frac{0.87^5}{0.87^3}$	0.87^2

3.

Variable	Value
x	12
y	9
z	11

4.1 (From IM 8.5.3, Desmos 8.5.03)

$$1.5b + 3g = 12$$

4.2 2 pounds of guavas

4.3 Number of pounds of bananas.

Responses vary. The number of pounds of bananas is most similar to the input of the function.

1. Priya says, "I can figure out 5^0 by looking at other powers of 5. If 5^3 is 125 and 5^2 is 25, then 5^1 is 5."

1.1 What pattern do you notice?

1.2 If this pattern continues, what should be the value of 5^0 ? Explain your thinking.

2. Select all the expressions that are equivalent to 4^{-3} .

-12

2^{-6}

$\frac{1}{4^3}$

$\left(\frac{1}{4}\right) \cdot \left(\frac{1}{4}\right) \cdot \left(\frac{1}{4}\right)$

12

$\frac{8^{-1}}{2^2}$

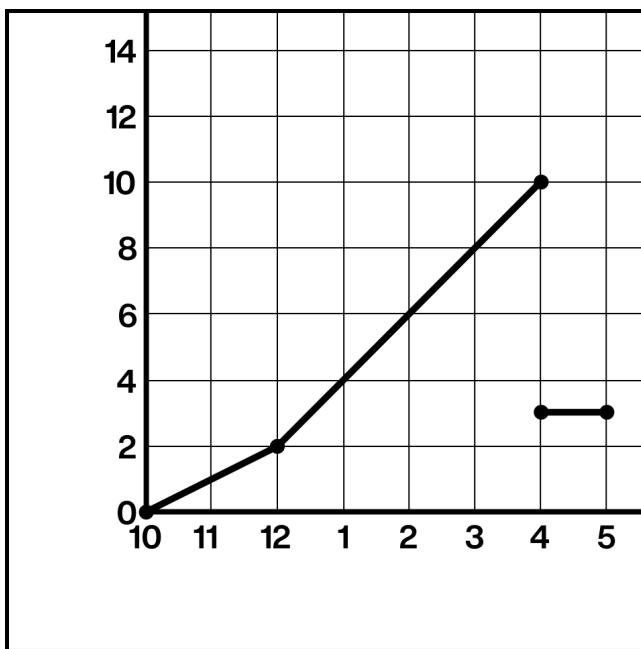
Unit 8.7, Lesson 5: Practice Problems

3. Andre sets up a rain gauge to measure rainfall in his backyard. It rains off and on all day Tuesday.

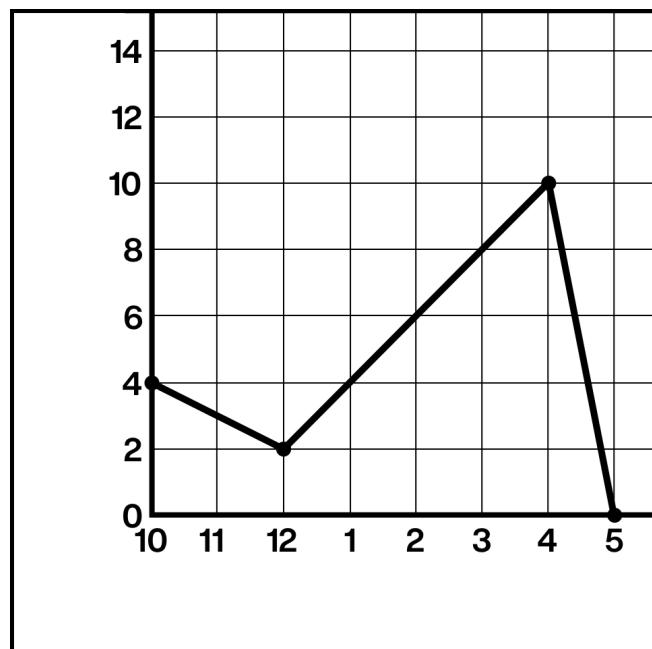
- At 10 a.m., the gauge is empty.
- Two hours later, the gauge has 2 centimeters of water in it.
- At 4 p.m., he finds the gauge has 10 centimeters of water in it.
- He accidentally knocks the gauge over and spills most of the water, leaving only 3 centimeters of water.
- At 5 p.m., there is no change in the water level.

- 3.1 Which of the two graphs could represent Andre's story?

A.



B.



Explain your thinking.

- 3.2 Label the axes on the graph you selected in 3.1. Include appropriate units in parentheses.

- 3.3 Use the graph to determine how much rain fell on Tuesday.

1.1 *Responses vary.* When the power of 5 drops by one, the value is divided by 5.

1.2 1

Responses vary. The value of 5^0 should be the value of 5^1 divided by 5.

2. ✓ 2^{-6}

✓ $\frac{1}{4^3}$

✓ $\left(\frac{1}{4}\right) \cdot \left(\frac{1}{4}\right) \cdot \left(\frac{1}{4}\right)$

3.1 (From IM 8.5.6, Desmos 8.5.06)

A.

Responses vary. The left graph shows that the gauge begins at 0 centimeters, whereas the right graph begins at 4 centimeters. Also, when Andre knocks the gauge over, the left graph shows the 3 centimeters remaining in the gauge, while the graph on the right indicates that all of the water is gone.

3.2 **Horizontal axis:** Time of day (hour)

Vertical axis: Height of water in rain gauge (centimeter)

3.3 10 centimeters

1. Evaluate each expression.

Expression	Value
5^0	
$\frac{6^3}{6^3}$	
$2^2 + 2^1 + 2^0$	

2. Rewrite each expression as a single power.

Expression	Single Power
$\frac{5^3 \cdot 5^4}{5^5}$	
$\left(\frac{3^5}{3^3}\right)^4$	
$\frac{2^4 \cdot 2^5 \cdot 2^6}{2^3 \cdot 2^7}$	

Expression	Single Power
$(7^4) \cdot \frac{7^{12}}{7^7}$	
$\frac{(10^5)^2}{(10^2)^3}$	

3. Write each expression as a single power with a negative exponent.
One is already written as an example.

Expression	Single Power With Negative Exponent
$\frac{1}{6} \cdot \frac{1}{6}$	6^{-2}
$\frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2}$	
$\frac{1}{5^7}$	

Expression	Single Power With Negative Exponent
$(\frac{1}{3} \cdot \frac{1}{3} \cdot \frac{1}{3} \cdot \frac{1}{3})^2$	
$\left(\frac{1}{10^3}\right)^3$	

Unit 8.7, Lesson 6: Practice Problems

4. Fill in the blank next to each scenario with the letter of its equation.

A dump truck is hauling loads of dirt to a construction site.

After 20 loads, there are 70 cubic feet: _____

A. $\frac{1}{2}x = y$

I am making a water-and-salt mixture that has 2 cups of salt for every 6 cups of water: _____

B. $y = \frac{5}{2}x$

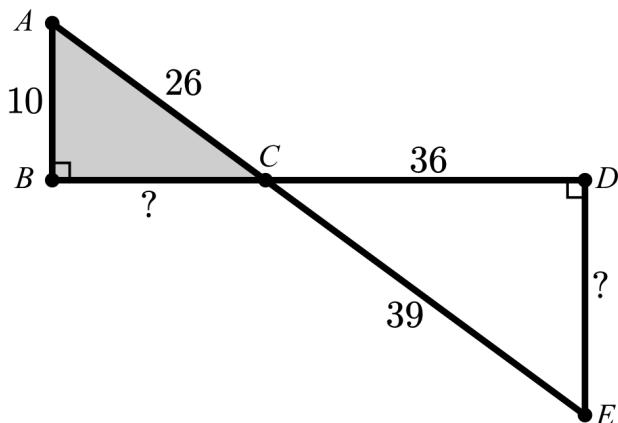
For every 48 cookies I bake, my students get 24: _____

C. $y = 3x$

A store has a “4 for \$10” sale on hats: _____

D. $y = 3.5x$

Here are two right triangles.



- 5.1 Explain why triangle ABC is similar to EDC .

- 5.2 Find the missing side lengths.

BC	DE

1.

Expression	Value
5^0	1
$\frac{6^3}{6^3}$	1
$2^2 + 2^1 + 2^0$	7

2.

Expression	Single Power
$\frac{5^3 \cdot 5^4}{5^5}$	5^2
$\left(\frac{3^5}{3^3}\right)^4$	3^8
$\frac{2^4 \cdot 2^5 \cdot 2^6}{2^3 \cdot 2^7}$	2^5
$(7^4) \cdot \frac{7^{12}}{7^7}$	7^9
$\frac{(10^5)^2}{(10^2)^3}$	10^4

3.

Expression	Single Power With Negative Exponent
$\frac{1}{6} \cdot \frac{1}{6}$	6^{-2}
$\frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2}$	2^{-3}
$\frac{1}{5^7}$	5^{-7}
$\left(\frac{1}{3} \cdot \frac{1}{3} \cdot \frac{1}{3} \cdot \frac{1}{3}\right)^2$	3^{-8}
$\left(\frac{1}{10^3}\right)^3$	10^{-9}

4.

- A dump truck is hauling loads of dirt to a construction site. After 20 loads, there are 70 square feet: **D**
- I am making a water-and-salt mixture that has 2 cups of salt for every 6 cups of water: **C**
- For every 48 cookies I bake, my students get 24: **A**
- A store has a “4 for \$10” sale on hats: **B**

5.1 *Responses vary.* Both triangles contain a right angle, and angles ACB and ECD are vertical angles. The triangles are similar because two pairs of corresponding angles are congruent.

5.2

BC	DE
24	15

1. Fill in the blank next to each number with the letter of its name.

0.000001 : _____

A. One billion

0.001 : _____

B. One thousandth

0.01 : _____

C. One million

1 000 000 : _____

D. One hundredth

1 000 000 000 : _____

E. One millionth

2. Write each expression as a multiple of a power of 10.

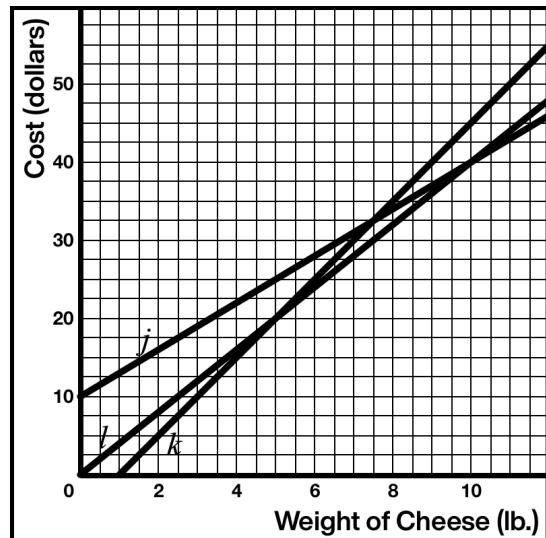
Expression	As a Multiple of a Power of 10
42 300	
2 000	
9 200 000	
Four thousand	
80 million	
32 billion	

3. Find three different ways to write the number 437,000 as a multiple of a power of 10.

Value	As a Multiple of a Power of 10
437 000	
437 000	
437 000	

Unit 8.7, Lesson 7: Practice Problems

4. A fancy cheese is not prepackaged, so a customer can buy any amount of it. The cost of this cheese at three stores is a function of the weight of the cheese.
- Store A sells the cheese for a dollars per pound.
 - Store B sells the same cheese for b dollars per pound, with a coupon for \$5 off their total purchase at the store.
 - Store C is an online store. They sell the same cheese for c dollars per pound, with a \$10 delivery fee.



This graph shows the price functions for each store.

- 4.1 Fill in the blank next to each store with the letter of the line that represents it.

Store A: _____

J. Line j

Store B: _____

K. Line k

Store C: _____

L. Line l

- 4.2 Which store has the lowest price for half a pound of cheese?

- A. Store A
- B. Store B
- C. Store C

- 4.3 If a customer wants to buy 6 pounds of cheese for a party, which store has the lowest price?

- A. Store A
- B. Store B
- C. Store C

- 4.4 How many pounds would a customer need to order to make Store C a good option? Explain your thinking.

1. 0.000001 : **E**
 0.001 : **B**
 0.01 : **D**
 $1,000,000$: **C**
 $1,000,000,000$: **A**

2. Responses vary.

Expression	As a Multiple of a Power of 10
42 300	$423 \cdot 10^2$
2 000	$2 \cdot 10^3$
9 200 000	$92 \cdot 10^5$
Four thousand	$4 \cdot 10^3$
80 million	$8 \cdot 10^7$
32 billion	$32 \cdot 10^9$

3. Responses vary.

Value	As a Multiple of a Power of 10
437 000	$4.37 \cdot 10^5$
437 000	$43.7 \cdot 10^4$
437 000	$437 \cdot 10^3$

- 4.1 (From IM 8.5.8, Desmos 8.5.5)
 - Store A: **L**
 - Store B: **K**
 - Store C: **J**

- 4.2 B. Store B

- 4.3 A. Store A

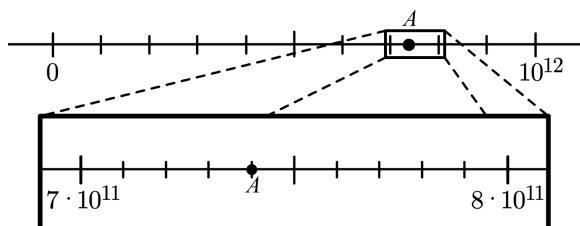
- 4.4 Responses vary. 11 pounds. Store C is the cheapest for every number of pounds after 10 .

1. Find three different ways to write the number 5 230 000 as a multiple of a power of 10.

Value	As a Multiple of a Power of 10
5 230 000	
5 230 000	
5 230 000	

2. What number is represented by point A?

Explain your thinking.



3. Rewrite each expression as a single power of 10.

Expression	Single Power of 10
$10^{-3} \cdot 10^{-2}$	
$10^4 \cdot 10^{-1}$	
$\frac{10^5}{10^7}$	
$(10^{-4})^5$	
$10^{-3} \cdot 10^2$	
$\frac{10^{-9}}{10^5}$	



Unit 8.7, Lesson 8: Practice Problems

4. Select each expression that is equivalent to $\frac{1}{10\,000}$.

$(10\,000)^{-1}$

$(-10\,000)$

$(100)^{-2}$

$(10)^{-4}$

$(-10)^4$

5. A fully inflated basketball has a radius of 12 centimeters.

How many cubic centimeters of air does your ball need to fully inflate?

Express your answer in terms of π .

Then estimate your answer using 3.14 to approximate π .

In Terms of π	Using 3.14 as an Estimate

6. Solve each of these equations. Explain or show all of your reasoning.

6.1 $2(3 - 2c) = 30$

6.2 $3x - 2 = 7 - 6x$

6.3 $31 = 5(b - 2)$

1. Responses vary.

Value	As a Multiple of a Power of 10
5 230 000	$5.23 \cdot 10^6$
5 230 000	$52.3 \cdot 10^5$
5 230 000	$523 \cdot 10^4$

2. $7.4 \cdot 10^{11}$

Responses vary. Point A lies between $7 \cdot 10^{11}$ and $8 \cdot 10^{11}$. It is $7.4 \cdot 10^{11}$ because it is four tick marks from $7.0 \cdot 10^{11}$.

- 3.

Expression	Single Power of 10
$10^{-3} \cdot 10^{-2}$	10^{-5}
$10^4 \cdot 10^{-1}$	10^3
$\frac{10^5}{10^7}$	10^{-2}
$(10^{-4})^5$	10^{-20}
$10^{-3} \cdot 10^2$	10^{-1}
$\frac{10^{-9}}{10^5}$	10^{-14}

4. $\checkmark (10\ 000)^{-1}$
 $\checkmark (100)^{-2}$
 $\checkmark (10)^{-4}$

- 5.

In Terms of π	Using 3.14 as an Estimate
$2\ 304\pi$ cubic cm	7 234.56 cubic cm

6.1 $c = -6$

6.2 $x = 1$

6.3 $b = \frac{41}{5}$

1. The Sun is roughly 10^2 times as wide as Earth.

The star KW Sagittarii is roughly 10^5 times as wide as Earth.

About how many times as wide is KW Sagittarii as the Sun? Explain your thinking.

You have 1 000 000 small cubes. Each cube measures 1 inch on a side.

- 2.1 If you stacked all of the cubes on top of one another to make an enormous tower, how high would they reach?

Express your answer in terms of inches, feet and miles.

Note: There are 12 inches in a foot and 5 280 feet in a mile.

Value	Unit
	inches
	feet
	miles

- 2.2 If you arranged all of the cubes on the floor to make a square, what would be the length of each side?
- 2.3 If you arranged all of the cubes on the floor to make a square, would the square fit in your classroom? Explain your thinking.
- 2.4 If you used all of the cubes to make one big cube, what would be the side length of the big cube? Explain your thinking.



Unit 8.7, Lesson 9: Practice Problems

3. Select all the expressions that are equivalent to 6^{-3} .

-18

$\left(\frac{1}{6}\right) \cdot \left(\frac{1}{6}\right) \cdot \left(\frac{1}{6}\right)$

$\frac{6}{6^4}$

$2^{-3} \cdot 3^{-3}$

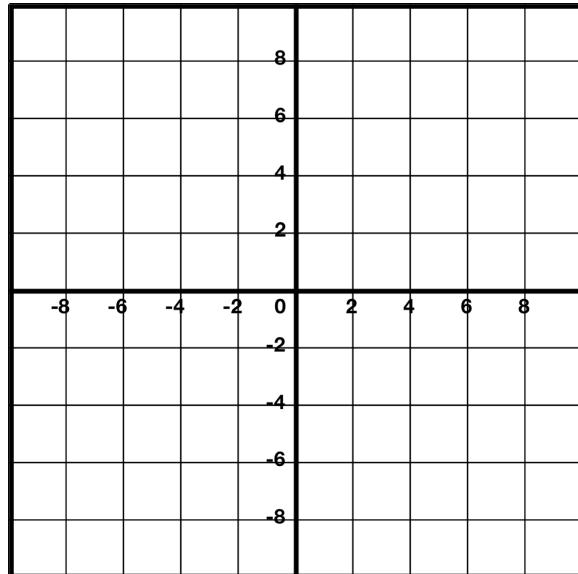
$\frac{1}{6^3}$

$\frac{12^6}{2^9}$

$(-6) \cdot (-6) \cdot (-6)$

4. Draw a line going through $(-6, 1)$ with a slope of $-\frac{2}{3}$.

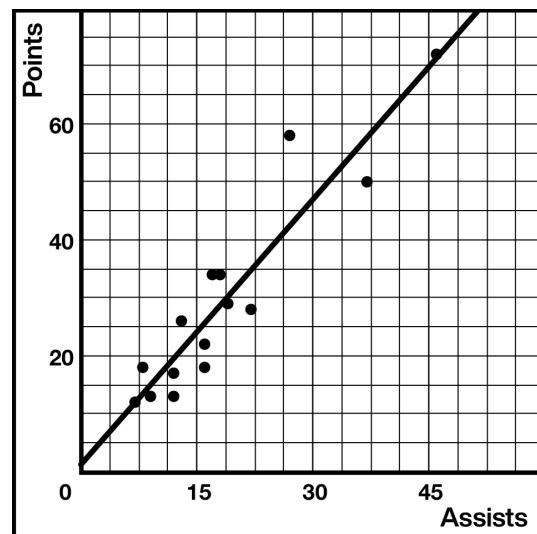
Then write the equation of the line.



5. Here is a scatter plot that shows the number of points and assists by a set of hockey players.

Which of the following describes the association in the scatter plot? Select all that apply.

- Linear association
- Non-linear association
- Positive association
- Negative association
- No association



1. 10^3 (or 1 000) times as wide

Responses vary. This can be determined by calculating $\frac{10^5}{10^2}$ since both the Sun's and KG

Sagittarii's widths can be compared to the width of Earth.

2.1

Value	Unit
1 000 000	inches
83 333. $\bar{3}$	feet
15. 782	miles

- 2.2 1 000 inches

Responses vary. The cube would be 1,000 inches on a side because $1\ 000 \cdot 1\ 000 = 1\ 000\ 000$. 1 000 inches is about 83 feet, so this probably would not fit in a classroom.

- 2.3 100 inches

Responses vary. The cube would be 100 inches on a side because $100 \cdot 100 \cdot 100 = 1\ 000\ 000$.

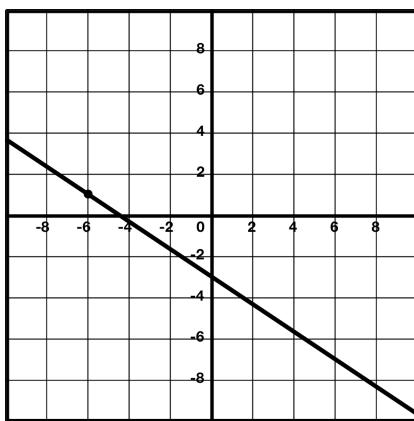
Unit 8.7, Lesson 9: Practice Problems

3. $\checkmark \frac{6}{6^4}$

$\checkmark \frac{1}{6^3}$

4. (From IM 8.3.10, Desmos 8.3.08)

$y = -\frac{2}{3}(x + 6) + 1$



$\checkmark \left(\frac{1}{6}\right) \cdot \left(\frac{1}{6}\right) \cdot \left(\frac{1}{6}\right)$

$\checkmark 2^{-3} \cdot 3^{-3}$

5. (From IM 8.6.7, Desmos 8.6.07)

 Linear Association Positive Association

**Unit 8.7, Lesson 10: Practice Problems**

Name _____

1. Which expressions are equivalent to $4 \cdot 10^{-3}$?

- $4 \cdot \left(\frac{1}{10}\right) \cdot \left(\frac{1}{10}\right) \cdot \left(\frac{1}{10}\right)$ $4 \cdot 0.0001$
 $4 \cdot (-10) \cdot (-10) \cdot (-10)$ 0.004
 4 · 0.001 0.0004

- 2.1 Write each expression as a multiple of a power of 10.

Expression	As a Multiple of a Power of 10
0.04	
0.072	
0.0000325	
Three thousandths	
23 hundredths	
729 thousandths	
41 millionths	

- 2.2 Write each expression in scientific notation.

Expression	Scientific Notation
0.04	
0.072	
0.0000325	
Three thousandths	
23 hundredths	
729 thousandths	
41 millionths	

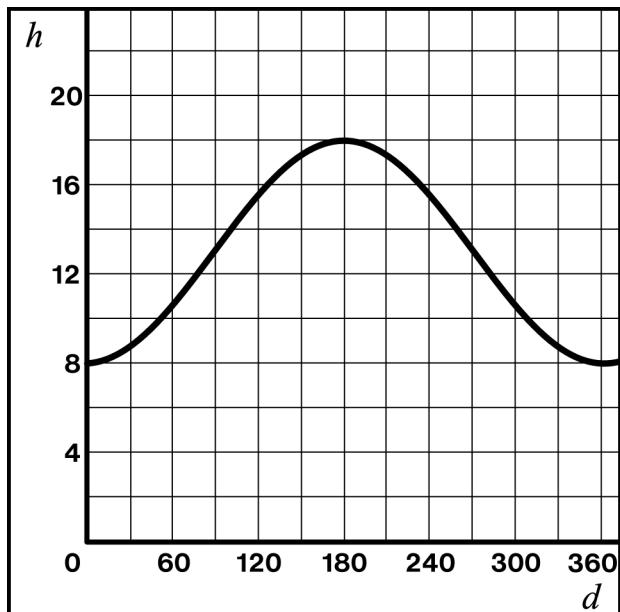
Unit 8.7, Lesson 10: Practice Problems

3. Write each expression in scientific notation.

Standard Notation	Scientific Notation
14,700	
0.00083	
760,000,000	
0.038	
0.38	
3.8	
3,800,000,000,000	

Here is the graph of days and the predicted number of hours of sunlight, h , on the d -th day of the year.

- 4.1 Is hours of sunlight a function of days of the year? Explain your thinking



- 4.2 For what days of the year do the hours of sunlight increase?

- 4.3 For what days of the year do the hours of sunlight decrease?

- 4.4 Which day of the year has the most hours of sunlight?

1. $\sqrt{4 \cdot \left(\frac{1}{10}\right) \cdot \left(\frac{1}{10}\right) \cdot \left(\frac{1}{10}\right)}$

$\sqrt{4 \cdot 0.001}$

$\sqrt{0.004}$

2.1 Responses vary.

Expression	As a Multiple of a Power of 10
0.04	$4 \cdot 10^{-2}$
0.072	$72 \cdot 10^{-3}$
0.0000325	$325 \cdot 10^{-7}$
Three thousandths	$3 \cdot 10^{-3}$
23 hundredths	$23 \cdot 10^{-2}$
729 thousandths	$729 \cdot 10^{-3}$
41 millionths	$41 \cdot 10^{-6}$

2.2

Expression	Scientific Notation
0.04	$4 \cdot 10^{-2}$
0.072	$7.2 \cdot 10^{-2}$
0.0000325	$3.25 \cdot 10^{-5}$
Three thousandths	$3 \cdot 10^{-3}$
23 hundredths	$2.3 \cdot 10^{-1}$
729 thousandths	$7.29 \cdot 10^{-1}$
41 millionths	$4.1 \cdot 10^{-5}$

3.

Standard Notation	Scientific Notation
14,700	$1.47 \cdot 10^4$
0.00083	$8.3 \cdot 10^{-4}$
760,000,000	$7.6 \cdot 10^8$
0.038	$3.8 \cdot 10^{-2}$
0.38	$3.8 \cdot 10^{-1}$
3.8	$3.8 \cdot 10^0$
3,800,000,000,000	$3.8 \cdot 10^{12}$

4.1

Yes.

Responses vary. For every d , there is one, and only one, value of h .

4.2

The hours of sunlight increase from Day 0 to Day 180.

4.3

The hours of sunlight decrease from Day 180 to Day 365.

4.4

180th day of the year.

1. Evaluate each expression. Express your answer in scientific notation.

Expression	Answer (in scientific notation)
$(1.5 \cdot 10^2)(5 \cdot 10^{10})$	
$\frac{4.8 \cdot 10^{-8}}{3 \cdot 10^{-3}}$	
$(5 \cdot 10^8)(4 \cdot 10^3)$	
$(7.2 \cdot 10^3) \div (1.2 \cdot 10^5)$	

- 2.1 Which number is greater?

$$17 \cdot 10^8 \text{ or } 4 \cdot 10^8$$

About how many times greater is one than the other?

- 2.2 Which number is greater?

$$2 \cdot 10^6 \text{ or } 7.839 \cdot 10^6$$

About how many times greater is one than the other?

- 2.3 Which number is greater?

$$42 \cdot 10^7 \text{ or } 8.5 \cdot 10^8$$

About how many times greater is one than the other?

Unit 8.7, Lesson 11: Practice Problems

3. Jada is making a scale model of the solar system.

The distance from Earth to the Moon is about 2.389×10^5 miles.

The distance from Earth to the Sun is about 9.296×10^7 miles.

She decides to put Earth on one corner of her dresser and the Moon in another corner about a foot away.

Where should she put the Sun?

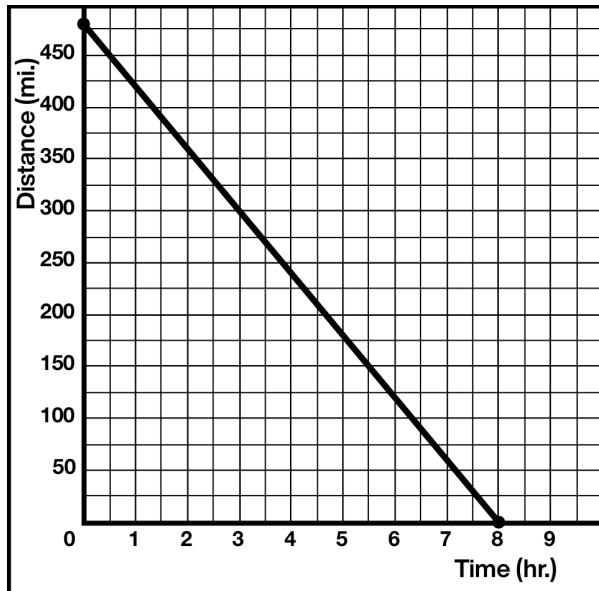
- A. On a windowsill in the same room
- B. In her kitchen, which is down the hallway
- C. A city block away

Explain your thinking.

4. A family sets out on a road trip to visit their cousins. They travel at a steady rate. The graph shows the remaining distance to their cousins' house for each hour of the trip.

- 4.1 How fast are they traveling?

- 4.2 Is the slope positive or negative? Explain how you know and why that fits the situation.



- 4.3 How far is the trip? Explain your thinking.

- 4.4 How long did the trip take? Explain your thinking.

1.

Expression	Answer (in scientific notation)
$(1.5 \cdot 10^2)(5 \cdot 10^{10})$	$7.5 \cdot 10^{12}$
$\frac{4.8 \cdot 10^{-8}}{3 \cdot 10^{-3}}$	$1.6 \cdot 10^{-5}$
$(5 \cdot 10^8)(4 \cdot 10^3)$	$2 \cdot 10^{12}$
$(7.2 \cdot 10^3) \div (1.2 \cdot 10^5)$	$6 \cdot 10^{-2}$

2.1 $17 \cdot 10^8$

About 4 times greater.

2.2 $7.839 \cdot 10^6$

About 4 times greater.

2.3 $8.5 \cdot 10^8$

About 2 times greater.

3. C. A city block away

Responses vary. The distance from Earth to the Sun is about $4 \cdot 10^9$, or 400, times the distance from Earth to the Moon. Since Jada's dresser is about a foot long, her model sun should be about 400 feet away from the dresser. Jada's house or apartment is probably not 400 feet long, so a block away is about right.

4.1

(From IM 8.3.9, Desmos 8.3.07)
60 miles per hour

4.2

Negative.

Responses vary. The slope is negative because the line moves down towards the right. It shows the change in remaining miles for each hour. 60 fewer miles remain after each hour, which means the car is traveling at a steady rate of 60 miles per hour.

4.3

480 miles

Responses vary. The trip is 480 miles because the remaining distance was 480 miles when they started out at 0 hours.

4.4

8 hours

Responses vary. The trip took 8 hours because after 8 hours, there were 0 miles remaining.

1. Evaluate each expression. Express your answer in scientific notation.

Expression	Answer (in scientific notation)
$(2 \cdot 10^5) + (6 \cdot 10^5)$	
$(4.1 \cdot 10^7) \cdot 2$	
$3 \cdot (1.5 \cdot 10^{11})$	
$(3 \cdot 10^3)^2$	
$(9 \cdot 10^6) \cdot (3 \cdot 10^6)$	

2. Evaluate each expression. Express your answer in scientific notation.

Expression	Answer (in scientific notation)
$5.3 \cdot 10^4 + 4.7 \cdot 10^4$	
$3.7 \cdot 10^6 - 3.3 \cdot 10^6$	
$4.8 \cdot 10^{-3} + 6.3 \cdot 10^{-3}$	
$6.6 \cdot 10^{-5} - 6.1 \cdot 10^{-5}$	

3. Han found a way to compute complicated expressions more easily. Since $2 \cdot 5 = 10$, he looks for pairings of 2s and 5s that he knows equal 10. Apply Han's technique to compute the expressions in the table.

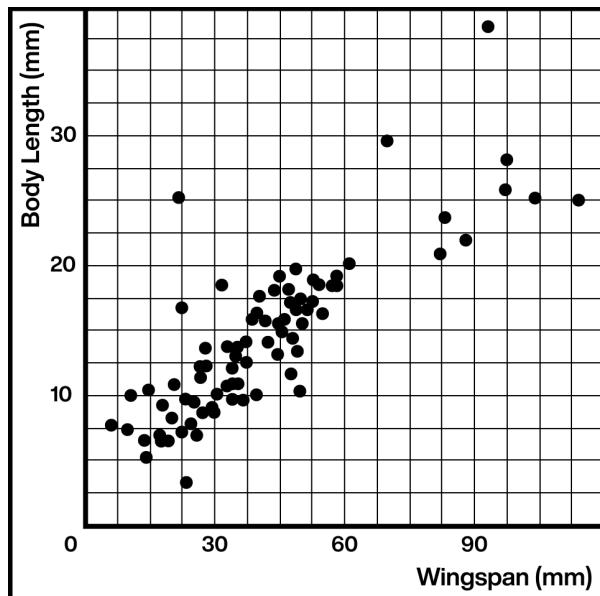
For example:

$$\begin{aligned}
 3 \cdot 2^4 \cdot 5^5 &= 3 \cdot 2^4 \cdot 5^4 \cdot 5 \\
 &= (3 \cdot 5) \cdot (2 \cdot 5)^4 \\
 &= 15 \cdot 10^4 \\
 &= 150\,000
 \end{aligned}$$

Expression	Value
$2^4 \cdot 5 \cdot (3 \cdot 5)^3$	
$\frac{2^3 \cdot 5^2 \cdot (2 \cdot 3)^2 \cdot (3 \cdot 5)^2}{3^2}$	

Unit 8.7, Lesson 12: Practice Problems

4. Ecologists measured the body length and the wingspan of 127 butterfly specimens caught in a single field.
- 4.1 Draw a straight line that is a good fit for the data.
- 4.2 Write an equation for your line.
- 4.3 What does the slope of the line tell you about the wingspans and lengths of these butterflies?
5. Diego was solving an equation, but when he checked his answer, he saw his solution was incorrect. He knew he made a mistake, but he couldn't find it.

**Diego's work:**

$$-4(7 - 2x) = 3(x + 4)$$

$$-28 - 8x = 3x + 12$$

$$-28 = 11x + 12$$

$$-40 = 11x$$

$$-\frac{40}{11} = x$$

- 5.1 What is the correct solution to the equation?

- 5.2 Where did Diego go wrong? Write on Diego's work above if it helps you show your thinking.

1.

Expression	Answer
$(2 \cdot 10^5) + (6 \cdot 10^5)$	$8 \cdot 10^5$
$(4.1 \cdot 10^7) \cdot 2$	$8.2 \cdot 10^7$
$3 \cdot (1.5 \cdot 10^{11})$	$4.5 \cdot 10^{11}$
$(3 \cdot 10^3)^2$	$9 \cdot 10^6$
$(9 \cdot 10^6) \cdot (3 \cdot 10^6)$	$2.7 \cdot 10^{13}$

2.

Expression	Answer
$5.3 \cdot 10^4 + 4.7 \cdot 10^4$	$1 \cdot 10^5$
$3.7 \cdot 10^6 - 3.3 \cdot 10^6$	$4 \cdot 10^5$
$4.8 \cdot 10^{-3} + 6.3 \cdot 10^{-3}$	$1.11 \cdot 10^{-2}$
$6.6 \cdot 10^{-5} - 6.1 \cdot 10^{-5}$	$5 \cdot 10^{-6}$

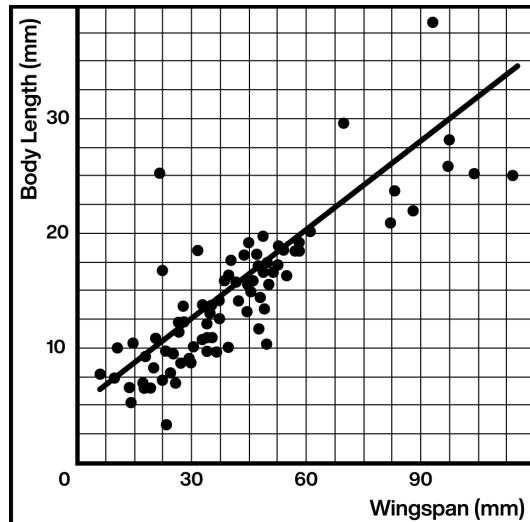
3.

Expression	Value
$2^4 \cdot 5 \cdot (3 \cdot 5)^3$	270 000
$\frac{2^3 \cdot 5^2 \cdot (2 \cdot 3)^2 \cdot (3 \cdot 5)^2}{3^2}$	180 000

4.1

(From IM 8.6.5, Desmos 8.6.05)

Responses vary.



4.2

$$\text{Responses vary. } y = \frac{1}{4}x + 5$$

4.3

Responses vary. For every 4 millimeters that the length of the wingspan increases, the body length increases 1 millimeter.

5.1

(From IM 8.4.5, Desmos 8.4.05)

$$x = 8$$

5.2

Diego's mistake occurred in the transition from the first line to the second line. The distributive property with $-4(7 - 2x)$ should give $-28 + 8x$.

- How many bucketloads would it take to bucket out the world's oceans?

Some useful information:

- The world's oceans hold roughly 1.4×10^9 cubic kilometers of water.
- A typical bucket holds roughly 20 000 cubic centimeters of water.
- There are 10^{15} cubic centimeters in a cubic kilometer.

Write your answer in scientific notation.

- Which is larger: the number of meters across the Milky Way or the total number of cells in all humans?

Some useful information:

- The Milky Way is about 100 000 light years across.
- There are about 37 trillion cells in a human body.
- One light year is about 10^{16} meters.
- The world population is about 7 billion.

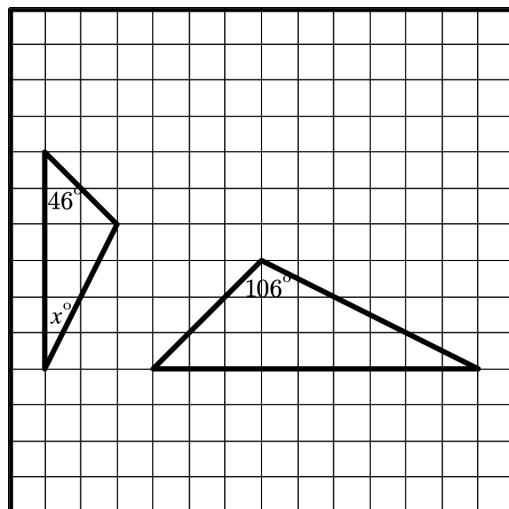
- Meters across the milky way
 Total number of cells in all humans

Explain your thinking.

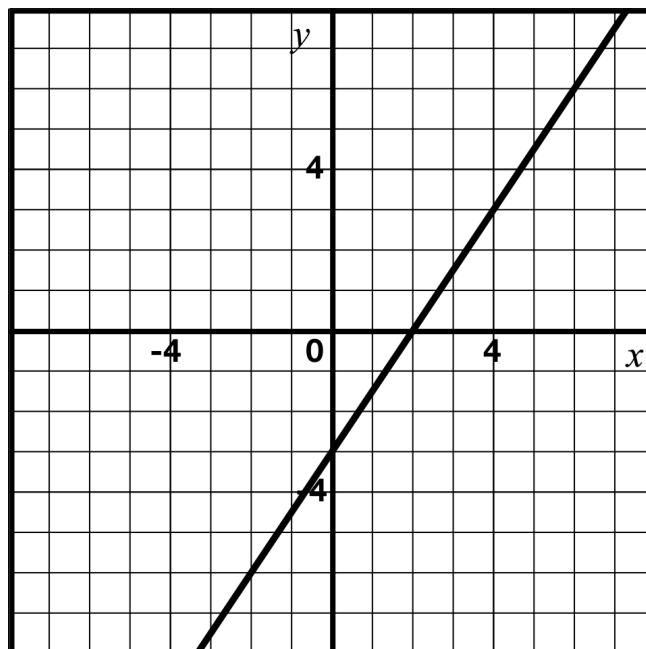
Unit 8.7, Lesson 13: Practice Problems

3. The two triangles are similar.

Find the value of x .



Here is the graph for one equation in a system of equations.



- 4.1 Write a second equation for the system so it has infinitely many solutions.
- 4.2 Write a second equation with a graph that goes through $(0, 2)$ so that the system has no solutions.
- 4.3 Write a second equation with a graph that goes through $(2, 2)$ so that the system has one solution at $(4, 3)$.

1. $7 \cdot 10^{19}$

(The world's oceans hold 1.4×10^{24} cubic centimeters of water, which is found by multiplying 1.4×10^9 by 10^{15} , and then dividing by 2×10^4 to get 0.7×10^{20} . In scientific notation, this quotient is 7×10^{19} .)

2. B. Total number of cells in all humans

Responses vary. Since 100 000 is 10^5 , it is about $10^5 \cdot 10^{16}$, or 10^{21} , meters across the Milky Way. Notice that 37 trillion is $3.7 \cdot 10^{13}$, and 7 billion is $7 \cdot 10^9$, so the total number of human cells is $(3.7 \cdot 10^{13}) \cdot (7 \cdot 10^9)$. This gives $25.9 \cdot 10^{22}$ human cells, which is about 260 times larger than 10^{21} (the approximate number of meters across the Milky Way). Using more precise values for the population and the number of meters in a light year will yield slightly different results.

3. $x = 28$

(Since the two triangles are similar, the obtuse angles are congruent, so they both measure 106° . The sum of the three angles in a triangle is 180° .)

4.1 $y = \frac{3}{2}x - 3$ (or equivalent)

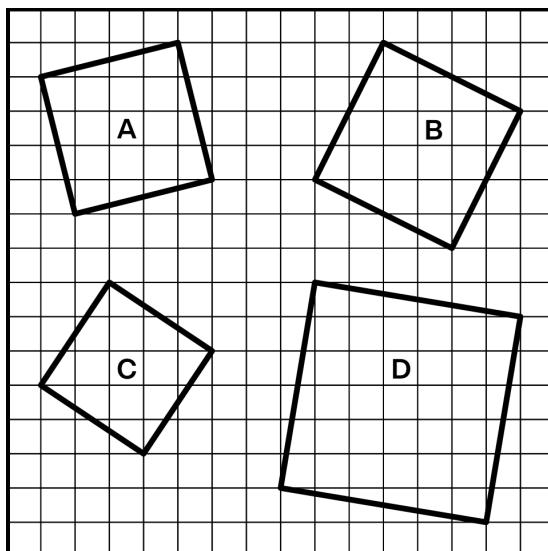
4.2 $y = \frac{3}{2}x + 2$ (or equivalent)

4.3 $y = \frac{1}{2}x + 1$ (or equivalent)

1. Find the area of each square.

Each grid square represents 1 square unit.

Square	Area (square units)
A	
B	
C	
D	



2. The side lengths of five squares are given in the table. Find the area of each square.

Side Length	Area
3 inches	
7 units	
100 cm	
40 inches	
x units	

3. The areas of four squares are given in the table. Find the side length of each square.

Side Length	Area
	81 square inches
	$\frac{4}{25}$ square cm
	0.49 square units
	m^2 square units



Unit 8.8, Lesson 1: Practice Problems

4. Evaluate $(3.1 \times 10^4) \cdot (2 \times 10^6)$. Choose the correct answer.
- A. 5.1×10^{10}
B. 5.1×10^{24}
C. 6.2×10^{10}
D. 6.2×10^{24}
5. Noah solves the following problem: Evaluate $5.4 \times 10^5 + 2.3 \times 10^4$ and give the answer in scientific notation.

Noah says, "I can rewrite 5.4×10^5 as 54×10^4 . Then, I can add the numbers:
 $54 \times 10^4 + 2.3 \times 10^4 = 56.3 \times 10^4$."

Do you agree with Noah's solution to the problem? Explain your thinking.

6. Select all the expressions that are equivalent to 3^8 .

$3^6 \cdot 10^2$

8^3

$\frac{3^6}{3^{-2}}$

$3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3$

$(3^4)^2$

$(3^2)^4$

1.

Square	Area (square units)
A	17
B	20
C	13
D	37

2.

Side Length	Area
3 inches	9 square inches
7 units	49 square units
100 cm	10 000 square cm
40 inches	1 600 square inches
x units	x^2 square units

3.

Side Length	Area
9 inches	81 square inches
$\frac{2}{5}$ cm	$\frac{4}{25}$ square cm
0.7 units	0.49 square units
m units	m^2 square units

4. C. 6.2×10^{10}

5. No. *Responses vary.* I don't agree with Noah's solution. His calculations are correct, but his final answer is not in scientific notation. To finish the problem, he should convert his answer to the form 5.63×10^5 .

- 6.
- ✓ $\frac{3^6}{3^{-2}}$
 - ✓ $3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3$
 - ✓ $(3^4)^2$
 - ✓ $(3^2)^4$

**Unit 8.8, Lesson 2: Practice Problems**

Name _____

1. Square A has an area of 81 square feet.

Select all the expressions that are equal to the side length of this square (in feet).

3

$\frac{81}{2}$

$\sqrt{81}$

$\sqrt{9}$

9

2. The areas of six squares are given in the table. Find the side length of each square.

Area (square units)	Side Length (units)
36	
37	
$\frac{100}{9}$	
$\frac{2}{5}$	
0.0001	
0.11	

3. Here is some information about three squares.

- Square A is smaller than Square B.
- Square B is smaller than Square C.
- The three squares' side lengths are $\sqrt{26}$, 4.2, and $\sqrt{11}$.

Write each side length next to the appropriate square in the table.

Square	Side Length
A	
B	
C	

Unit 8.8, Lesson 2: Practice Problems

4. The side lengths of five squares are given in the table. Find the area of each square.

Side Length	Area
$\frac{1}{5}$ cm	
$\frac{3}{7}$ units	
0.1 meters	

5. Here is a table showing the seven largest countries by area.

5.1 How much greater is the area of Russia than the area of Canada?

5.2 The Asian countries on this list are Russia, China, and India. The American countries are Canada, the United States, and Brazil.

Which has the greater total area?

- A. The three Asian countries
- B. The three American countries

Explain your thinking.

Country	Area (square km)
Russia	1.71×10^7
Canada	9.98×10^6
China	9.60×10^6
United States	9.53×10^6
Brazil	8.52×10^6
Australia	6.79×10^6
India	3.29×10^6

6. Select all the expressions that are equivalent to 10^{-6} .

$\frac{1}{1,000,000}$

$\frac{1}{10^6}$

$\left(\frac{1}{10}\right)^6$

$10^8 \cdot 10^{-2}$

$\frac{-1}{1,000,000}$

$\frac{1}{10 \cdot 10 \cdot 10 \cdot 10 \cdot 10 \cdot 10}$

Unit 8.8, Lesson 2: Practice Problems

Answer Key

1. ✓ $\sqrt{81}$

✓ 9

2.

Area	Side Length
36 square units	6 units
37 square units	$\sqrt{37}$ units
$\frac{100}{9}$ square units	$\frac{10}{3}$ units
$\frac{2}{5}$ square units	$\sqrt{\frac{2}{5}}$ units
0.0001 square units	0.01 units
0.11 square units	$\sqrt{0.11}$ units

3.

Square	Side Length
A	$\sqrt{11}$
B	4.2
C	$\sqrt{26}$

4. (From IM 8.8.1, Desmos 8.8.01)

Side Length	Area
$\frac{1}{5}$ cm	$\frac{1}{25}$ square cm
$\frac{3}{7}$ units	$\frac{9}{49}$ square units
$\frac{11}{8}$ inches	$\frac{121}{64}$ square inches
0.1 meters	0.01 square meters
3.5 cm	12.25 square cm

5.1 (From IM 8.7.15, Desmos 8.7.12)

 7.12×10^6 square kilometers greater.

5.2 The Asian countries.

The Asian countries' areas sum to 2.999×10^7 square kilometers, whereas the American countries' areas sum to 2.808×10^7 square kilometers.

6. (From IM 8.7.5, Desmos 8.7.05)

✓ $\frac{1}{1,000,000}$

✓ $\left(\frac{1}{10}\right)^6$

✓ $\frac{1}{10^6}$

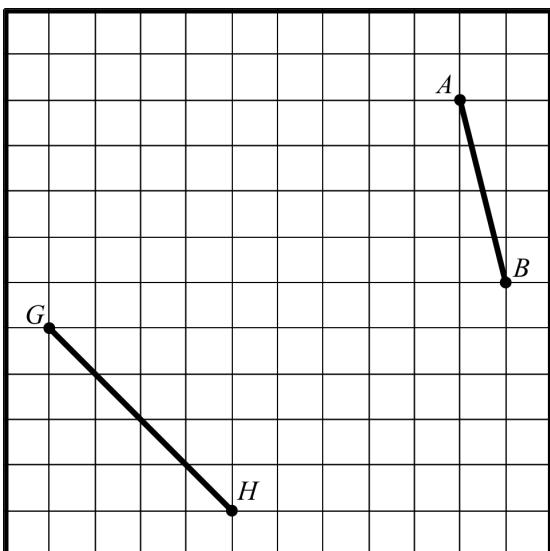
✓ $\frac{1}{10 \cdot 10 \cdot 10 \cdot 10 \cdot 10 \cdot 10}$

1. Find the exact length of each line segment.

Then estimate the length of each line segment to the nearest tenth of a unit.

Each grid square represents 1 square unit.

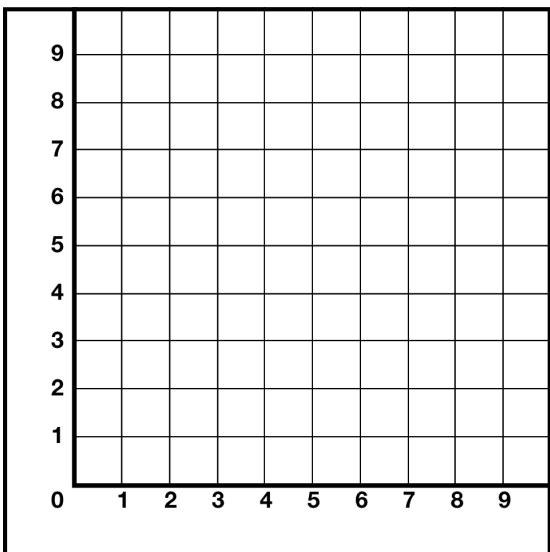
Segment	Exact Length	Estimate (nearest tenth)
AB		
GH		



2. Plot the following numbers on the x -axis.

- $\sqrt{16}$
- $\sqrt{35}$
- $\sqrt{66}$

Consider using the grid to help.



3. $\sqrt{7}$ is a solution to the equation $x^2 = 7$.

Find a decimal approximation of $\sqrt{7}$ whose square is between 6.9 and 7.1.

Unit 8.8, Lesson 3: Practice Problems

4. Graphite is made up of layers of graphene. Each layer of graphene is about 200 picometers, or 200×10^{-12} meters, thick.

How many layers of graphene are there in a 1.6-millimeter-thick piece of graphite?

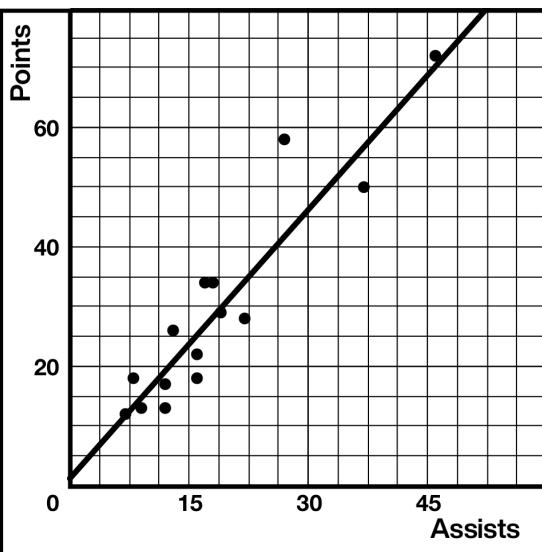
Express your answer in scientific notation.

5. Here is a scatter plot that shows the number of assists and points for a group of hockey players.

A model is graphed with the scatter plot. The model is represented by $y = 1.5x + 1.2$.

- 5.1 What does the slope of the line mean in this situation?

- 5.2 Based on the model, how many points will a player have if he has 30 assists?



6. The points (12, 23) and (14, 45) lie on a line. What is the slope of the line?

1.

Segment	Exact Length	Estimate (nearest tenth)
AB	$\sqrt{17}$ units	4.1 units
GH	$\sqrt{32}$ units	5.7 units

2. • $\sqrt{16}$ at 4
• $\sqrt{35}$ at a little less than 6
• $\sqrt{66}$ at a little more than 8

3. *Responses vary.*
2.63, 2.64, 2.65, 2.66

4. (From IM 8.7.14, Desmos 8.7.11)
About 8×10^6 .

The thickness of the graphite is 1.6×10^{-3} meters. The number of layers of graphene is given by $\frac{1.6 \times 10^{-3}}{200 \times 10^{-12}} = 0.008 \times 10^9$. This number, in scientific notation, is 8×10^6 , or about 8 million.

- 5.1 (From IM 8.6.6, Desmos 8.6.06)
For every assist, a player's points have gone up by 1.5 .
- 5.2 Approximately 46.2 points (or 46 points since you cannot score 0.2 points).
6. (From IM 8.3.5, Desmos 8.3.04)
 $\frac{22}{2}$ (or 11)

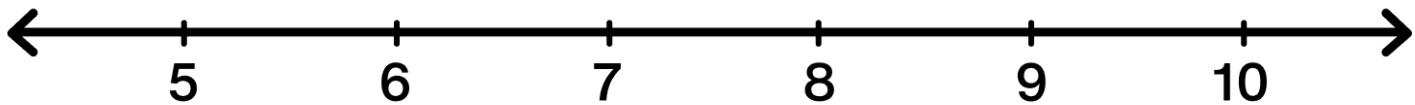
1.1 Explain how you know that $\sqrt{37}$ is a little more than 6.

1.2 Explain how you know that $\sqrt{95}$ is a little less than 10.

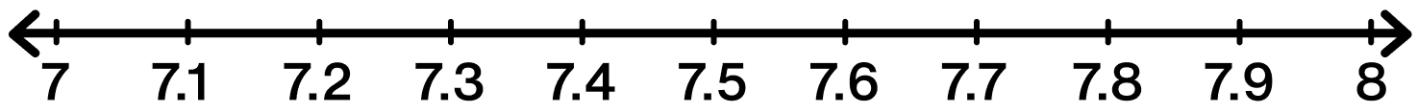
1.3 Explain how you know that $\sqrt{30}$ is between 5 and 6.

2. Plot and label each number on the number line:

- 6
- $\sqrt{83}$
- $\sqrt{40}$
- $\sqrt{64}$
- 7.5

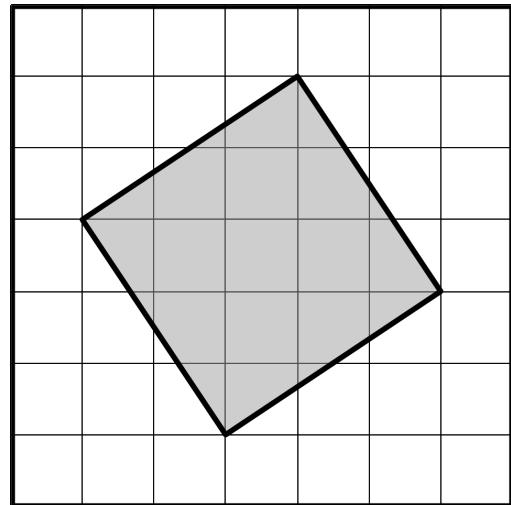


3. Plot and label two square root values between 7 and 8 on the number line.



Unit 8.8, Lesson 4: Practice Problems

4. Each grid square represents 1 square unit.
What is the exact side length of the shaded square?



5. For each pair of numbers, circle the larger number. Estimate how many times as large.

5.1 $700 \cdot 10^4$ or $0.37 \cdot 10^6$

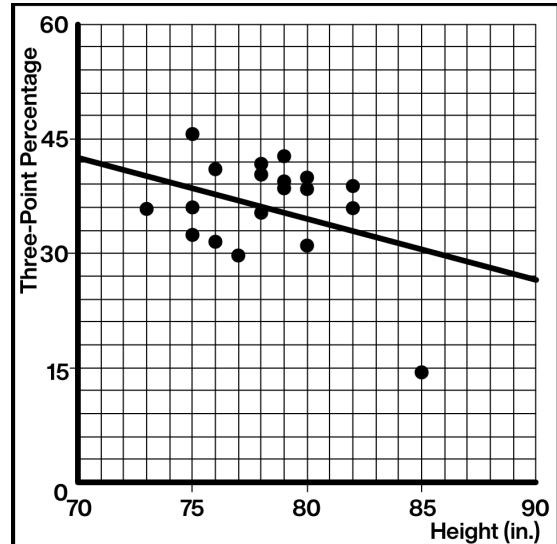
5.2 $4.87 \cdot 10^4$ or $15 \cdot 10^5$

5.3 500,000 or $2.3 \cdot 10^8$

6. This scatter plot shows the heights (in inches) and the three-point percentages for different basketball players last season.

- 6.1 Circle any data points that appear to be outliers.

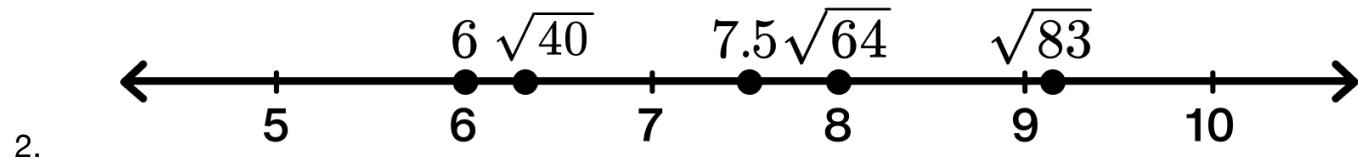
- 6.2 Describe how the outlier(s) compare to the value(s) predicted by the model.



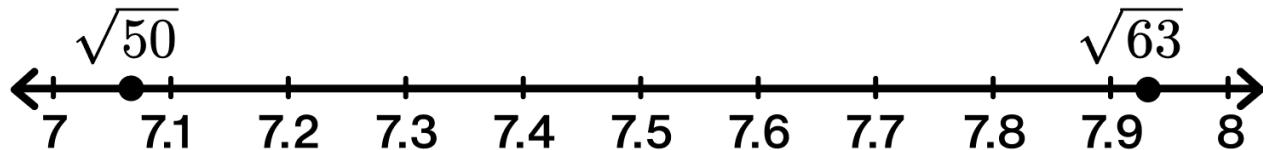
1.1 $\sqrt{36}$ is exactly 6, and $\sqrt{37}$ is a little more than that.

1.2 $\sqrt{100}$ is exactly 10, and 95 is a little less than that.

1.3 $\sqrt{25} = 5$ and $\sqrt{36} = 6$. $\sqrt{30}$ is in between.



3. Responses vary.



4. (From IM 8.8.2, Desmos 8.8.02)

$\sqrt{13}$ units

5.1 (From IM 8.7.10, Desmos 8.7.08)

$700 \cdot 10^4$ (about 20 times as large).

5.2 $15 \cdot 10^5$ (about 30 times as large).

5.3 $2.3 \cdot 10^8$ (about 500 times as large).

6.1 (From IM 8.6.4, Desmos 8.6.04)

The point at (85, 14) is an outlier.

6.2 This point represents a player who had a significantly worse three-point percentage (by about 15% of the attempts) than the model predicts for his height.

- 1.1 Given these side lengths, what is the volume of each cube?

Side Length	Volume
4 cm	
$\sqrt[3]{11}$ ft.	
s units	

- 1.2 Given these volumes, what is the side length of each cube?

Side Length	Volume
	1 000 cubic cm
	23 cubic ft.
	v cubic units

2. For each expression, write an equivalent expression that doesn't use a cube root symbol.

Expression	Equivalent Expression
$\sqrt[3]{1}$	
$\sqrt[3]{216}$	
$\sqrt[3]{8\ 000}$	
$\sqrt[3]{\frac{1}{64}}$	
$\sqrt[3]{\frac{27}{125}}$	
$\sqrt[3]{0.027}$	
$\sqrt[3]{0.000125}$	



Unit 8.8, Lesson 5: Practice Problems

3. For each equation, write the positive solution as a whole number or using square root or cube root notation.

Equation	Positive Solution
$t^3 = 216$	$t =$
$a^2 = 15$	$a =$
$m^3 = 8$	$m =$
$c^3 = 343$	$c =$
$f^3 = 181$	$f =$

4. For each cube root, write which two consecutive integers the value is between. Consecutive integers are whole numbers that are next to each other. One is done as an example.

Number	Between
$\sqrt[3]{5}$	1 and 2
$\sqrt[3]{11}$	
$\sqrt[3]{80}$	
$\sqrt[3]{120}$	
$\sqrt[3]{250}$	

5. Order the values in the table from least to greatest (1 = least, 6 = greatest).

Number	Order
$\sqrt[3]{27}$	
$\sqrt[3]{530}$	
$\sqrt{48}$	
$\sqrt{121}$	
π	
$\frac{19}{2}$	

1.1

Side Length	Volume
4 cm	64 cubic cm
$\sqrt[3]{11}$ ft.	11 cubic ft.
s units	s^3 cubic units

1.2

Side Length	Volume
10 cm	1,000 cubic cm
$\sqrt[3]{23}$ ft.	23 cubic ft.
$\sqrt[3]{v}$ units	v cubic units

2.

Expression	Equivalent Expression
$\sqrt[3]{1}$	1
$\sqrt[3]{216}$	6
$\sqrt[3]{8\,000}$	20
$\sqrt[3]{\frac{1}{64}}$	$\frac{1}{4}$
$\sqrt[3]{\frac{27}{125}}$	$\frac{3}{5}$
$\sqrt[3]{0.027}$	0.3
$\sqrt[3]{0.000125}$	0.05

3.

Equation	Positive Solution
$t^3 = 216$	$t = 6$
$a^2 = 15$	$a = \sqrt{15}$
$m^3 = 8$	$m = 2$
$c^3 = 343$	$c = 7$
$f^3 = 181$	$f = \sqrt[3]{181}$

4.

Number	Between
$\sqrt[3]{5}$	1 and 2
$\sqrt[3]{11}$	2 and 3
$\sqrt[3]{80}$	4 and 5
$\sqrt[3]{120}$	4 and 5
$\sqrt[3]{250}$	6 and 7

5.

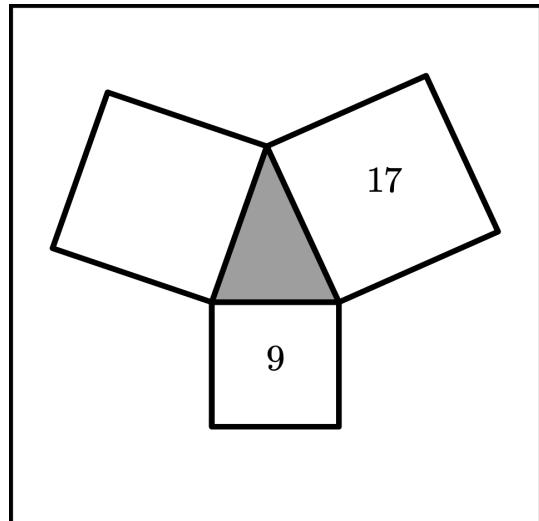
Number	Order
$\sqrt[3]{27}$	1 (least)
$\sqrt[3]{530}$	4
$\sqrt{48}$	3
$\sqrt{121}$	6 (greatest)
π	2
$\frac{19}{2}$	5

1. Here is a diagram of a triangle and three squares.

Priya says the area of the large unmarked square is 26 square units because $9 + 17 = 26$.

Do you agree?

Explain your thinking.



2. This right angle triangle has side lengths m , p , and z .

Select all the equations that represent the relationship between m , p , and z .

$m^2 + p^2 = z^2$

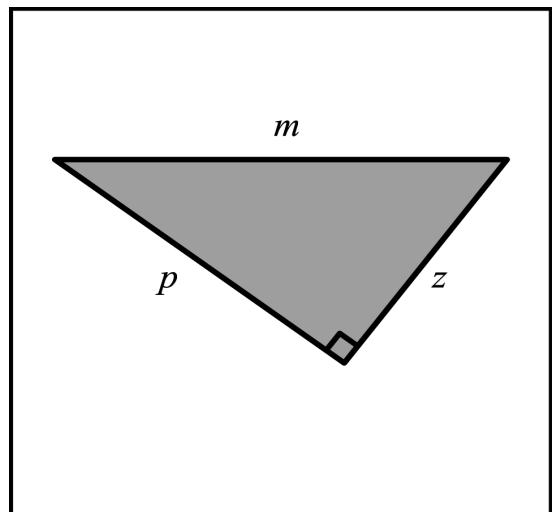
$m^2 = p^2 + z^2$

$m^2 = z^2 + p^2$

$p^2 + m^2 = z^2$

$z^2 + p^2 = m^2$

$p^2 + z^2 = m^2$





Unit 8.8, Lesson 6: Practice Problems

3. The table shows the lengths of the three sides for several right triangles.
Write an equation that expresses the relationship between the side lengths of each triangle.

Side Lengths	Equation
10, 6, 8	
$\sqrt{5}$, $\sqrt{3}$, $\sqrt{8}$	
5, $\sqrt{5}$, $\sqrt{30}$	
1, $\sqrt{37}$, 6	
3, $\sqrt{2}$, $\sqrt{7}$	

4. Order the following expressions by value from least to greatest (1 = least, 4 = greatest).

Number	Order
$0.025 \div 1$	
$2.5 \div 1\,000$	
$250\,000 \div 1\,000$	
$25 \div 10$	

5. A teacher tells her students she is just over 1.5 billion seconds old.

5.1 Write her age in seconds using scientific notation.

5.2 What is a more reasonable unit of measurement for this situation?

5.3 Convert the teacher's age to the new unit.

1. No, I disagree.

Responses vary.

Priya's pattern only works for right triangles, and this is an acute triangle.

2. $\sqrt{m^2} = p^2 + z^2$

$$\sqrt{m^2} = z^2 + p^2$$

$$\sqrt{z^2 + p^2} = m^2$$

$$\sqrt{p^2 + z^2} = m^2$$

3.

Sides	Equation
10, 6, 8	$6^2 + 8^2 = 10^2$
$\sqrt{5}, \sqrt{3}, \sqrt{8}$	$\sqrt{5}^2 + \sqrt{3}^2 = \sqrt{8}^2$
5, $\sqrt{5}, \sqrt{30}$	$5^2 + \sqrt{5}^2 = \sqrt{30}^2$
1, $\sqrt{37}, 6$	$1^2 + 6^2 = \sqrt{37}^2$
3, $\sqrt{2}, \sqrt{7}$	$\sqrt{7}^2 + \sqrt{2}^2 = 3^2$

4.

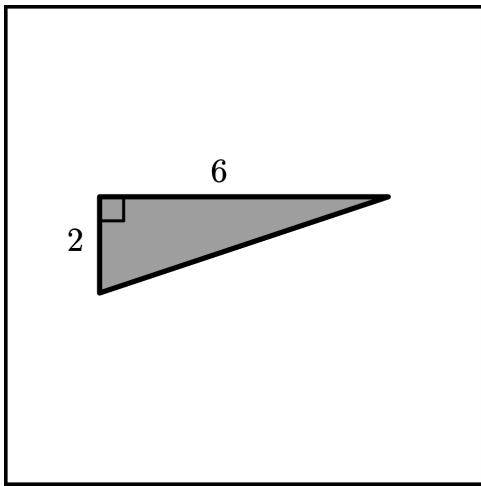
Number	Order
$0.025 \div 1$	2
$2.5 \div 1,000$	1 (least)
$250,000 \div 1,000$	4 (greatest)
$25 \div 10$	3

5.1 1.5×10^9

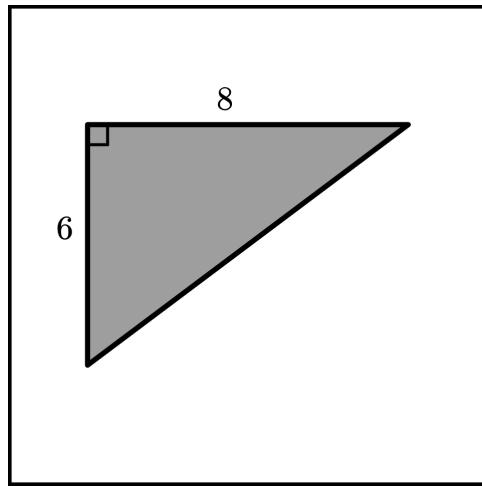
5.2 Years

5.3 48 years old

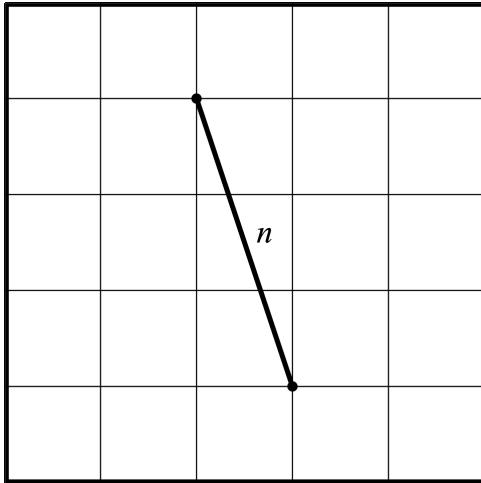
- 1.1 Find the length of the unlabeled side.



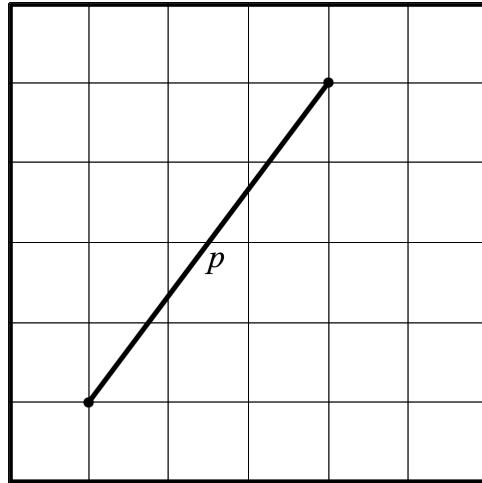
- 1.2 Find the length of the unlabeled side.



- 1.3 This segment is n units long.
What is the value of n ?

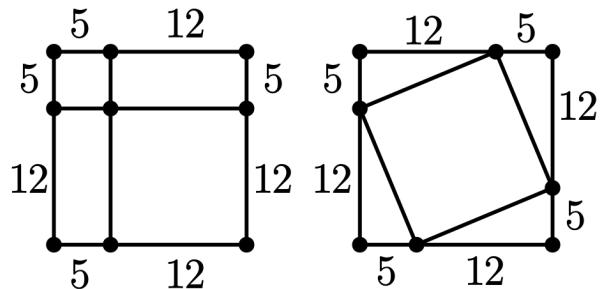


- 1.4 This segment is p units long.
What is the value of p ?



Unit 8.8, Lesson 7: Practice Problems

2. Without doing any calculations, use the areas of the two identical squares to explain why $5^2 + 12^2 = 13^2$.



3. For each square root, write which two consecutive integers the value is between. Consecutive integers are whole numbers that are next to each other. One is done as an example.

Number	Between
$\sqrt{2}$	1 and 2
$\sqrt{10}$	
$\sqrt{54}$	
$\sqrt{18}$	
$\sqrt{99}$	
$\sqrt{41}$	

4. Write each expression as a single power of 10.

Expression	Single Power of 10
$10^5 \cdot 10^0$	
$\frac{10^9}{10^0}$	

1.1 $\sqrt{40}$ units (approximately 6.3 units)

1.2 $\sqrt{100}$ units (exactly 10 units)

1.3 $\sqrt{10}$ units because $1^2 + 3^2 = 10$.

1.4 $\sqrt{25}$ (or 5) units because $3^2 + 4^2 = 5^2$.

2. Responses vary. The areas of the two large squares are the same since they are both 17 by 17 units. The area of the two rectangles in the left square is the same as the area of the four triangles in the right square (each pair of triangles makes a rectangle). So the area of the two smaller squares on the left must be the same as the area of the smaller square on the right. This means $5^2 + 12^2 = 13^2$.

3. (From IM 8.8.4, Desmos 8.8.04)

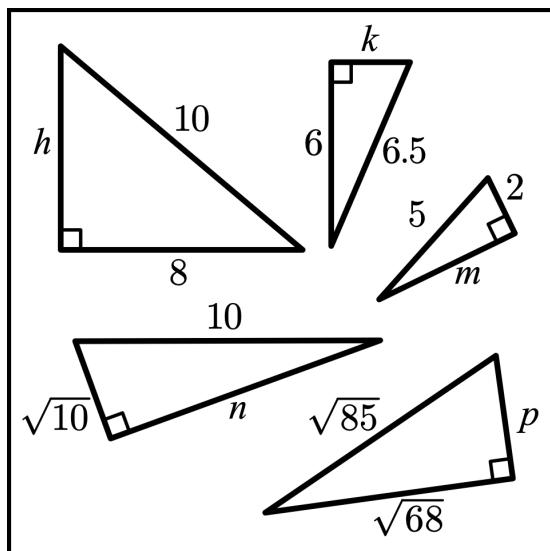
Number	Between
$\sqrt{2}$	1 and 2
$\sqrt{10}$	3 and 4
$\sqrt{54}$	7 and 8
$\sqrt{18}$	4 and 5
$\sqrt{99}$	9 and 10
$\sqrt{41}$	6 and 7

4. (From IM 8.7.4, Desmos 8.7.04)

Expression	Single Power of 10
$10^5 \cdot 10^0$	10^5
$\frac{10^9}{10^0}$	10^9

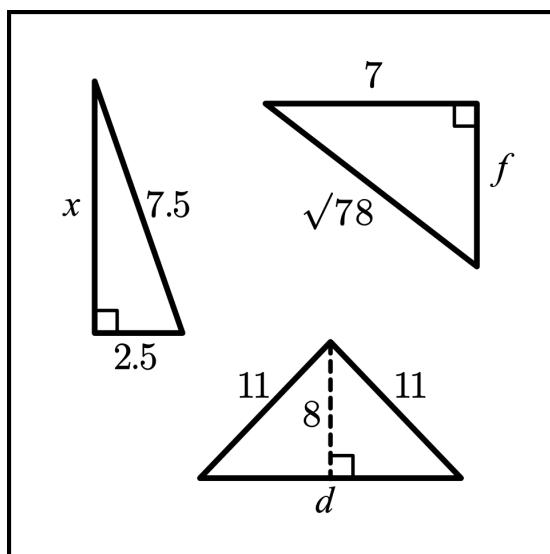
1. Find the exact value of each variable representing a side length in a right triangle.

Side	Length
h	
k	
m	
n	
p	



2. Find the value of each variable to the nearest tenth.

Side	Length
x	
f	
d	



3. A right triangle has side lengths of a , b , and c units.

The longest side has a length of c units.

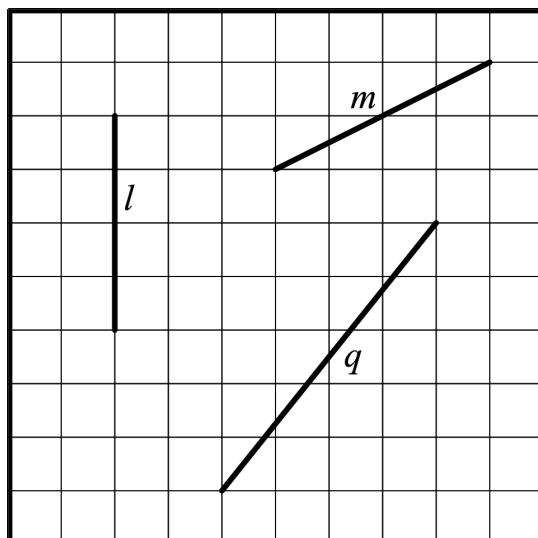
Complete each equation to show three relations among a , b , and c .

Equations
$c^2 =$
$a^2 =$
$b^2 =$

Unit 8.8, Lesson 8: Practice Problems

4. What is the exact length of each line segment?
(Each grid square represents 1 square unit.)

Segment	Length
l	
m	
q	



5. In 2015, there were roughly 1×10^6 high school football players and 2×10^3 professional football players in the United States.

About how many times more high school football players were there? Explain your thinking.

6. Evaluate each expression.

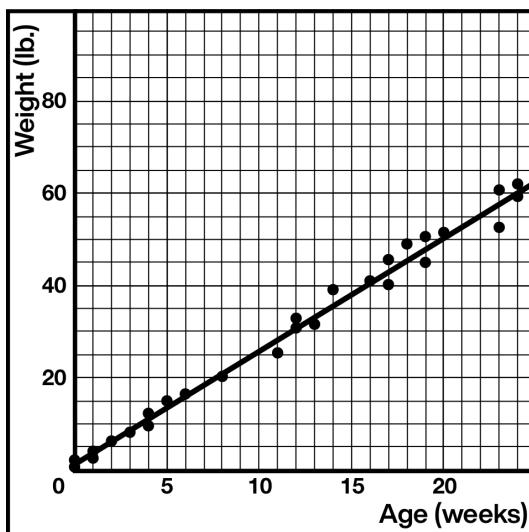
6.1 $\left(\frac{1}{2}\right)^3$

6.2 $\left(\frac{1}{2}\right)^{-3}$

7. Here is a scatter plot of weight vs. age for different Dobermans. The model, represented by $y = 2.45x + 1.22$, is graphed with the scatter plot. Here, x represents age in weeks, and y represents weight in pounds.

- 7.1 What does the slope mean in this situation?

- 7.2 Based on this model, how heavy would you expect a newborn Doberman to be?





Unit 8.8, Lesson 8: Practice Problems

1.

Side	Length
h	6
k	2.5
m	$\sqrt{21}$
n	$\sqrt{90}$
p	$\sqrt{17}$

2.

Side	Length
x	7.1
f	5.4
d	15.1

3. (From IM 8.8.7, Desmos 8.8.07)

Responses vary.

Equations
$c^2 = a^2 + b^2$
$a^2 = c^2 - b^2$
$b^2 = c^2 - a^2$

Answer Key

4. (From IM 8.8.7, Desmos 8.8.7)

Segment	Length
l	4 units
m	$\sqrt{20}$ units
q	$\sqrt{41}$ units

5. (From IM 8.7.15, Desmos 8.7.12)

There are approximately 500 times more high school football players.

$$\frac{1 \times 10^6}{2 \times 10^3} = 0.5 \times 10^3 = 5 \times 10^2$$

6.1 (From IM 8.7.6, Desmos 8.7.06)

$$\frac{1}{8}$$

6.2 8

7.1 (From IM 8.6.6, Desmos 8.6.06)

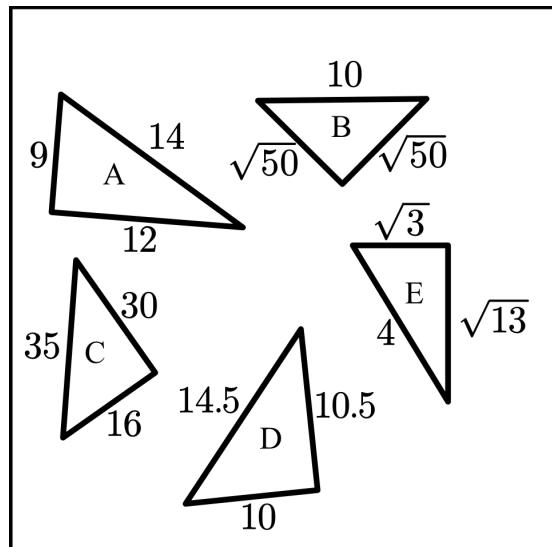
The slope means that a Doberman can be expected to gain 2.45 pounds per week.

7.2 1.22 pounds (the y -intercept of the function).

1. Select **all** of the triangles that are definitely right triangles.

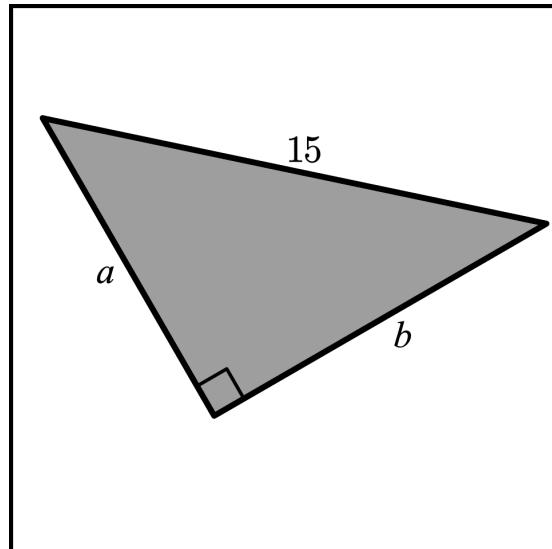
(Note that not all triangles are drawn to scale.)

- A
- B
- C
- D
- E



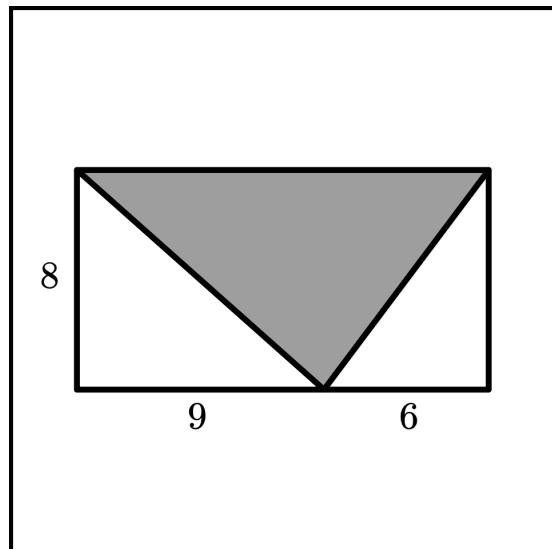
2. A right triangle has a hypotenuse of 15 centimeters. What are possible lengths for the two legs of the triangle?

Leg	Length
a	
b	



3. Here is a 15 -by- 8 rectangle divided into triangles. Is the shaded triangle a right triangle?

Explain your thinking.



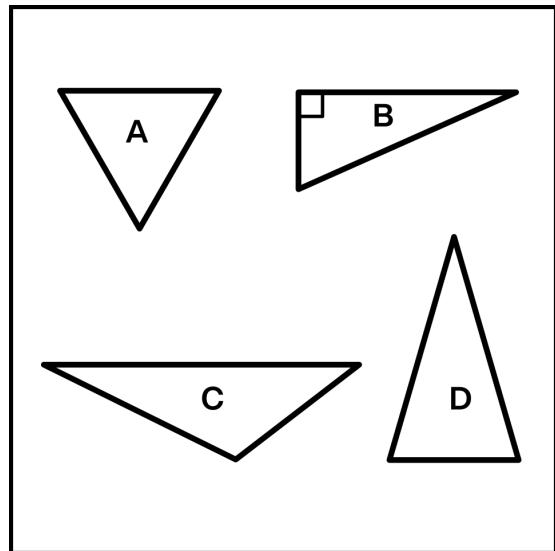
Unit 8.8, Lesson 9: Practice Problems

4. For each right triangle, a and b represent the lengths of the legs, and c represents the length of the hypotenuse. Find the missing length given the other two lengths.

Right Triangle	a	b	c
M	12	5	
N		21	29

5. For which triangle does the Pythagorean theorem express the relationship between the lengths of its three sides?

- a. A
- b. B
- c. C
- d. D



6. Andre makes a trip to Mexico. He exchanges some dollars for pesos at a rate of 20 pesos per dollar. While in Mexico, he spends 9 000 pesos. When he returns, he exchanges his pesos for dollars (still at 20 pesos per dollar). He gets back $\frac{1}{10}$ the amount he started with.

Find how many dollars Andre exchanged for pesos. Explain your thinking.

(If you get stuck, try writing an equation representing Andre's trip using a variable for the number of dollars he exchanged.)

1. ✓ *B*
✓ *D*
✓ *E*

2. Responses vary.

Leg	Length
<i>a</i>	$\sqrt{200}$ cm
<i>b</i>	5 cm

3. No, it is not. Use the Pythagorean theorem to find the length of the interior sides of the triangle: the lengths are $\sqrt{145}$ and 10. The longest side is 15 (the length of the rectangle). Now check whether this triangle's side lengths make $a^2 + b^2 = c^2$. Because $145 + 100 = 245$, not 225, the converse of the Pythagorean theorem states this triangle is not a right triangle.

4. (From IM 8.8.8, Desmos 8.8.08)

Right Triangle	<i>a</i>	<i>b</i>	<i>c</i>
<i>M</i>	12	5	13
<i>N</i>	20	21	29

5. (From IM 8.8.6, Desmos 8.8.06)

✓ *B*

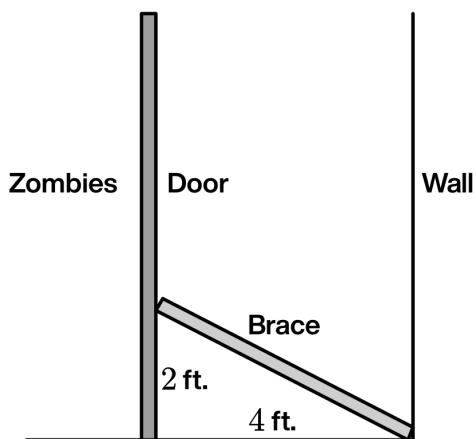
6. (From IM 8.4.5, Desmos 8.4.05)

500 dollars

Responses vary. $\frac{20x - 9\,000}{20} = \frac{x}{10}$, where x represents the number of dollars he exchanged. Rewrite the equation as $20x - 9\,000 = 2x$, and then solve to find $x = 500$.

1. A man is trying to zombie proof his house. He wants to cut a length of wood that will brace the door against the wall. The wall is 4 feet away from the door, and he wants the brace to rest 2 feet up the door.

About how long should he cut the brace?



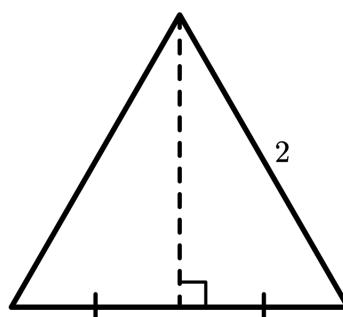
2. At a restaurant, a trash can's opening is rectangular and measures 7 inches by 9 inches. The serving trays measure 12 inches by 16 inches. Jada says it is impossible for a tray to accidentally fall through the trash can opening because the shortest side of a tray is longer than either side of the opening.

Do you agree or disagree with Jada's explanation? Explain your thinking.

3. Here is an equilateral triangle. The length of each side is 2 units. A height is drawn. In an equilateral triangle, a line drawn from one corner to the center of the opposite side represents the height.

3.1 Find the exact height.

3.2 Find the area of the equilateral triangle.



3.3 **Challenge:** Using x for the length of each side in the equilateral triangle, express its area in terms of x .



Unit 8.8, Lesson 10: Practice Problems

4. A standard city block in Manhattan is a rectangle measuring 80 meters by 270 meters. A resident wants to get from one corner of a block containing a park to the opposite corner of the block. She wonders about the difference between cutting diagonally through the park and going around the park along the streets.

How much shorter would her walk be if she cuts through the park? Round your answer to the nearest meter.

5. Select **all** the sets of side lengths that form a right triangle.

8, 7, 15

$\sqrt{8}$, 11, $\sqrt{129}$

4, 10, $\sqrt{84}$

$\sqrt{1}$, 2, $\sqrt{3}$

6. For each pair of numbers, circle the larger number. Estimate how many times as large.

6.1 $12 \cdot 10^9$ or $4 \cdot 10^9$

6.2 $1.5 \cdot 10^{12}$ or $3 \cdot 10^{12}$

6.3 $20 \cdot 10^4$ or $6 \cdot 10^5$

7. A line contains the point $(3, 5)$.

If the line has a negative slope, which of these points could also be on the line?

A. $(4, 7)$

C. $(6, 5)$

B. $(2, 0)$

D. $(5, 4)$

8. Noah and Han are preparing for a jump rope contest. Noah can jump 40 times in 0.5 minutes. Han can jump y times in x minutes, where $y = 78x$.

If they both jump for 2 minutes, who jumps more times?

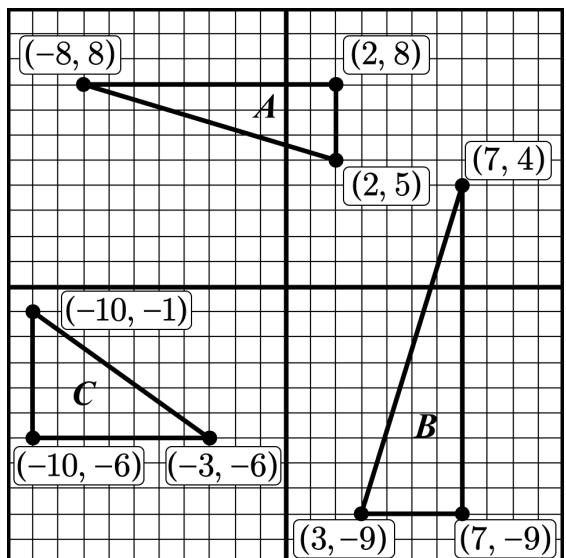
How many more?

1. $\sqrt{20}$ (or around 4.5 feet)
2. No. *Responses vary.* It is impossible for the tray to fall through the opening, but not for the reason Jada gives. The longest dimension of the trash can opening is the diagonal. The diagonal is $\sqrt{130}$ inches long because $7^2 + 9^2 = 130$. The diagonal is between 11 and 12 inches long because $11^2 < 130 < 12^2$. The tray cannot fall through the opening because the diagonal is a little shorter than the shortest dimension of the tray.
- 3.1 $\sqrt{3}$ units (or equivalent)
- 3.2 $\sqrt{3}$ square units (or equivalent)
- 3.3 $\frac{x^2\sqrt{3}}{4}$ square units (or equivalent)
4. 68 meters
5. (From IM 8.8.9, Desmos 8.8.09)
✓ 4, 10, $\sqrt{84}$
✓ $\sqrt{8}$, 11, $\sqrt{129}$
✓ $\sqrt{1}$, 2, $\sqrt{3}$
- 6.1 (From IM 8.7.10, Desmos 8.7.08)
 $12 \cdot 10^9$
3 times as large
- 6.2 $3 \cdot 10^{12}$
2 times as large
- 6.3 $6 \cdot 10^5$
3 times as large
7. (From IM 8.3.10, Desmos 8.3.08)
D. (5, 4)
8. (From IM 8.3.4, Desmos 8.3.03)
Noah. Noah jumps 160 times and Han jumps 156 times, so Noah jumps 4 more times.

1. Three right triangles are drawn in the coordinate plane, and the coordinates of their vertices are labeled.

For each right triangle, label the lengths of the sides.

Triangle	Smaller Leg	Longer Leg	Hypotenuse
A			
B			
C			



2. Find the distance between each pair of points.

If you get stuck, try plotting the points on graph paper.

Points	Distance Between Points
$P = (0, -11)$ and $Q = (0, 2)$	
$A = (0, 0)$ and $B = (-3, -4)$	
$C = (8, 0)$ and $D = (0, -6)$	

3. Find the distance between each pair of points.

If you get stuck, try plotting the points on graph paper.

Points	Distance Between Points
$K = (5, 0)$ and $L = (-4, 0)$	
$M = (-21, -29)$ and $N = (0, 0)$	

Unit 8.8, Lesson 11: Practice Problems

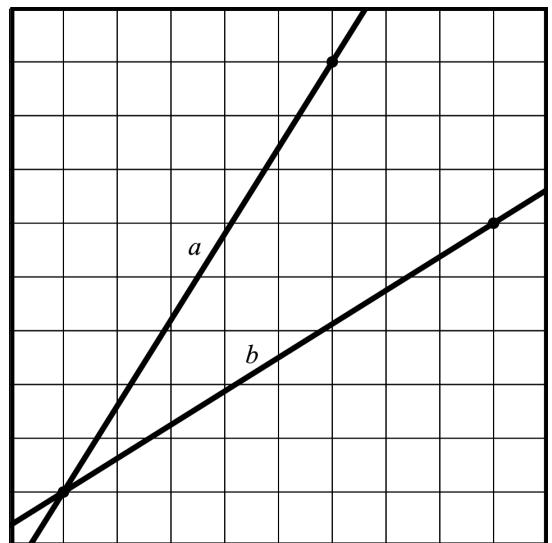
4.1 Which line has a slope of 0.625 ?

- A. Line *a*
- B. Line *b*

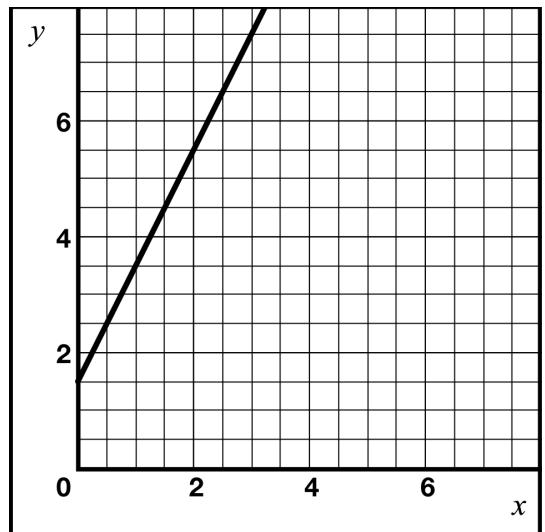
4.2 Which line has a slope of 1.6 ?

- A. Line *a*
- B. Line *b*

4.3 Explain why the slopes of the lines are 0.625 and 1.6 .



5. Write an equation for the graph.



1.

Triangle	Smaller Leg	Longer Leg	Hypotenuse
A	3	10	$\sqrt{109}$
B	4	13	$\sqrt{185}$
C	5	7	$\sqrt{74}$

2.

Points	Distance Between Points
$P = (0, -11)$ and $Q = (0, 2)$	13 units
$A = (0, 0)$ and $B = (-3, -4)$	5 units
$C = (8, 0)$ and $D = (0, -6)$	10 units

3.

Points	Distance Between Points
$K = (5, 0)$ and $L = (-4, 0)$	9 units
$M = (-21, -29)$ and $B = (0, 0)$	$\sqrt{1282}$ units

4.1 (From IM 8.2.10, Desmos 8.2.09)

B. Line b 4.2 A. Line a

4.3 Responses vary. To find the slopes, construct triangles perpendicular to the axes whose hypotenuses lie on their line. The slopes of the lines are then the quotient of the length of the vertical edge by the length of the horizontal edge.

5. (From IM 8.3.7, Desmos 8.3.05)

$$y = 2x + 1.5$$



Unit 7.4, Lesson 13: Practice Problems

Name _____

Warm-Up

Select **all** of the true statements.

- 2.25 > 2 2.25 < 2 -2.25 > -2 -2.25 < -2 2.25 > -2

Practice

1.1 Finish writing $\frac{3}{8}$ as a decimal.

$$\begin{array}{r} 0.3 \\ 8) 3.00 \\ \underline{-24} \end{array}$$

1.2 Is the decimal representation of $\frac{3}{8}$ terminating or repeating?

Explain how you know.

Use long division to write each fraction as a decimal.

2.1 $\frac{9}{25}$

2.2 $\frac{11}{30}$

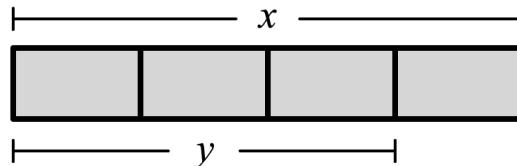
2.3 $\frac{4}{11}$

Unit 7.4, Lesson 13: Practice Problems

- 2.4 What is similar about these answers and what is different?
- 2.5 Which of these fractions has the greatest value? How do you know?

For each description or equation, decide whether it matches Diagram A, Diagram B, or neither.

3.1 An increase by $\frac{1}{4}$ _____

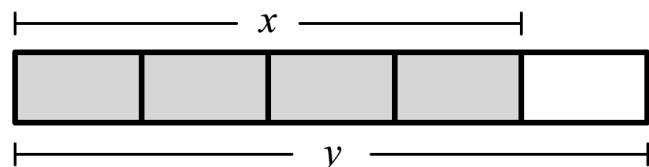
Diagram A

3.2 An increase by $\frac{1}{3}$ _____

3.3 A decrease by $\frac{1}{5}$ _____

3.4 A decrease by $\frac{1}{4}$ _____

3.5 $y = 1.\bar{6}x$ _____

Diagram B

3.6 $y = 1.\bar{3}x$ _____

3.7 $y = 0.75x$ _____

3.8 $y = 1.25x$ _____

Explore

Make a true statement by filling in the blanks using any of the digits 1 to 9 without repeating.

$$\frac{\square}{\square} = 0.\square\square$$

Reflect

1. Draw a heart next to the question you are most proud of.
2. Use the space below to ask one question you have or to share something you are proud of.

Warm-Up

2.25 > 2 2.25 < 2 -2.25 > -2 -2.25 < -2 2.25 > -2

Practice

1.1 0.375

1.2 Terminating. *Explanations vary.* This decimal stops after three digits with no remainder.

2.1 0.36

2.2 $0.\overline{36}$

2.3 $0.\overline{36}$

2.4 *Responses vary.* All three fractions have the same values in the tenths and hundredths place, but $\frac{9}{25}$ terminates while $\frac{11}{30}$ and $\frac{4}{11}$ repeat.

2.5 $\frac{11}{30}$. *Explanations vary.* The decimal representations of all three fractions have the same values in the tenths and hundredths place, and $\frac{11}{30}$ has the greatest value in the thousandths place.

3.1 Diagram B

3.2 Diagram A

3.3 Diagram B

3.4 Diagram A

3.5 Neither

3.6 Neither

3.7 Diagram A

3.8 Diagram B

Explore

Responses vary.

See similar problems at openmiddle.com

**Unit 8.8, Lesson 12: Practice Problems**

Name _____

Andre and Jada are discussing how to write $\frac{17}{20}$ as a decimal. Andre says he can get the decimal by using long division to divide 17 by 20. Jada says she can multiply by $\frac{5}{5}$ to get an equivalent fraction with a denominator of 100, and then write the number of hundredths as a decimal.

- 1.1 Do both of these strategies work?

Which strategy do you prefer? Explain your reasoning.

- 1.2 Write $\frac{17}{20}$ as a decimal. Explain your thinking.

2. Write each expression as a decimal.

Expression	Decimal
$\sqrt{\frac{9}{100}}$	
$\frac{99}{100}$	
$\sqrt{\frac{9}{16}}$	
$\frac{23}{10}$	

3. Write each expression as a fraction.

Expression	Fraction
$\sqrt{0.81}$	
0.0276	
$\sqrt{0.04}$	
10.01	

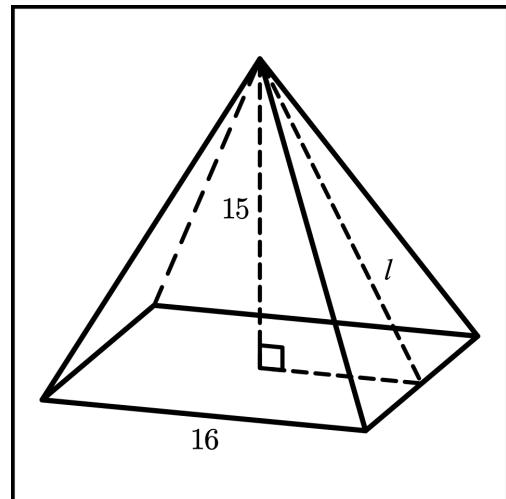
Unit 8.8, Lesson 12: Practice Problems

4. For each equation, write the positive solution as a whole number or using square root or cube root notation.

Equation	Positive Solution
$x^2 = 90$	$x =$
$p^3 = 90$	$p =$
$z^2 = 1$	$z =$
$y^3 = 1$	$y =$
$w^2 = 36$	$w =$
$h^3 = 64$	$h =$

Here is a right square pyramid.

- 5.1 What is the slant height l of the triangular face of the pyramid? If you get stuck, use a cross section of the pyramid.



- 5.2 What is the surface area of the pyramid?

1.1 Yes.

Responses vary.

- I prefer Jada's method because I can calculate it mentally.
- I prefer Andre's method because it always works, even if the denominator is not a factor of 100.

1.2 0.85

Responses vary.

$$\frac{17}{20} \cdot \frac{5}{5} = \frac{85}{100}, \text{ so } \frac{17}{20} \text{ equals } 0.85.$$

2.

Expression	Decimal
$\sqrt{\frac{9}{100}}$	0.3
$\frac{99}{100}$	0.99
$\sqrt{\frac{9}{16}}$	0.75
$\frac{23}{10}$	2.3

3.

Expression	Fraction
$\sqrt{0.81}$	$\frac{9}{10}$
0.0276	$\frac{276}{10,000}$
$\sqrt{0.04}$	$\frac{1}{5}$
10.01	$\frac{1001}{100}$

4. (From IM 8.8.13, Desmos 8.8.05)

Equation	Positive Solution
$x^2 = 90$	$x = \sqrt{90}$
$p^3 = 90$	$p = \sqrt[3]{90}$
$z^2 = 1$	$z = 1$
$y^3 = 1$	$y = 1$
$w^2 = 36$	$w = 6$
$h^3 = 64$	$h = 4$

 5.1 (From IM 8.8.10, Desmos 8.8.10)
 17 units

5.2 800 square units

**Unit 8.8, Lesson 13: Practice Problems**

Name _____

1. Elena and Han are discussing how to write the repeating decimal $x = 0.\overline{137}$ as a fraction.

Han says that $0.\overline{137}$ equals $\frac{13,764}{99,900}$. "I calculated $1000x = 137.\overline{777}$ because the decimal begins repeating after three digits. Next, I subtracted to get $999x = 137.64$. Then, I multiplied by 100 to get rid of the decimal: $99,900x = 13,764$. Finally, I divided to get $x = \frac{13,764}{99,900}$."

Elena says that $0.\overline{137}$ equals $\frac{124}{900}$. "I calculated $10x = 1.\overline{377}$ because one digit repeats. Next, I subtracted to get $9x = 1.24$. Then, I did what Han did to get $900x = 124$ and finally divided to get $x = \frac{124}{900}$."

Who is correct? Circle your answer.

- A. Han B. Elena C. Both D. Neither

Explain your thinking.

- 2.1 How are the numbers 0.444 and $0.\overline{4}$ the same?

- 2.2 How are the numbers 0.444 and $0.\overline{4}$ different?

- 3.1 Fill in the blank next to each fraction with the letter of its decimal representation.

$$\frac{2}{3} : \underline{\hspace{2cm}}$$

A. $3.\overline{45}$

D. $0.\overline{23}$

$$\frac{126}{37} : \underline{\hspace{2cm}}$$

B. $0.\overline{6}$

E. 3.450

C. $3.\overline{405}$

F. $0.\overline{6}$

- 3.2 Write each decimal as a fraction.

Decimal	Fraction
$0.\overline{75}$	
$0.\overline{3}$	

Unit 8.8, Lesson 13: Practice Problems

4. Fill in the blank next to each fraction with the letter of its decimal representation.

$\frac{48}{99} : \underline{\hspace{2cm}}$

$\frac{7}{90} : \underline{\hspace{2cm}}$

A. 0.07 D. 0. $\overline{05}$

$\frac{5}{99} : \underline{\hspace{2cm}}$

$\frac{5}{9} : \underline{\hspace{2cm}}$

B. 0.0 $\overline{7}$ E. 0.4 $\overline{8}$

$\frac{44}{90} : \underline{\hspace{2cm}}$

$\frac{7}{100} : \underline{\hspace{2cm}}$

C. 0. $\overline{5}$ F. 0.4 $\overline{8}$

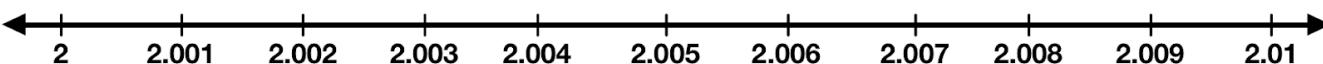
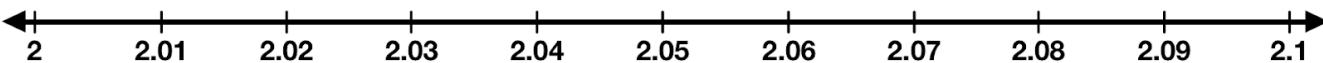
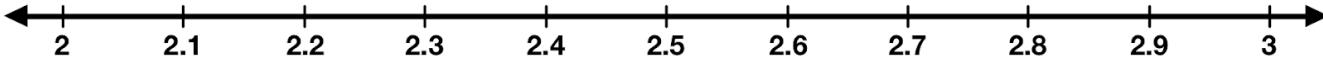
5. Write each decimal as a fraction.

Decimal	Fraction
0. $\overline{7}$	
0. $\overline{2}$	
0.1 $\overline{3}$	
0.1 $\overline{4}$	

Decimal	Fraction
0. $\overline{03}$	
0.63 $\overline{8}$	
0.52 $\overline{4}$	
0.1 $\overline{5}$	

6. Here is some information related to the value of $\sqrt{5}$: $2.2^2 = 4.84$ and $2.3^2 = 5.29$.

Without directly calculating the square root, plot $\sqrt{5}$ on all three number lines using successive approximation.



Unit 8.8, Lesson 13: Practice Problems**Answer Key**

1. Both. *Responses vary.* Han and Elena both get fractions that are equal to $0.\overline{137}$. These are equivalent fractions, but Elena's fraction has fewer common factors in the numerator and denominator. The equivalent fraction with the lowest possible denominator is $\frac{31}{225}$.

- 2.1 *Responses vary.* They are the same in that they are both rational numbers between 0.4 and 0.5, and the first three digits in their decimal expansions are the same.

- 2.2 *Responses vary.* They are different in that $0.\overline{4}$ is greater than 0.444 because it has a greater digit in the ten-thousandths place. 0.444 is a terminating decimal, while $0.\overline{4}$ is an infinitely repeating decimal.

- 3.1 $\frac{2}{3}$: B. $0.\overline{6}$
 $\frac{126}{37}$: C. $3.\overline{405}$

3.2

Decimal	Fraction
$0.\overline{75}$	$\frac{75}{99}$ (or equivalent)
$0.\overline{3}$	$\frac{1}{3}$ (or equivalent)

4.

$$\frac{48}{99} : F. 0.\overline{48} \qquad \frac{7}{90} : B. 0.0\overline{7}$$

$$\frac{5}{99} : D. 0.\overline{05} \qquad \frac{5}{9} : C. 0.\overline{5}$$

$$\frac{44}{90} : E. 0.4\overline{8} \qquad \frac{7}{100} : A. 0.07$$

5.

Decimal	Fraction
$0.\overline{7}$	$\frac{7}{9}$ (or equivalent)
$0.\overline{2}$	$\frac{2}{9}$ (or equivalent)
$0.1\overline{3}$	$\frac{2}{15}$ (or equivalent)
$0.\overline{14}$	$\frac{14}{99}$ (or equivalent)
$0.\overline{03}$	$\frac{3}{99}$ (or equivalent)
$0.6\overline{38}$	$\frac{632}{990}$ (or equivalent)
$0.52\overline{4}$	$\frac{472}{900}$ (or equivalent)
$0.1\overline{5}$	$\frac{14}{90}$ (or equivalent)

First number line: $\sqrt{5}$ should be between 2.2 and 2.2.**Second number line:** $\sqrt{5}$ should be between 2.23 and 2.24.**Third number line:** $\sqrt{5}$ should be between 2.236 and 2.237.

1. State whether each number is rational or irrational.

Number	Rational or Irrational
$\frac{-13}{3}$	
$\sqrt{37}$	
- 77	
$-\sqrt{100}$	
$-\sqrt{12}$	
0.1234	

2. Select the best explanation for why $-\sqrt{10}$ is irrational.
- A. $-\sqrt{10}$ is irrational because it is not rational.
 - B. $-\sqrt{10}$ is irrational because it is less than zero.
 - C. $-\sqrt{10}$ is irrational because it is not a whole number.
 - D. $-\sqrt{10}$ is irrational because if I put $-\sqrt{10}$ into a calculator, I get -3.16227766 , which does not make a repeating pattern.
- 3.1 Give an example of a rational number and explain how you know it is rational.
- 3.2 Give three examples of irrational numbers.
4. Select all the irrational numbers.

$\frac{-123}{45}$

$\frac{2}{3}$

$\sqrt{14}$

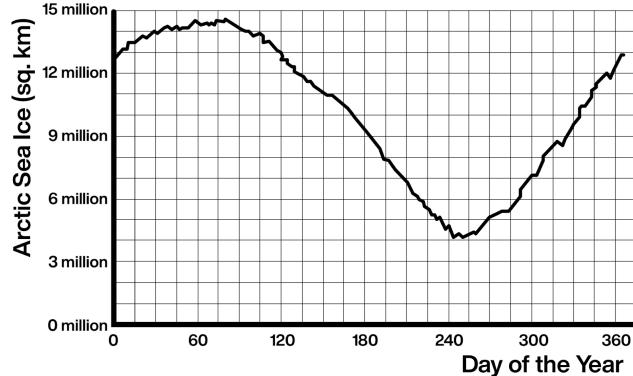
$\sqrt{99}$

$\sqrt{100}$

$\sqrt{64}$

Unit 8.8, Lesson 14: Practice Problems

5. Which value is an exact solution of the equation $m^2 = 14$? Circle your answer.
- A. 7 B. $\sqrt{14}$ C. 3.74 D. $\sqrt{3.74}$
6. A square has vertices $(0, 0)$, $(5, 2)$, $(3, 7)$, and $(-2, 5)$. Which statement is true?
- A. The square's side length is between 6 and 7.
B. The square's side length is between 5 and 6.
C. The square's side length is 5.
D. The square's side length is 7.
7. Rewrite each expression using a single exponent.
- | | | | |
|-------------------|------------------|---------------------------|------------------------|
| 7.1 $(10^2)^{-3}$ | 7.2 $(3^{-3})^2$ | 7.3 $3^{-5} \cdot 4^{-5}$ | 7.4 $2^5 \cdot 3^{-5}$ |
|-------------------|------------------|---------------------------|------------------------|
8. The graph represents the area of arctic sea ice in square kilometers as a function of the day of the year in 2016.
- 8.1 Give an approximate interval of days when the area of arctic sea ice was decreasing.
- 8.2 On which days was the area of arctic sea ice 12 million square kilometers?
9. A high school is hosting an event for seniors but will also allow some juniors to attend.



The principal approved the event for 200 students and decided the number of juniors should be 25% of the number of seniors.

How many juniors will be allowed to attend? If you get stuck, try writing two equations that each represent the number of juniors and seniors at the event.

1.

Number	Rational or Irrational
$\frac{-13}{3}$	Rational
$\sqrt{37}$	Irrational
-77	Rational
$-\sqrt{100}$	Rational
$-\sqrt{12}$	Irrational
0.1234	Rational

2. (From IM 8.8.3, Desmos 8.8.14)
 A. $-\sqrt{10}$ is irrational because it is not rational.

- 3.1 (From IM 8.8.3, Desmos 8.8.14)
Responses vary.
 $\frac{2}{3}$ is a rational number because rational numbers are fractions and their opposites, and $\frac{2}{3}$ is a fraction.

- 3.2 Responses vary.
- $\sqrt{2}$
 - $\sqrt{12}$
 - $\sqrt{1.5}$

4. (From IM 8.8.3, Desmos 8.8.14)
 ✓ $\sqrt{14}$
 ✓ $-\sqrt{99}$

5. $\sqrt{14}$

6. (From IM 8.8.2, Desmos 8.8.02)
 B. The square's side length is between 5 and 6.

7. (From IM 8.7.8, Desmos 8.7.06)
- 10^{-6} (or equivalent)
 - 3^{-6} (or equivalent)
 - 12^{-5} (or equivalent)
 - $\left(\frac{2}{3}\right)^5$ (or equivalent)

- 8.1 (From IM 8.5.5, Desmos 8.5.05)
Responses vary. Correct responses should be close to: "Day 75 to day 250."

- 8.2 Days 135, 350, and 360

9. (From IM 8.4.14, Desmos 8.4.13)
 40 juniors