desmos **Science Mom Lesson 63**

**Unit 8.3, Lesson 9: Practice Problems** Name ______________________________

1.1 Suppose you wanted to graph the equation $y =- 4x - 1$. Describe the steps you would take to draw the graph.

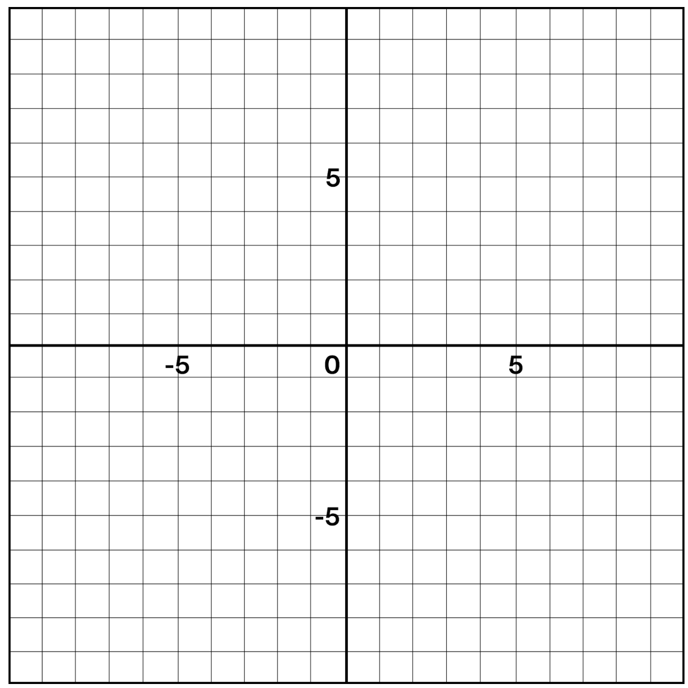
1.2 How would you check that the graph you drew is correct?

Graph the following lines and then write an equation for each:

2.1 A line with a slope of $0$ and a $y$-intercept of $5$.

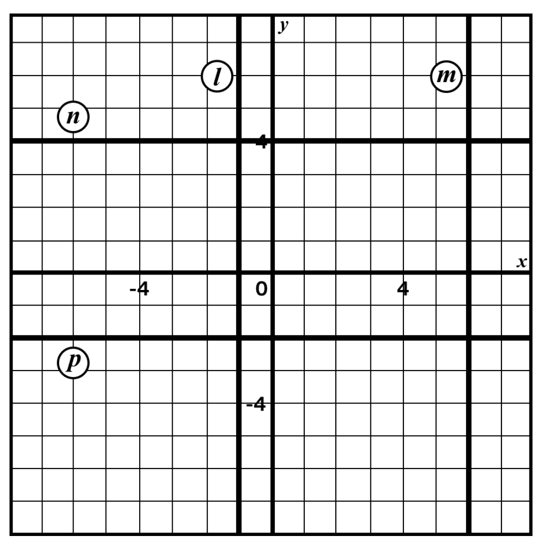
2.2 A line with a slope of $2$ and a $y$-intercept of $-1$.

2.3 A line with a slope of $-\frac{1}{2}$ and a $y$-intercept of $1$.

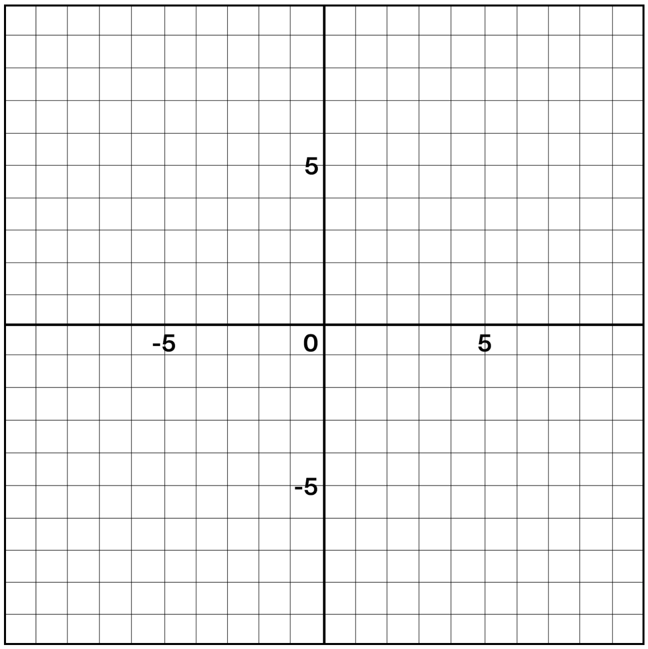



3. Write an equation for each line.

| Line | Equation |
|---|---|
| $l$ | |
| $m$ | |
| $n$ | |
| $p$ | |



4. Write an equation for a line that passes through $(2,\ 5)$ and $(6,\ 7)$.




A publisher wants to know the thickness of a new book. The book has a front cover and a back cover, each with a thickness of $\frac{1}{4}$ of an inch. The paper has a thickness of $\frac{1}{4}$ inch per $100$ pages.

5.1 Write an equation that represents the total width of the book, $y$, for every $100$ pages of paper, $x$.

5.2 The publisher chooses to have front and back covers with a thickness of $\frac{1}{3}$ of an inch instead. Write an equation that represents the **new** total width of the book, $y$, for every $100$ pages of paper, $x$.

**Unit 8.3, Lesson 9: Practice Problems** **Answer Key**

1.1 *Responses vary.* I would draw the graph by starting with the intercept $(0, -1)$. Use the slope of $-4$ to find other points by increasing by $1$ on the $x$-axis and decreasing by $4$ on the $y$-axis. Then find two or more solutions to the equation and graph the points whose coordinates are the ordered pairs of the solutions. Then draw a line connecting the points.

1.2 *Responses vary.* I would check by identifying the coordinates of some points on the line and substitute them into the equation to make sure they make the equation true.

2.1 $y = 5$

2.2 $y = 2x - 1$

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

3.

| Line | Equation |
|---|---|
| $l$ | $x = -1$ |
| $m$ | $x = 6$ |
| $n$ | $y = 4$ |
| $p$ | $y = -2$ |

4. $y = \frac{1}{2}x + 4$ (or equivalent)

5.1 $y = \frac{1}{2} + \frac{1}{4}x$

5.2 $y = \frac{2}{3} + \frac{1}{4}x$

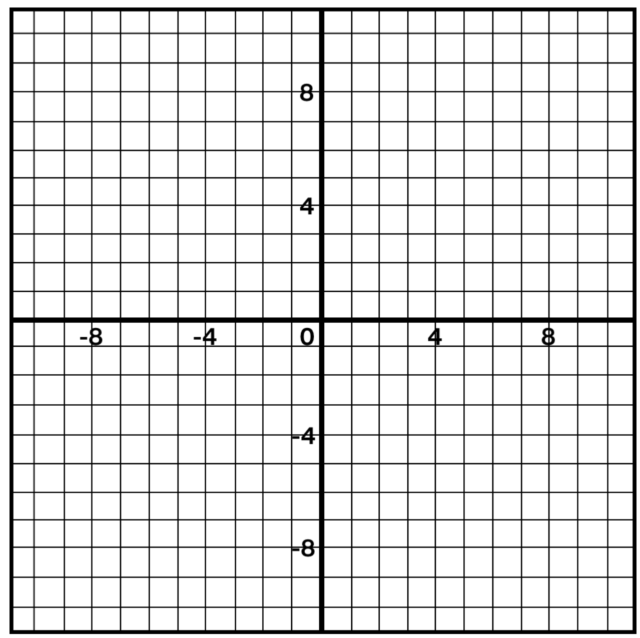
**Unit 8.3, Lesson 10: Practice Problems** Name ____________________

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

- ☐ $(0, 2)$
- ☐ $(0, 6)$
- ☐ $(2, 3)$
- ☐ $(3, -2)$
- ☐ $(3, 0)$
- ☐ $(6, -2)$

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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**Unit 8.3, Lesson 10: Practice Problems**

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

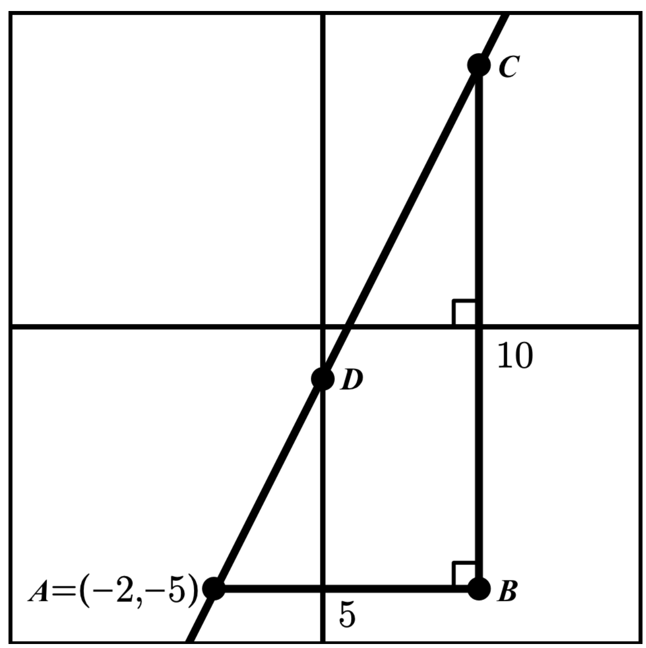
| | | |
|---|---|---|
| A. $2x + 3y = 7$ | | $(-3, -7), (0, -4), (-1, -5)$ |
| B. $3x = \frac{y}{2}$ | | $(3\frac{1}{2}, 0), (-1, 3), (0, 2\frac{1}{3})$ |
| C. $x - y = 4$ | | $(14, 21), (2, 3), (8, 12)$ |
| D. $y = -x + 1$ | | $(0.5, 3), (1, 6), (1.2, 7.2)$ |
| E. $y = 1.5x$ | | $(\frac{1}{2}, \frac{1}{2}),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

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 $D$.



**Unit 8.3, Lesson 10: Practice Problems**

## Answer Key

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.** | $(3\frac{1}{2}, 0), (-1, 3), (0, 2\frac{1}{3})$ |
| 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. $B = (3, -5)$
   $C = (3, 5)$
   $D = (0, -1)$

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**Unit 8.3, Lesson 11: Practice Problems** Name ______________________________

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

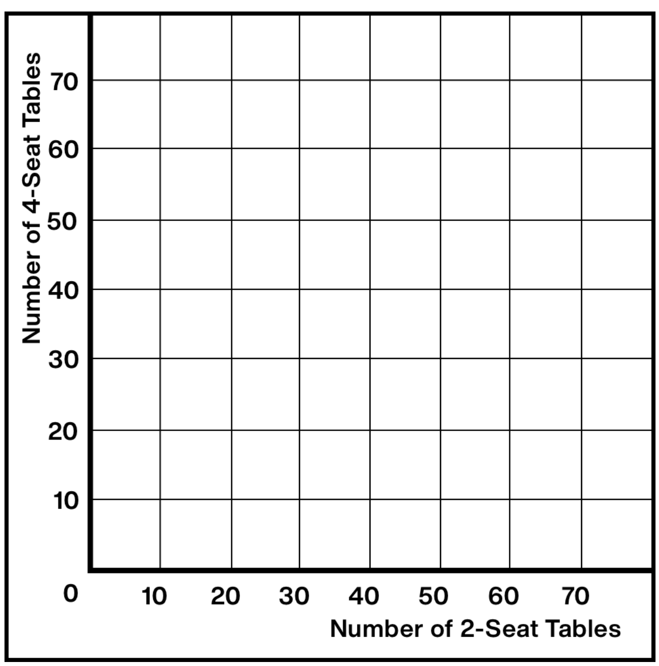
The total number of people that can be seated in the restaurant is $120$.

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?

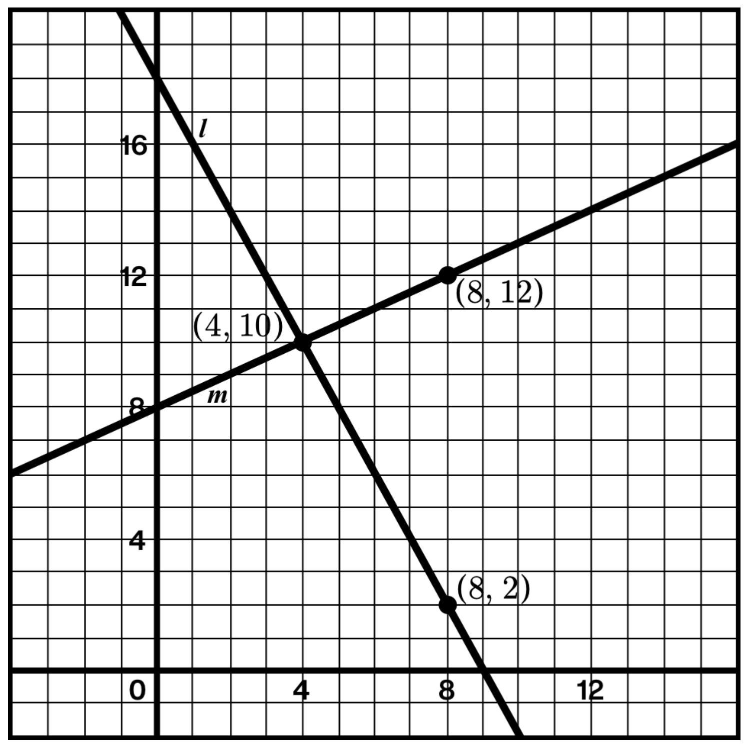
1.5 Circle the $x$- and $y$-intercepts on your graph. Interpret the meaning of each intercept.

**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: $\frac{1}{2}$

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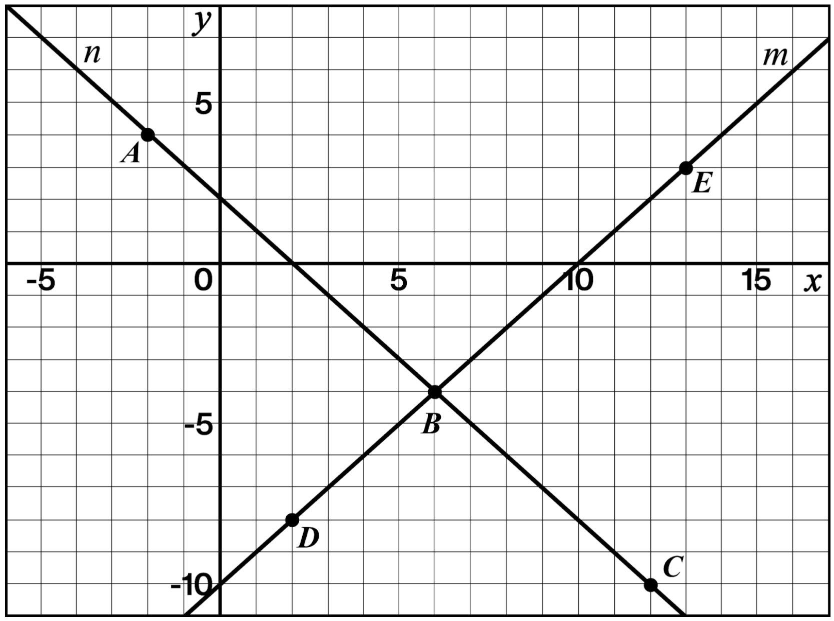
**Unit 8.4, Lesson 9: Practice Problems** Name ______________________________

Use this graph to answer the questions.




| | |
|---|---|
| 1.1 Which line, $m$ or $n$, goes with each statement?<br><br>a. A set of points where the coordinates of each point have a sum of $2$.<br><br>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:<br><br>a. Two numbers with a sum of $2$.<br><br>b. Two numbers where the $y$-coordinate is $10$ less than the $x$-coordinate.<br><br>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: $4x - 4 = 4x + \_\_\_\_$ .

Fill in the blanks to make the following statements true.

| | | |
|---|---|---|
| 2.1 True for no values of $x$.<br><br>$4x - 4 = 4x + \_\_\_\_$ | 2.2 True for all values of $x$.<br><br>$4x - 4 = 4x + \_\_\_\_$ | 2.3 True for one value of $x$.<br><br>$4x - 4 = 4x + \_\_\_\_$ |

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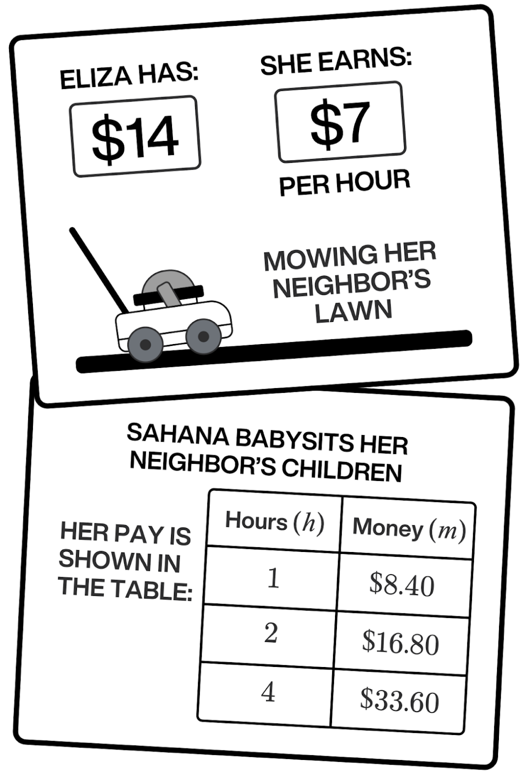
**Unit 8.4, Lesson 9: Practice Problems**

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).

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

**Unit 8.4, Lesson 9: Practice Problems** **Answer Key**

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.)

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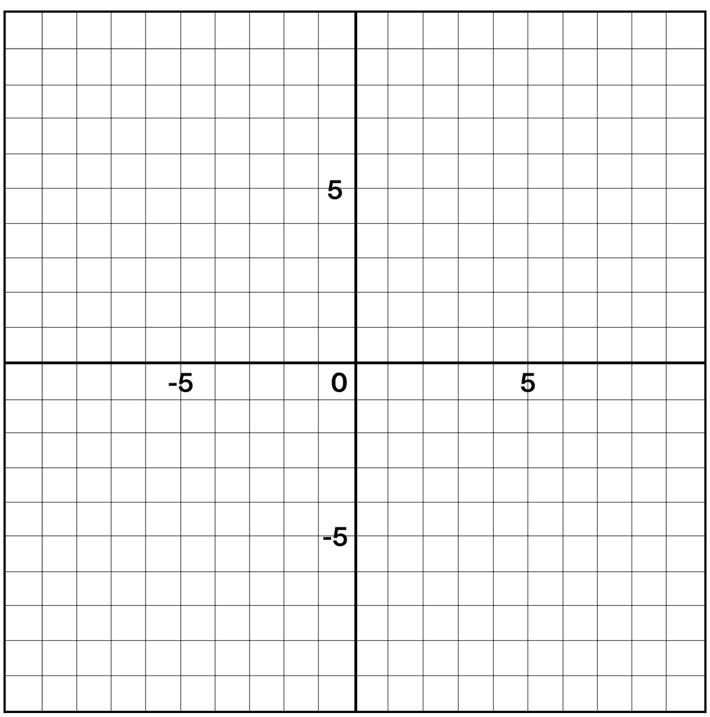
**Unit 8.4, Lesson 10: Practice Problems** Name ______________________________

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.

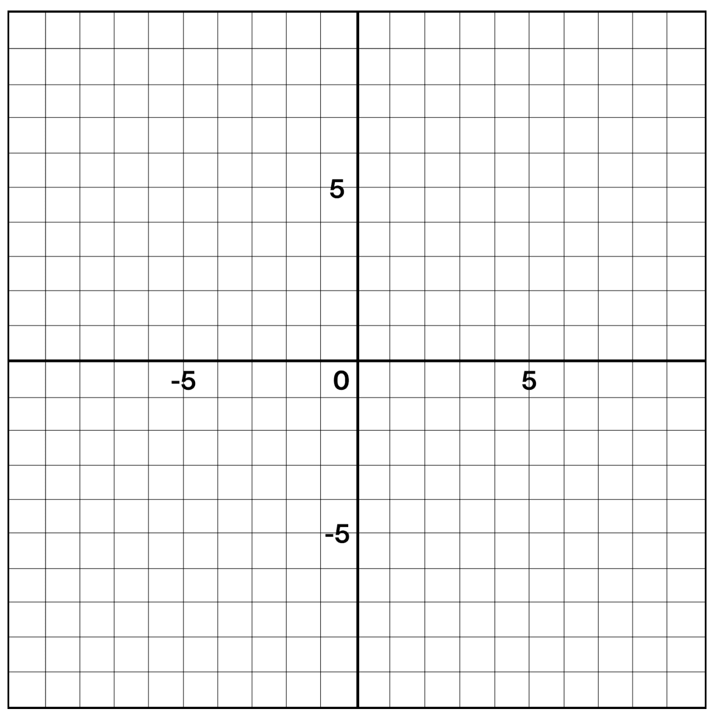
Use the graph if it helps you with your thinking.




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.



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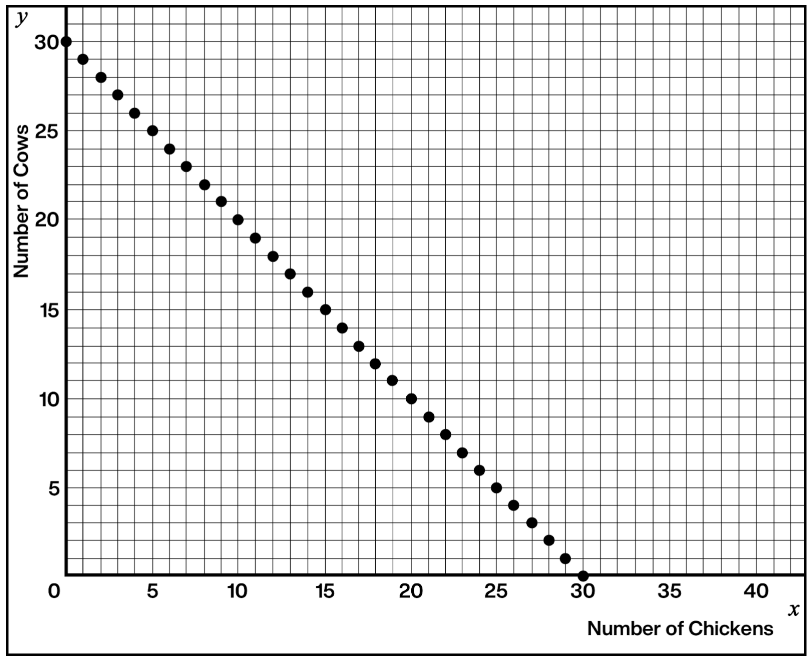
**Unit 8.4, Lesson 10: Practice Problems**

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:

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

**Unit 8.4, Lesson 10: Practice Problems**

# Answer Key

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)

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

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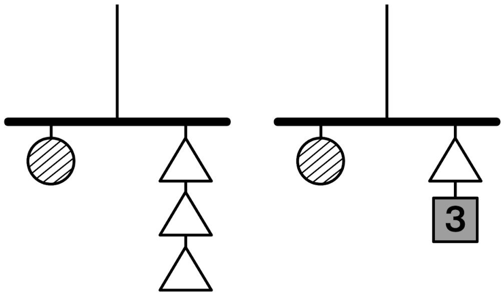
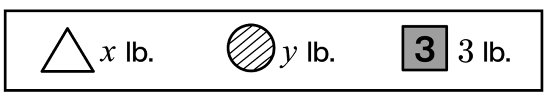
**Unit 8.4, Lesson 11: Practice Problems** Name ______________________________

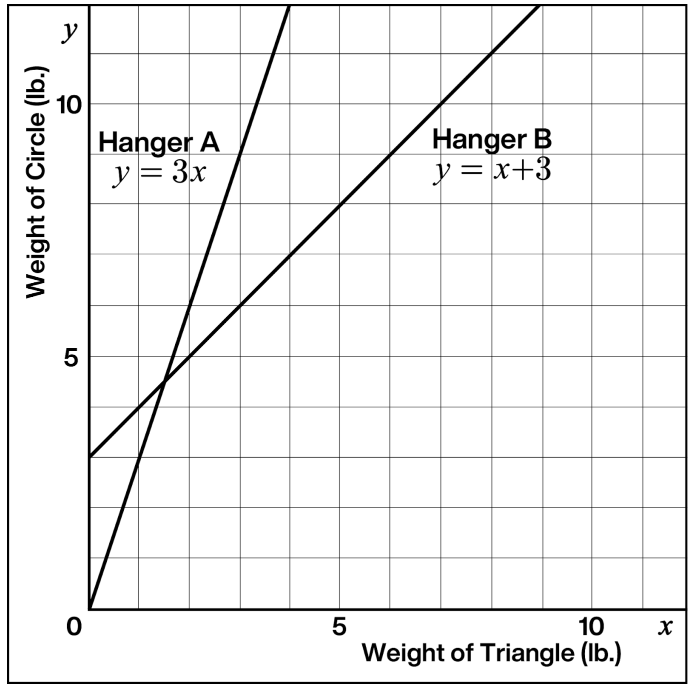
The hangers and the graph represent the same system of equations.




**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?

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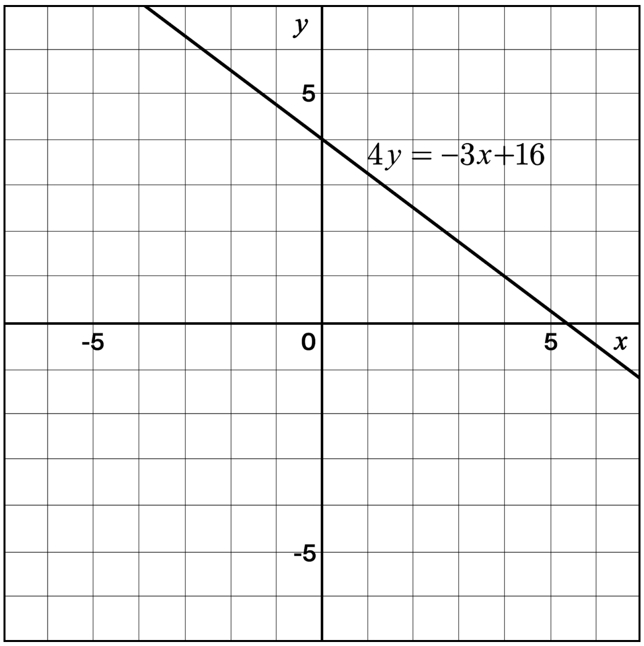
**Unit 8.4, Lesson 11: Practice Problems**

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.

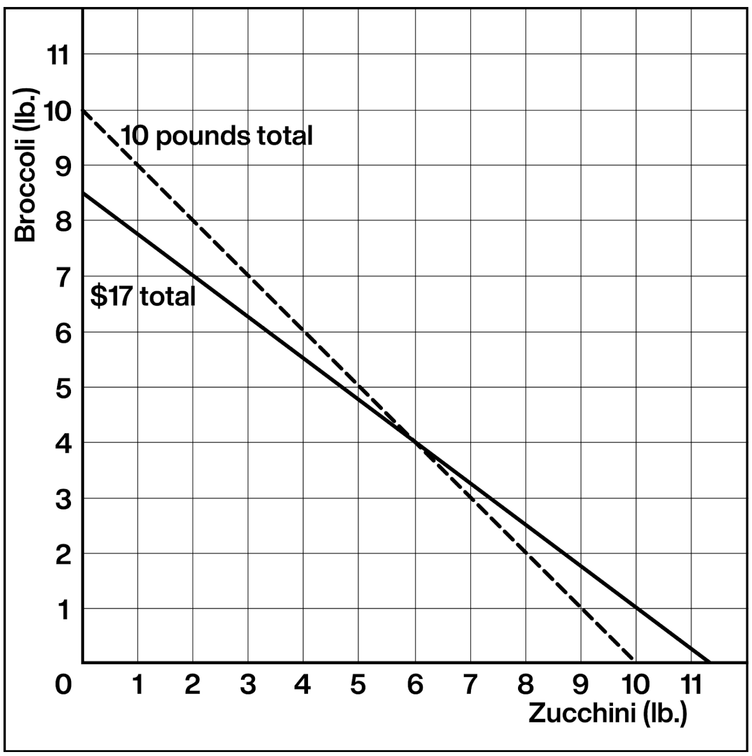
2.3 Write a second equation whose graph goes through $(0, 2)$ and $(4, 1)$ so that the system has one solution.

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?



**Unit 8.4, Lesson 11: Practice Problems** **Answer Key**

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.

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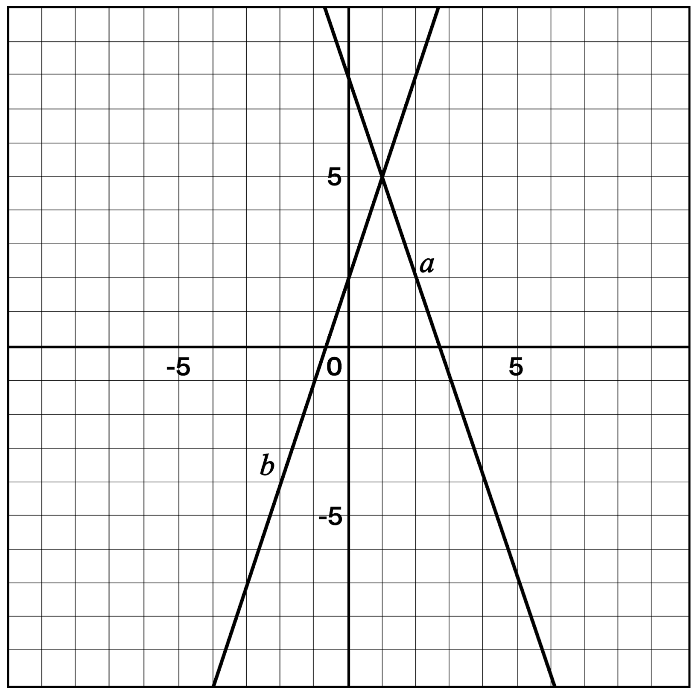
**Unit 8.4, Lesson 12: Practice Problems** Name ________________________

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.

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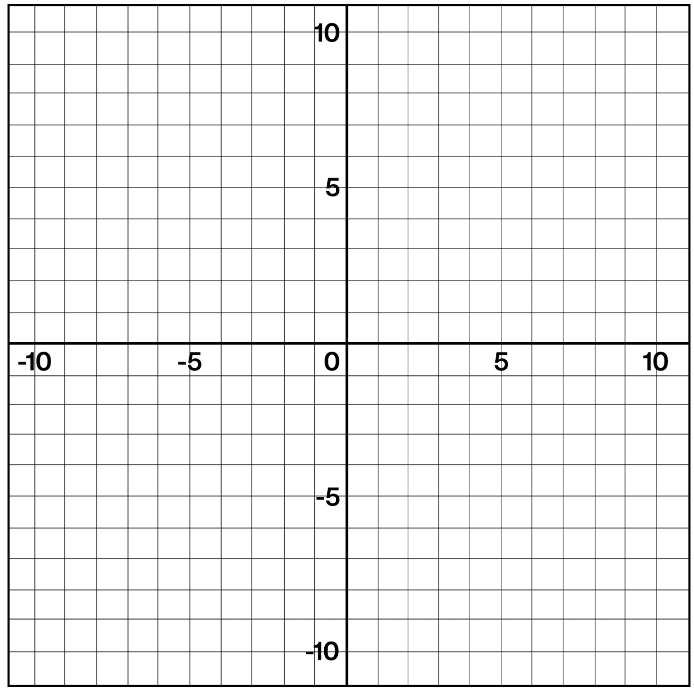
**Unit 8.4, Lesson 12: Practice Problems**

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:

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

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**Unit 8.4, Lesson 12: Practice Problems** **Answer Key**

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. $x = 0$

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**Unit 8.4, Lesson 13: Practice Problems** Name ____________________

| | |
|---|---|
| 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. |

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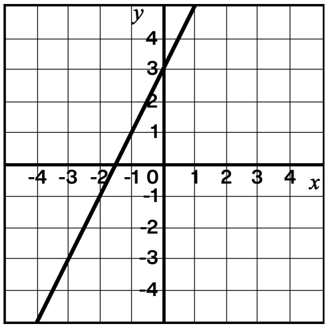
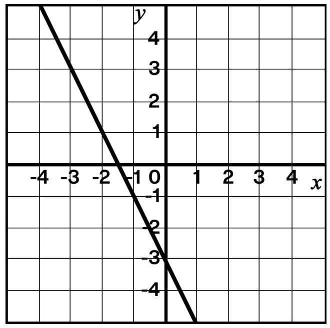
**Unit 8.4, Lesson 13: Practice Problems**

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

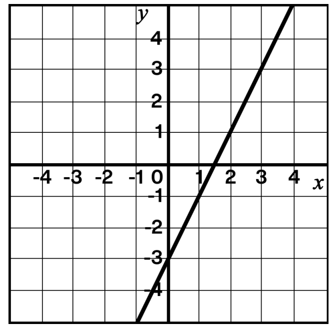
A.




B.




C.

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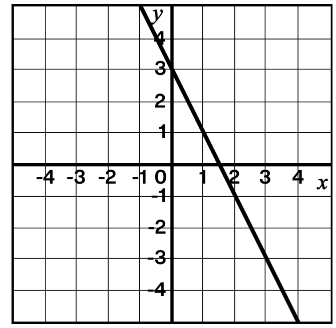
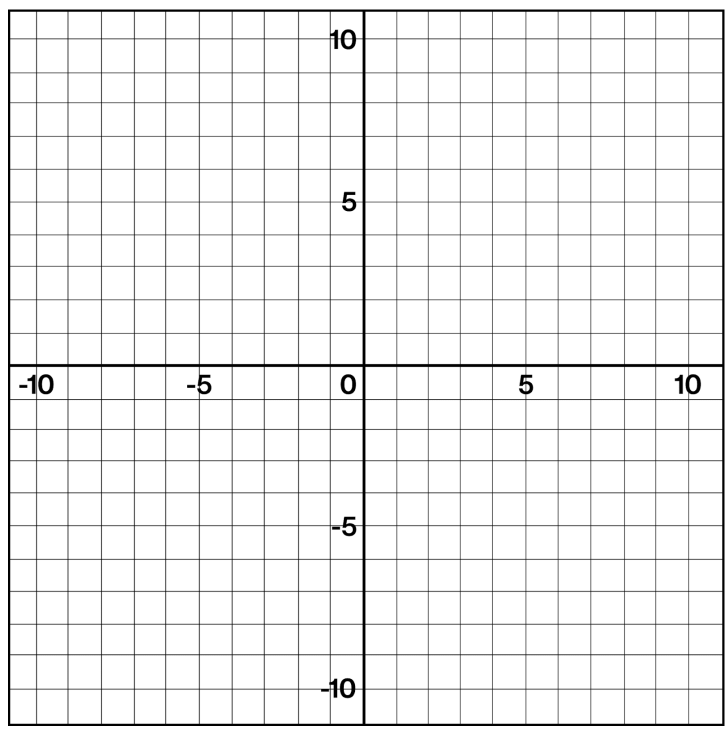



$y =- 2x + 3$ $\quad$ $y = 2x + 3$ $\quad$ $y = 2x - 3$ $\quad$ $y =- 2x - 3$

6. Here are two points: $(-3, 4)$ and $(1, 7)$. What is the slope of the line between the two points?

- ☐ $\frac{4}{3}$
- ☐ $\frac{3}{4}$
- ☐ $\frac{1}{6}$
- ☐ $\frac{2}{3}$



**Unit 8.4, Lesson 13: Practice Problems** **Answer Key**

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

2. $(10,\ 30)$

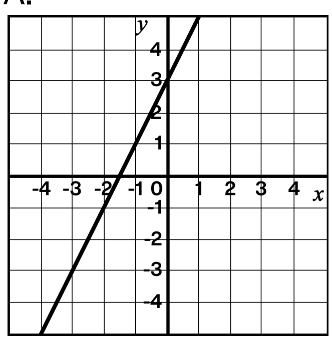
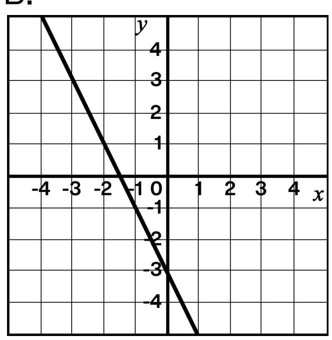
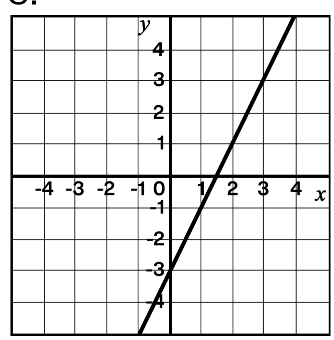
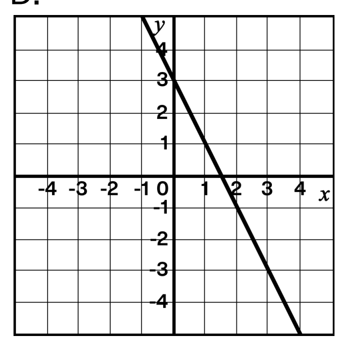
3. $y =- 2x + 3$

4.1 *Responses vary.*

$2x - 6y = 4$

4.2 $3x - 18y = 12$

5. (Unit 3, Lesson 9)

| A. | B. | C. | D. |
|---|---|---|---|
|  |  |  |  |
| $y = 2x + 3$ | $y =- 2x - 3$ | $y = 2x - 3$ | $y =- 2x + 3$ |

6. (Unit 3, Lesson 8)

✓ $\frac{3}{4}$

desmos Science Mom Lesson 71

**Unit 8.4, Lesson 14: Practice Problems** Name ______________________

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 $9$ penaltis, 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.

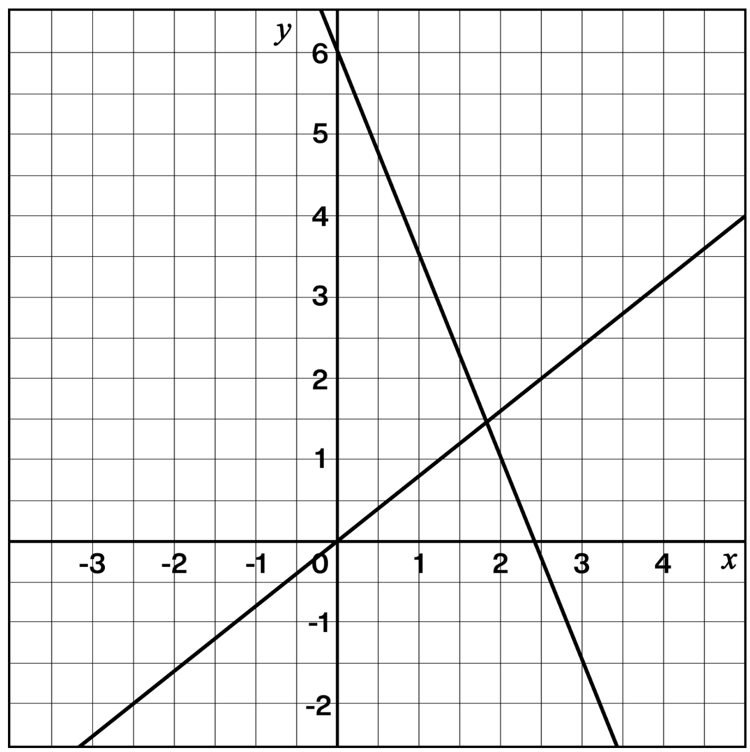
desmos

**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.

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**Unit 8.4, Lesson 14: Practice Problems** **Answer Key**

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)

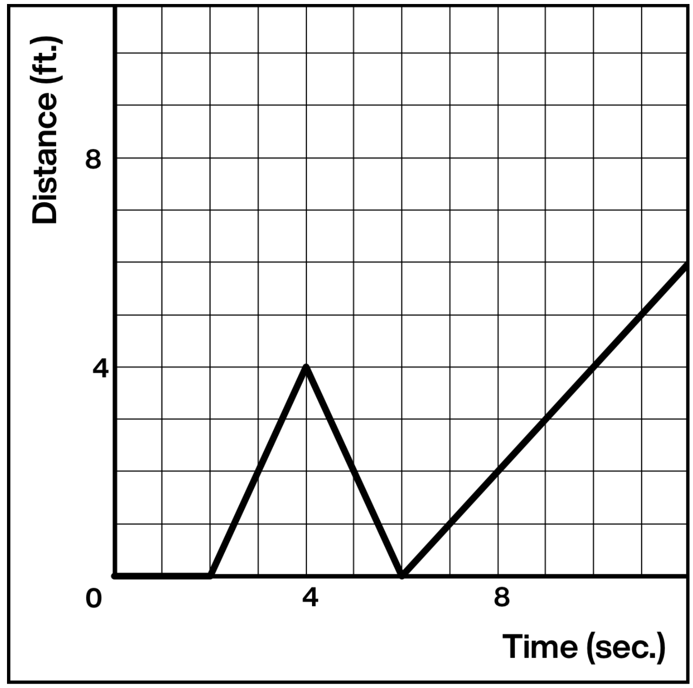
✓ $y = 6 - 2.5x$
✓ $y = 0.8x$

4.3 (Unit 4, Lesson 12)

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

**Unit 8.5, Lesson 1: Practice Problems** Name ______________________

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?

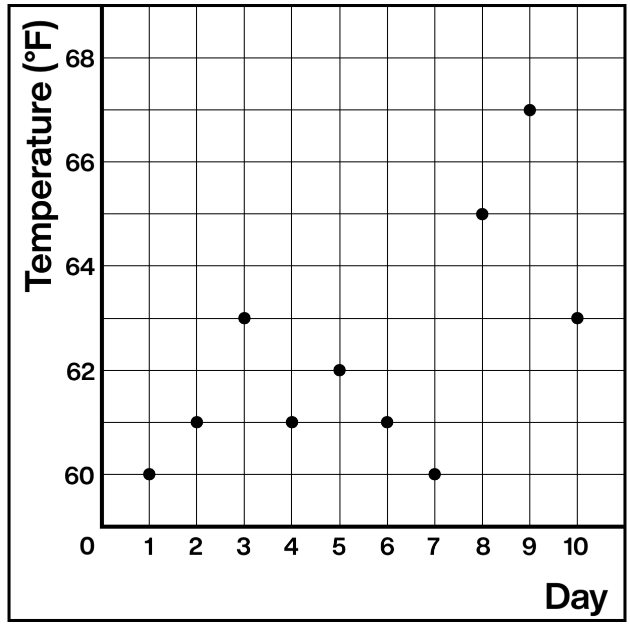
2. For what value of $x$ do the expressions $2x + 3$ and $3x - 6$ have the same value?

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?

**Unit 8.5, Lesson 1: Practice Problems** **Answer Key**

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

desmos Science Mom Lesson 73

**Unit 8.5, Lesson 2: Practice Problems** Name ______________________

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

| Input | Output |
|---|---|
| 0 | |
| 2 | |
| 4 | |
| 6 | |
| 8 | |
| 10 | |

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.

$$m + s = 26$$
$$3m + 8s = 123$$

   How many essay questions are on the test?

   Show or explain your thinking.

# Answer Key

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.

desmos Science Mom Lesson 74

**Unit 8.5, Lesson 3: Practice Problems** Name ____________________

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 |

Is speed a function of time?

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 |

Is distance a function of time?

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 time a function of distance?

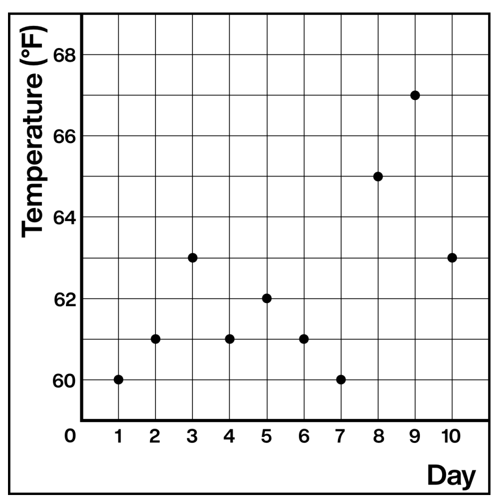
1.4 How did you decide which relationships were functions?

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.



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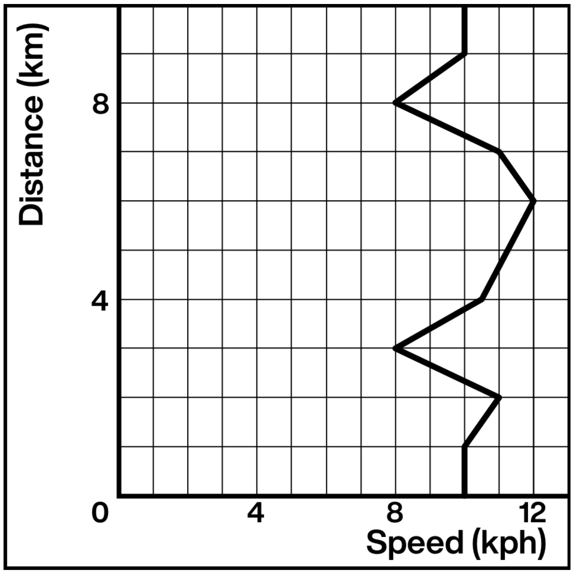
**Unit 8.5, Lesson 3: Practice Problems**

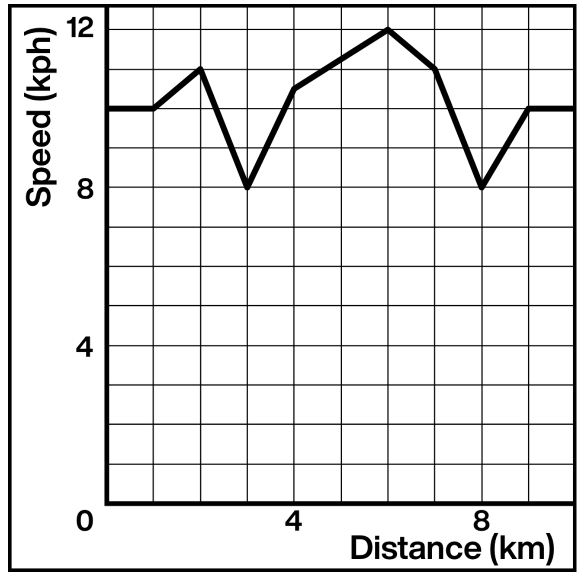
Diego runs a $10$-kilometer race and keeps track of his speed.

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.

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

**Unit 8.5, Lesson 3: Practice Problems** **Answer Key**

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.

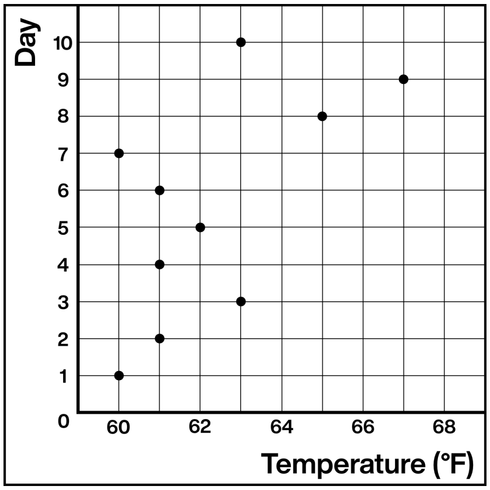
4.1 (From IM 8.4.6, Desmos 8.4.06)
$z = -\frac{13}{7}$

4.2 (From IM 8.4.6, Desmos 8.4.06)
$x = 1$

desmos Science Mom Lesson 75

**Unit 8.5, Lesson 4: Practice Problems** Name ____________________

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:

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

**Unit 8.5, Lesson 4: Practice Problems** **Answer Key**

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)

   $(-3, -11)$

desmos Science Mom Lesson 76

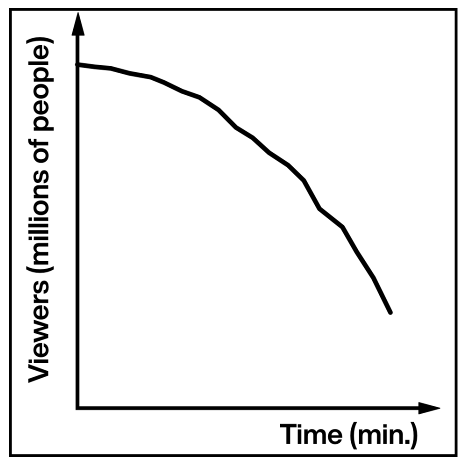
**Unit 8.5, Lesson 5: Practice Problems** Name ______________________________

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

Tell a story of the plant's height.

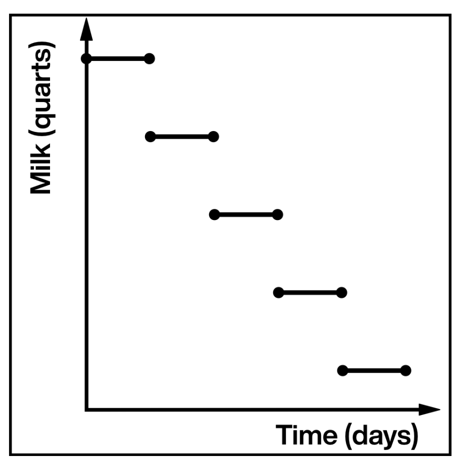

1.2 This graph represents the number of viewers of a short video vs. time.

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.



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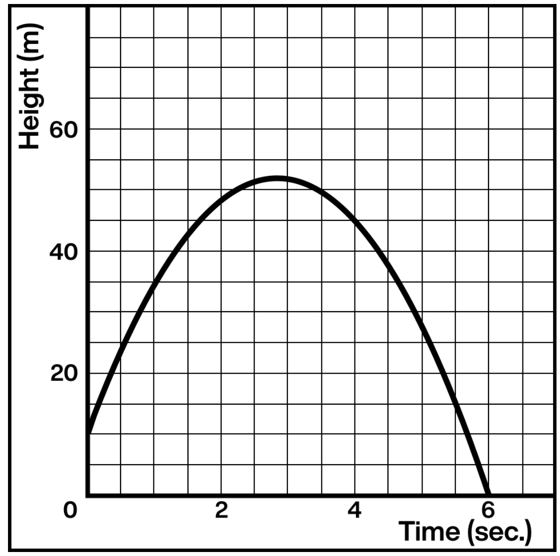
**Unit 8.5, Lesson 5: Practice Problems**

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.

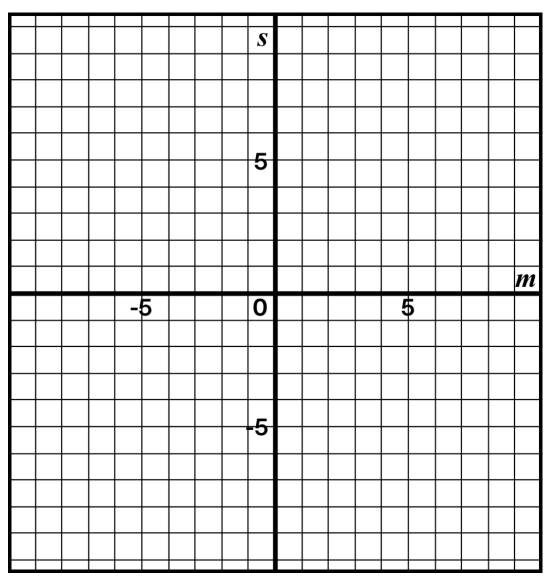
2.2 About how tall is the tower from which the object was shot?

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.



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**Unit 8.5, Lesson 5: Practice Problems** **Answer Key**

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.

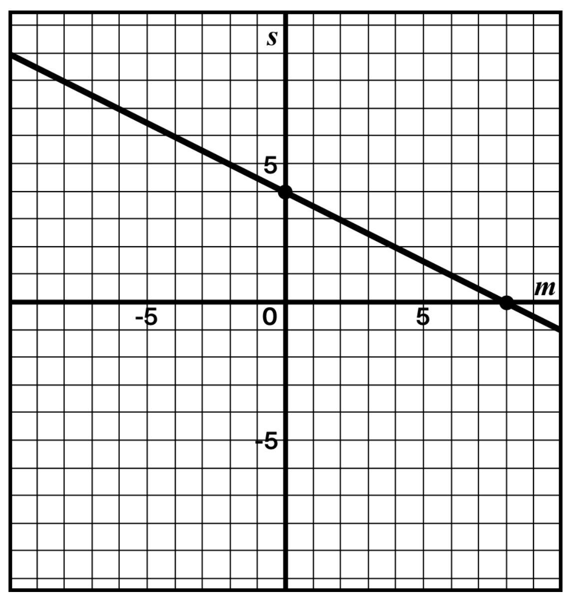
2.2 The tower is about $10$ meters tall.

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

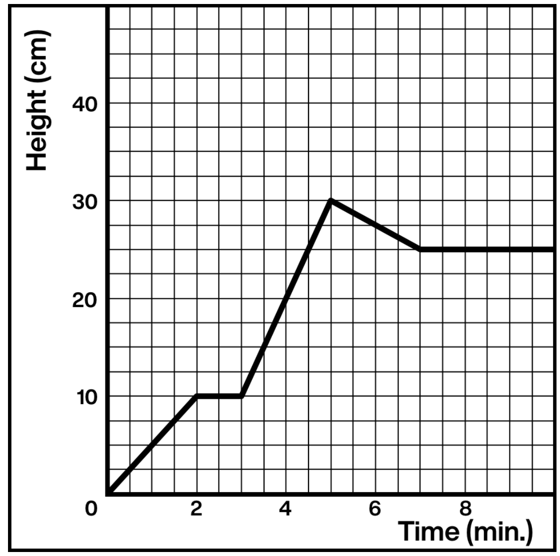


desmos Science Mom Lesson 77

**Unit 8.5, Lesson 6: Practice Problems** Name ______________________________

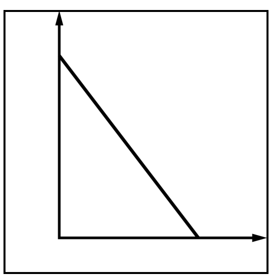
1. Koharu fills her aquarium with water. The graph shows the height of water in the aquarium vs. time.

   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.



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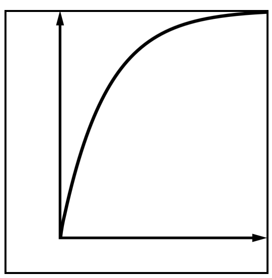
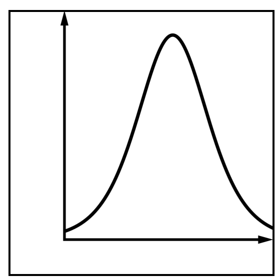
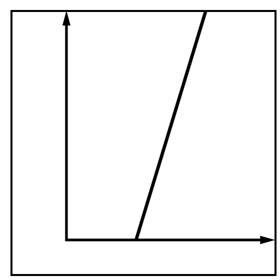


C.

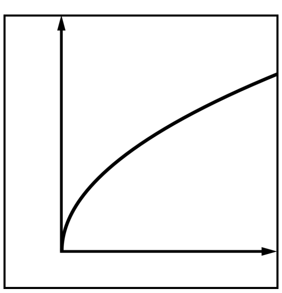


D.

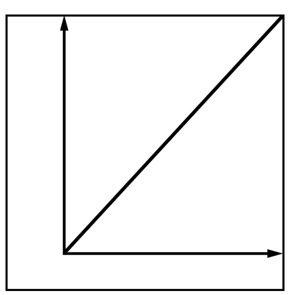


2.2 One person knows a secret. That person tells two people who each tell two people. The pattern continues. The number of people who know the secret is measured over time. Select the graph that best matches the story.

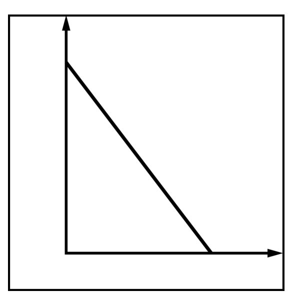
A.



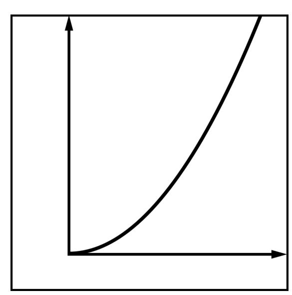
B.



C.



D.

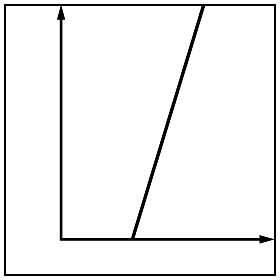


desmos

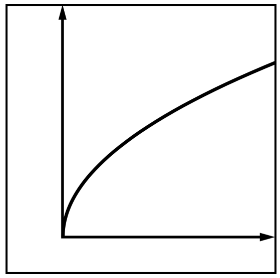
## Unit 8.5, Lesson 6: Practice Problems

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.

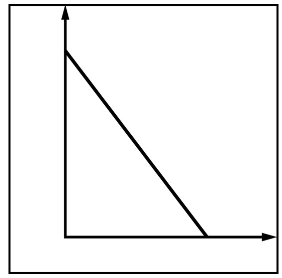
A.



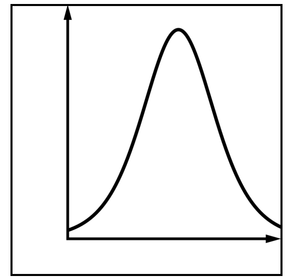
B.



C.



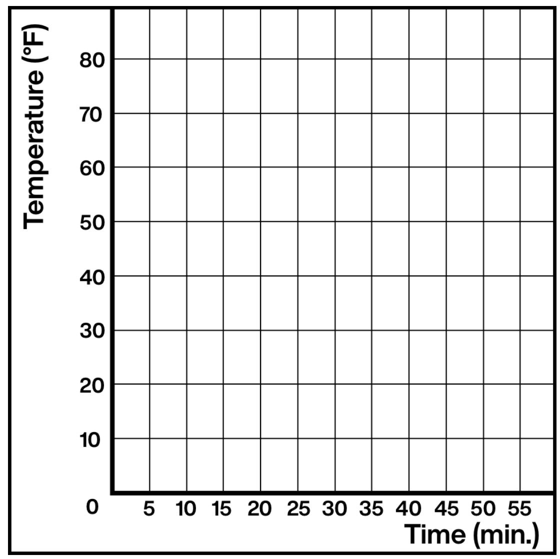
D.



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.

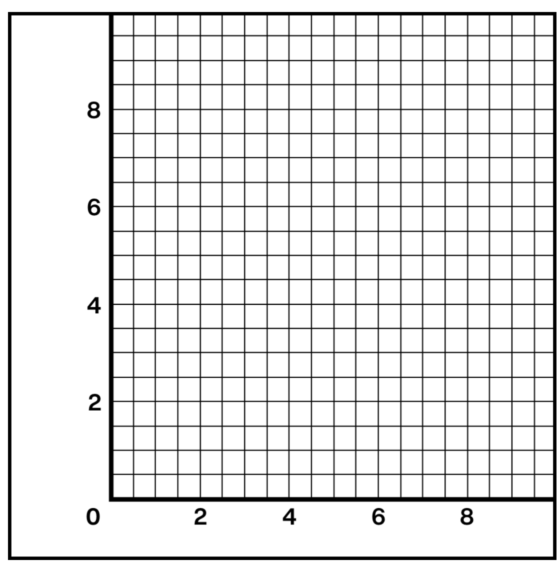



4.1 Draw two lines to form a system of linear equations with no solutions. Then write an equation for each line.

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.



**Unit 8.5, Lesson 6: Practice Problems** **Answer Key**

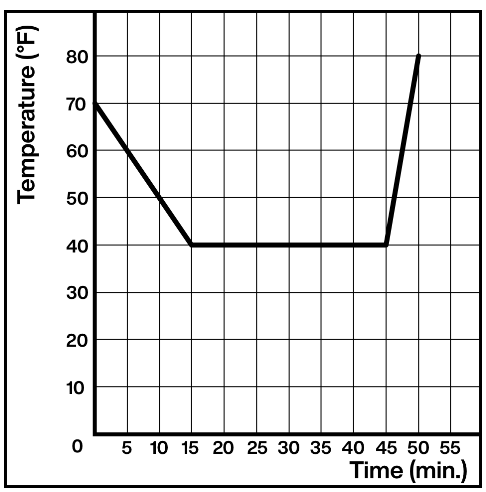
1. *Responses vary.* Koharu turns on the water faucet, and the water in the aquarium increases at a constant rate for the first two minutes to a height of $10$ cm. Then Koharu's mom calls her to take out the trash, so she turns off the faucet for the minute it takes her to take out the trash. After she 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)

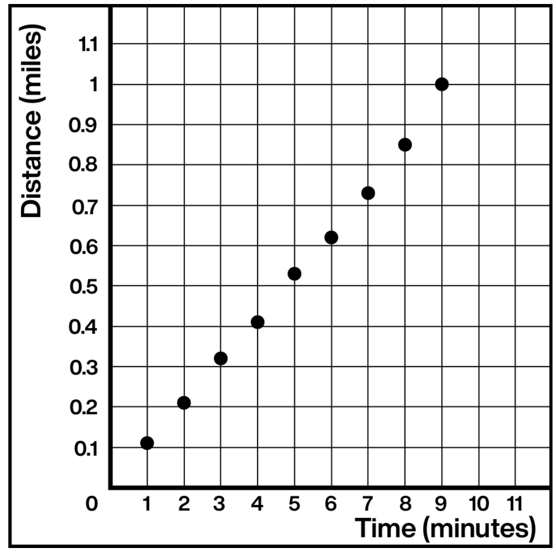
*Responses vary.* The graph can be any two lines that are parallel.

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.

**Unit 8.5, Lesson 7: Practice Problems** Name ______________________________

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:** $b = 4a - 5$

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

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

$b =$_________ $c =$_________

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

Explain your answer or why there is not enough information.

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

Explain your answer or why there is not enough information.

desmos

**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?

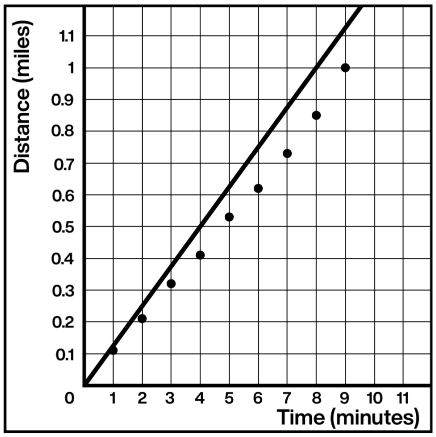
3.3 Use the relationship $A = \pi r^2$ to fill in the missing parts of the table below.

| $r$ | $A$ |
|---|---|
| $3$ | |
| | $16\pi$ |
| $\frac{1}{2}$ | |
| | $100\pi$ |

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 $A = \pi r^2$

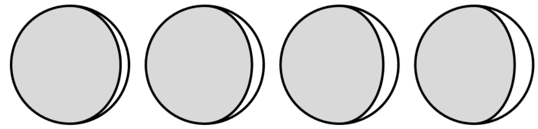
3.2 Yes for both. Using, for example, $2$ and $-2$ would produce the same output, but $-2$ is not a valid input in this situation since a radius cannot be negative.

3.3

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

**Unit 8.5, Lesson 9: Practice Problems** Name ______________________________

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.



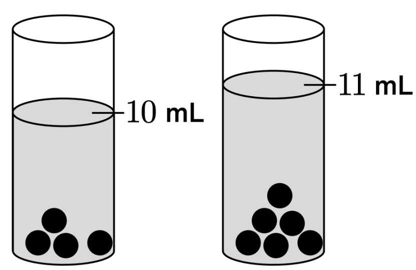
1.1 Use a linear model to fill out the table below.

| 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? __________

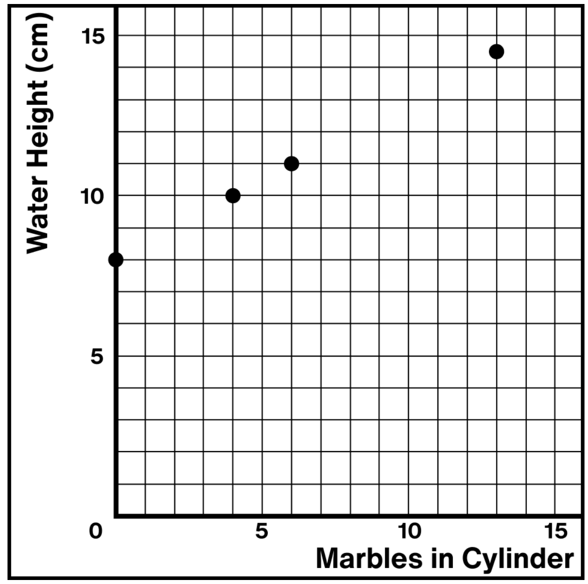
2.2 What should be the height of the water after $13$ marbles are dropped in? ___________

desmos

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

# Answer Key

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)
$a = \frac{1}{4}$

**Unit 8.6, Lesson 1: Practice Problems** Name ______________________

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.

desmos

**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.

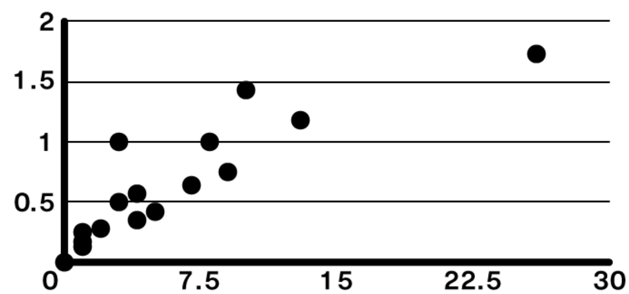
   Below that is a scatter plot that goes with the table.

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

   **Horizontal axis:**________________________

   **Vertical axis:** __________________________

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




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?

desmos

**Unit 8.6, Lesson 1: Practice Problems**

# Answer Key

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)
$80\pi$ cubic centimeters

3.2 $720\pi$ cubic centimeters

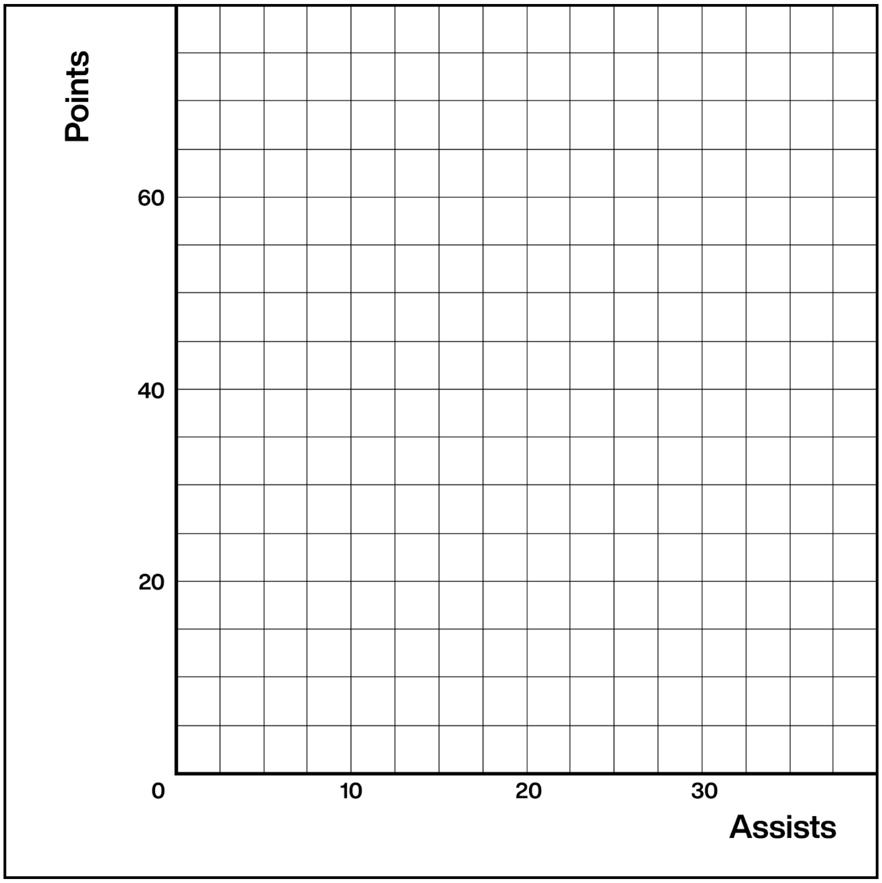
3.3 $20\pi$ cubic centimeters

Science Mom Lesson 81

**Unit 8.6, Lesson 2: Practice Problems** Name ________________________________

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

desmos

**Unit 8.6, Lesson 2: Practice Problems**

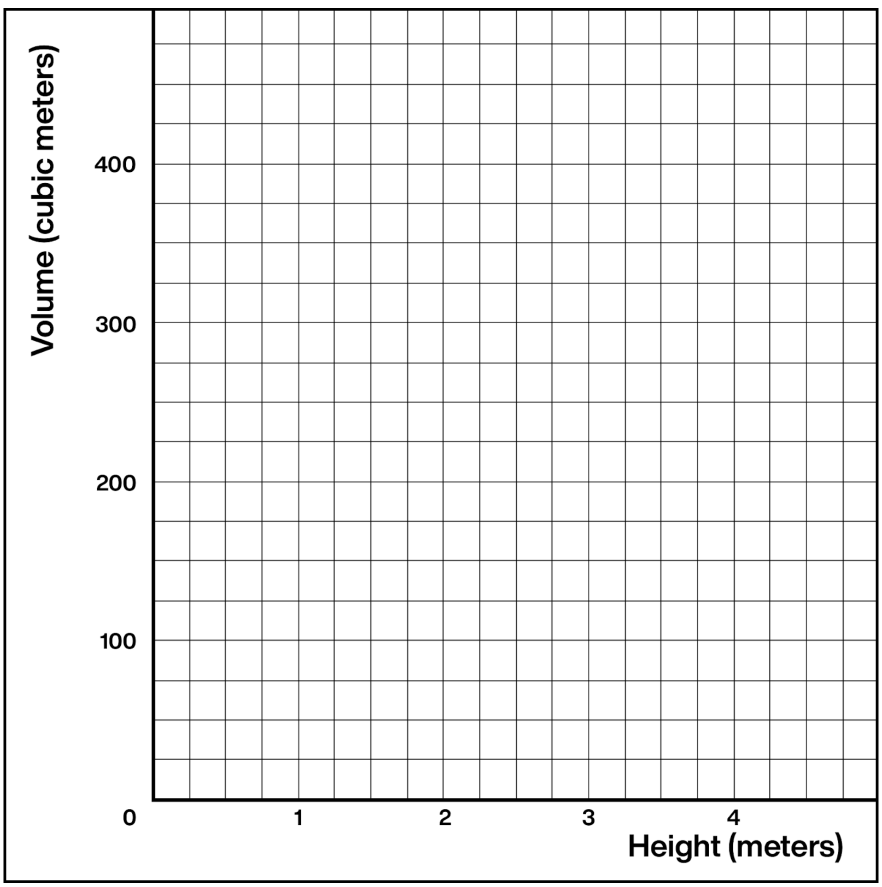
3.1 When is it better to use a table?

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 $\pi$.




4.3 If you double the height of a cylinder, what happens to the volume?

Use the equation to help you explain your thinking.

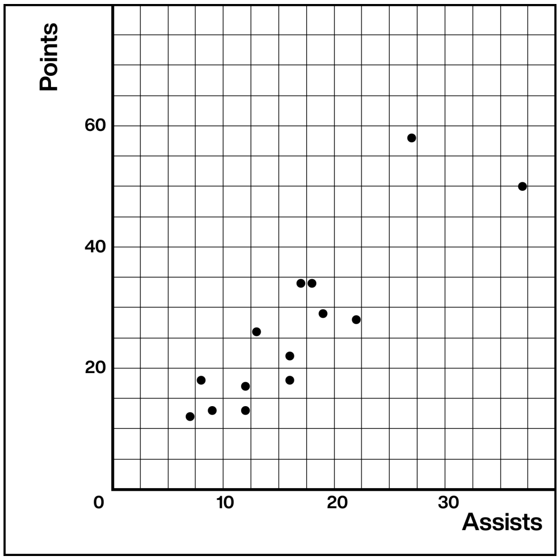
4.4 If you multiply the height of a cylinder by $\frac{1}{3}$, what happens to the volume?

Use the graph to help explain your thinking.

desmos



1.



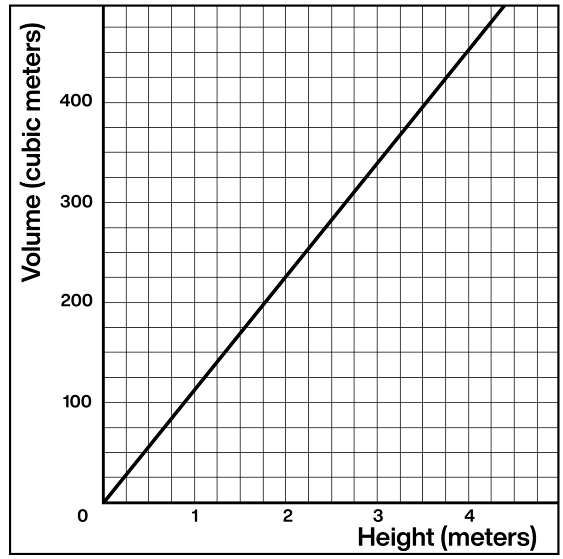

2. ✓ Scatter plot
✓ Table

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



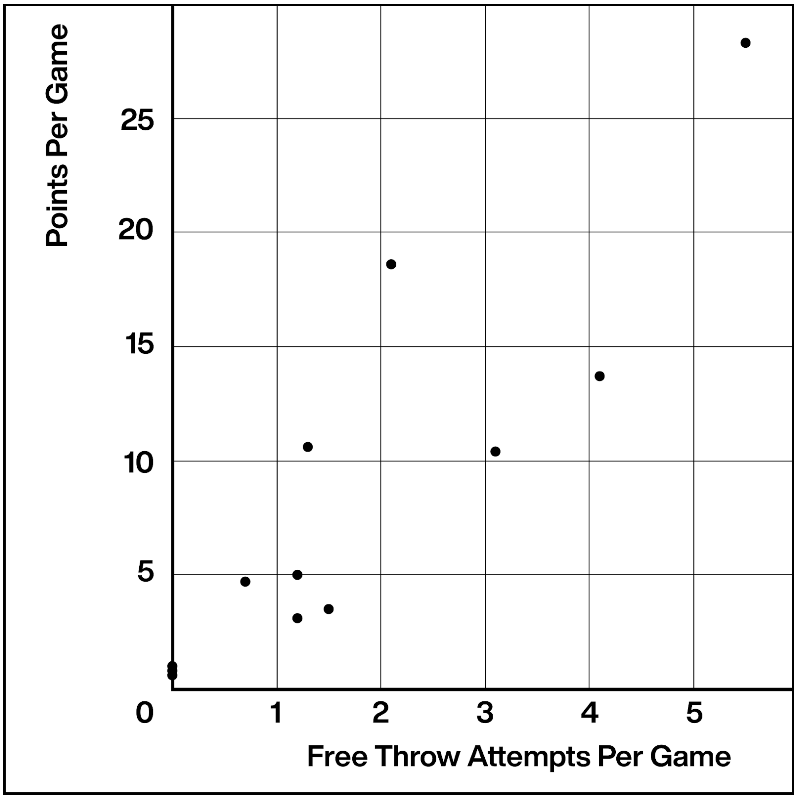

4.3 If you double the height, the volume doubles. Replacing $h$ with $2h$ in the equation gives $V = 36\pi \cdot 2h = 2(36\pi h)$, which is double the original volume.

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.

**Unit 8.6, Lesson 3: Practice Problems** Name ______________________________

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 $36\pi$ cubic centimeters and height $h$.

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

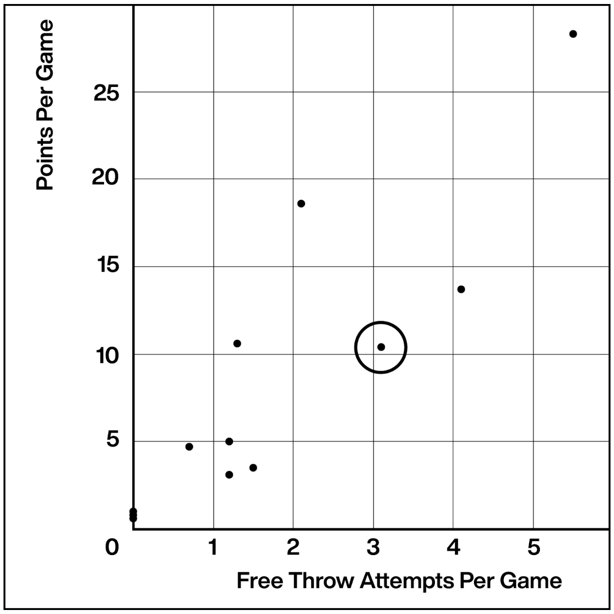
| Height (cm) | Volume (cubic cm) |
|---|---|
| $h$ | $36\pi$ |
| $2h$ | |
| $5h$ | |
| $\frac{h}{2}$ | |
| $\frac{h}{5}$ | |

desmos

## Unit 8.6, Lesson 3: Practice Problems

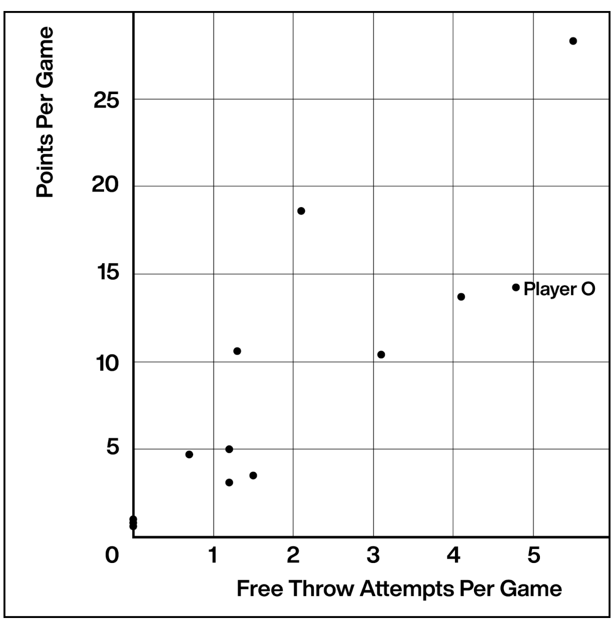
# Answer Key

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

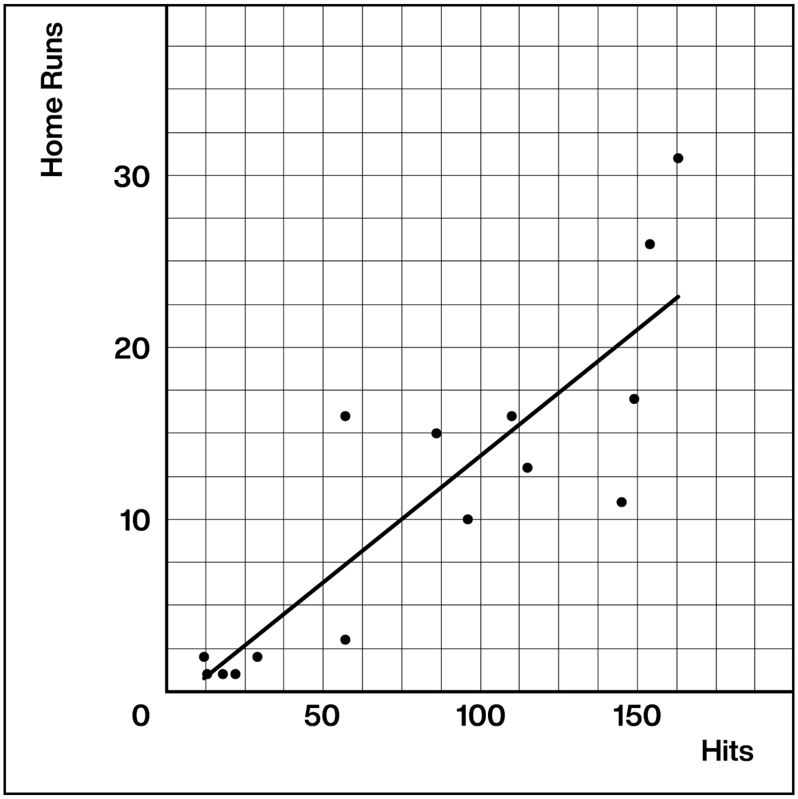
3. (From IM 8.5.17, Desmos 8.5.12)

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

desmos Science Mom Lesson 83

**Unit 8.6, Lesson 4: Practice Problems** Name ______________________

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.

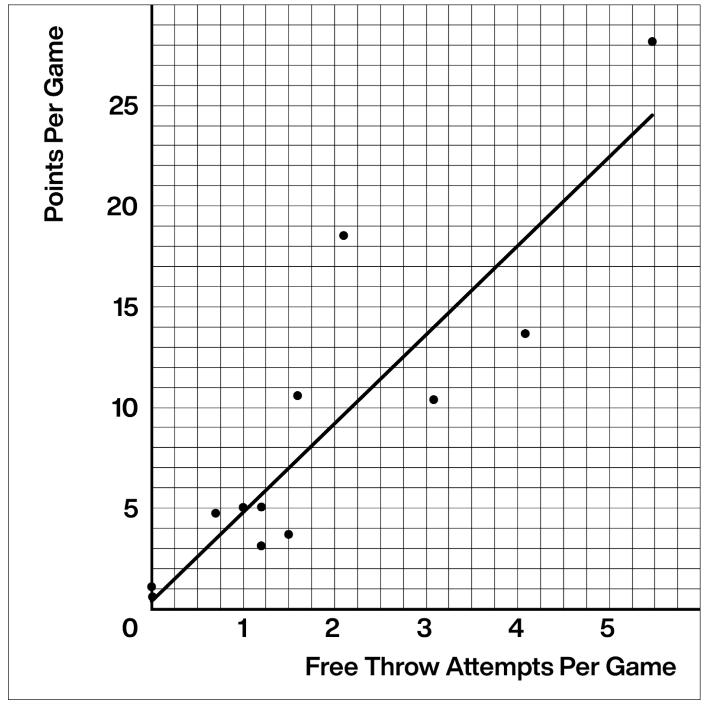
How many hits did this player have?

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?

desmos

Unit 8.6, Lesson 4: Practice Problems

# Answer Key

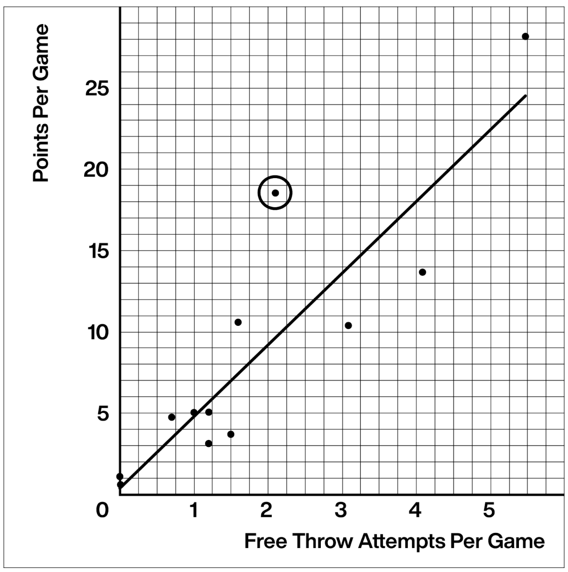
1.1 **Home runs:** $26$

**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.

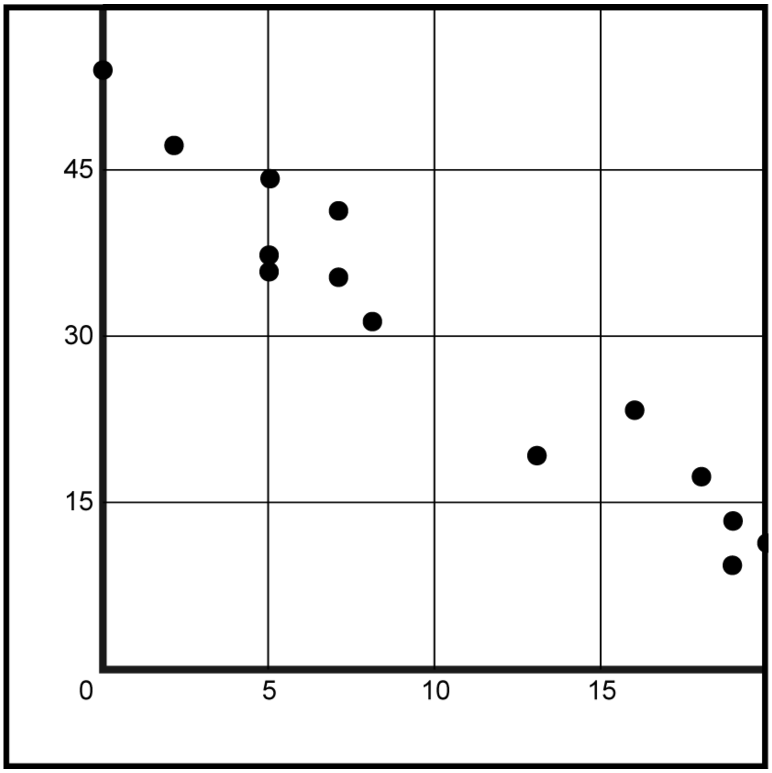
2.3 $20.2$ points per game because $4.413(4.5) + 0.377$ is roughly equal to $20.2$.

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.

**Unit 8.6, Lesson 5: Practice Problems** Name ______________________

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.

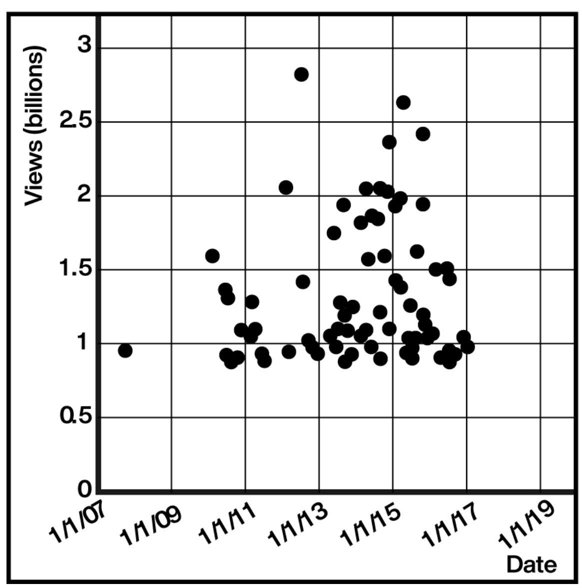



1.2 Use your line of fit to estimate what you would expect the output value to be when the input is $10$.

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.



desmos

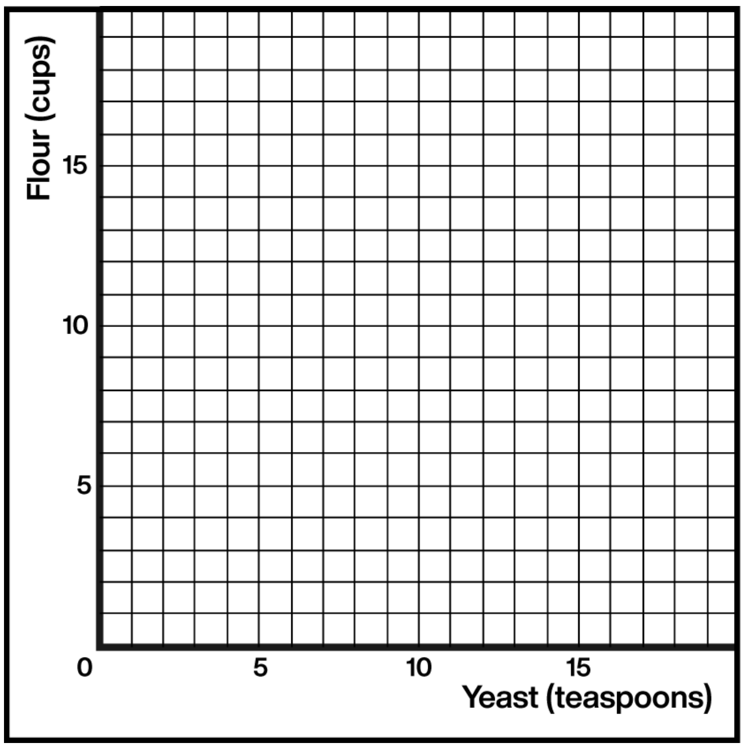
**Unit 8.6, Lesson 5: Practice Problems**

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.

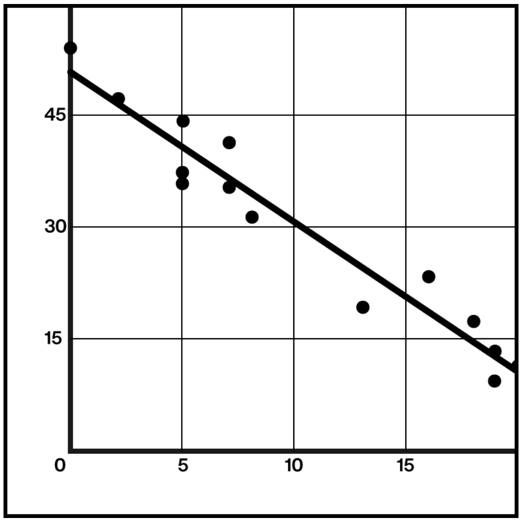



3.4 Write the coordinates of two points on the line.

Unit 8.6, Lesson 5: Practice Problems

**Answer Key**

1.1




1.2 The output would be close to $30$.

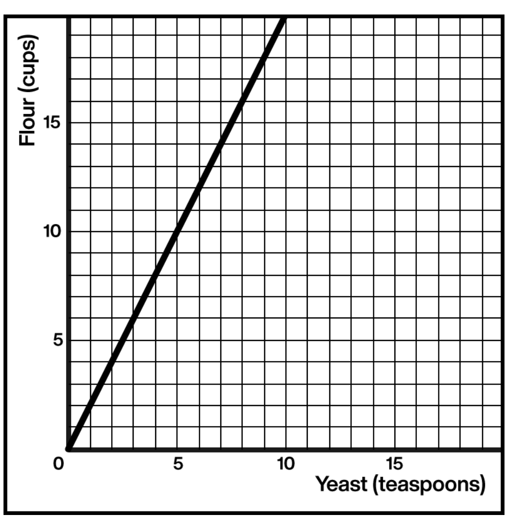
2.1 (From IM 8.6.03, Desmos 8.6.03)
The most popular video has roughly $2.8$ billion views.

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 $(10, 20)$

Science Mom Lesson 85

**Unit 8.6, Lesson 6: Practice Problems** Name ________________________________

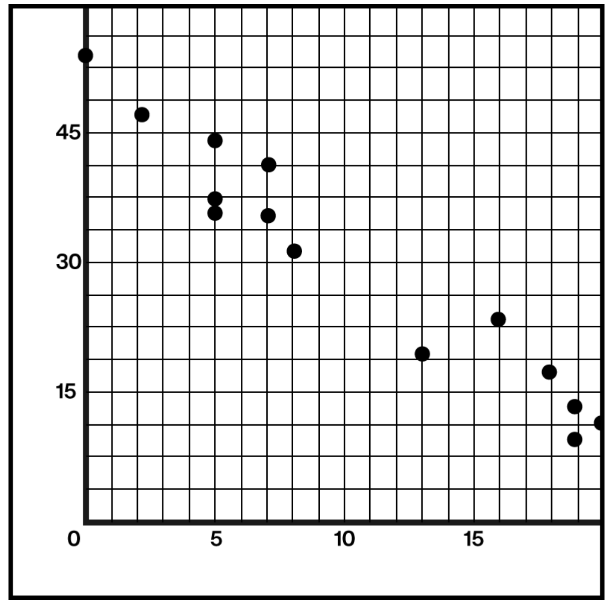
1. Which statement is true about the data in the scatter plot?

   A. As $x$ increases, $y$ tends to increase.

   B. As $x$ increases, $y$ tends to decrease.

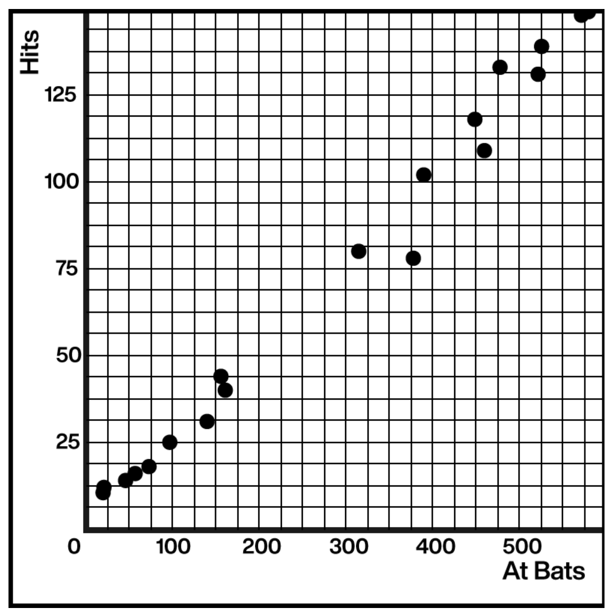
   C. As $x$ increases, $y$ tends to stay unchanged.

   D. $x$ and $y$ are unrelated.



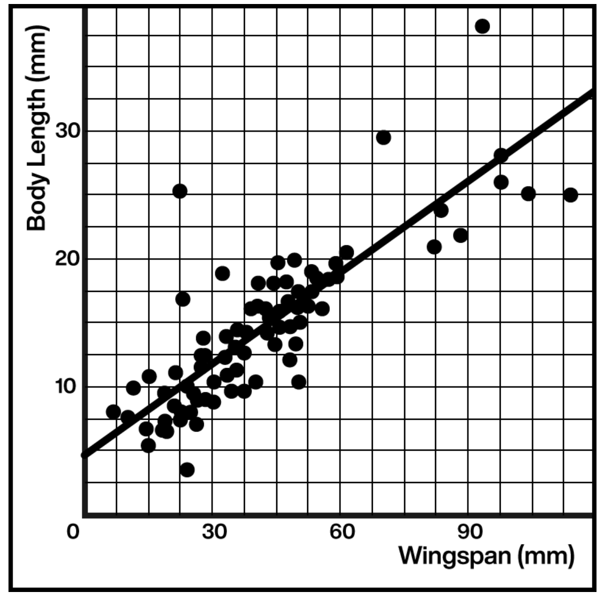

2. Here is a scatter plot that compares hits to at bats for players on a baseball team.

   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?



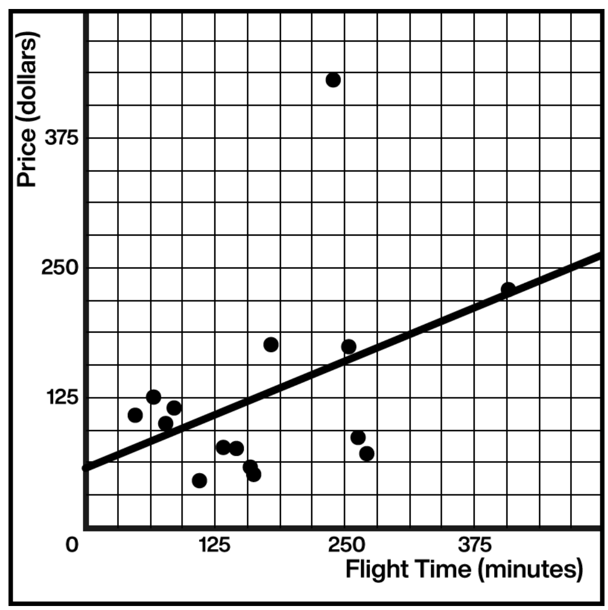

A. For every $1$ mm the wingspan increases, the length of the butterfly increases $0.238$ mm.

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:

$$y = -3x + 13$$
$$y = -2x + 1$$

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

desmos

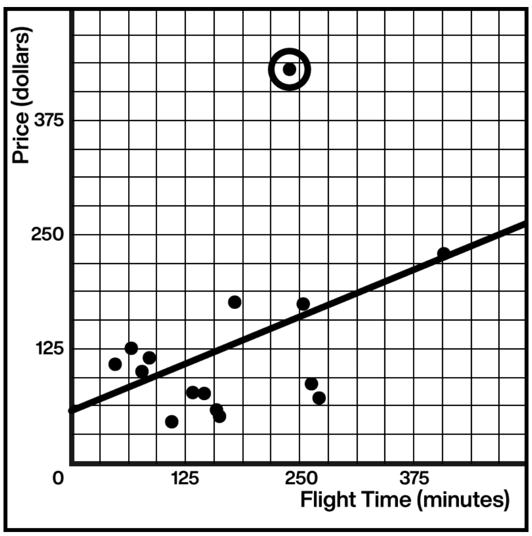
**Unit 8.6, Lesson 6: Practice Problems** **Answer Key**

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)



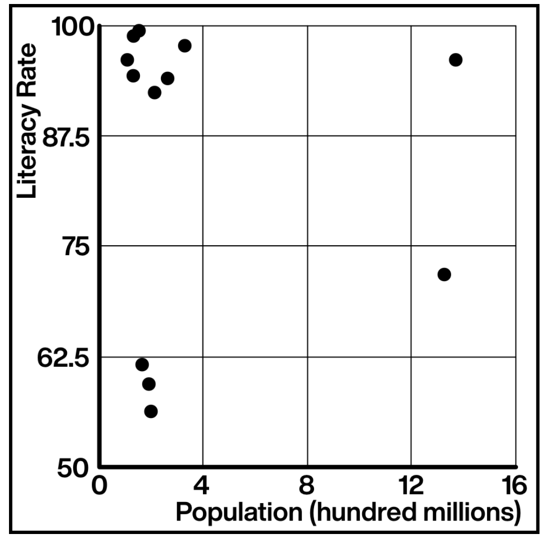

4.2 This point represents a destination that costs around $\$250$ more than the model predicts for its flight time.

5. (From IM 8.4.14, Desmos 8.4.12)
$(12, -23)$

**Unit 8.6, Lesson 7: Practice Problems** Name ________________________

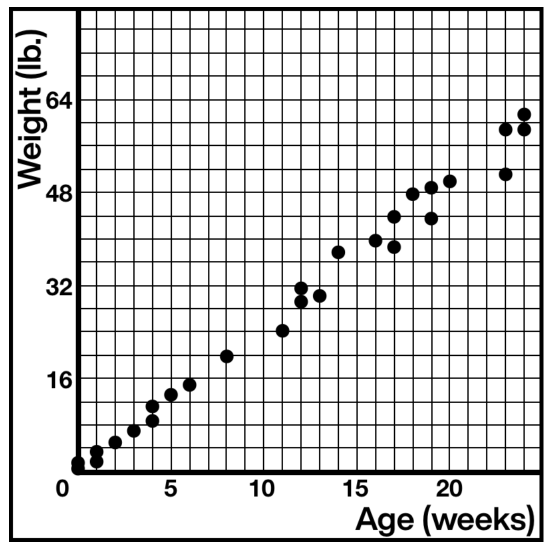
1. The literacy rate and population for $12$ countries with more than $100$ million people are shown in the scatter plot.

   Circle any clusters in the data.



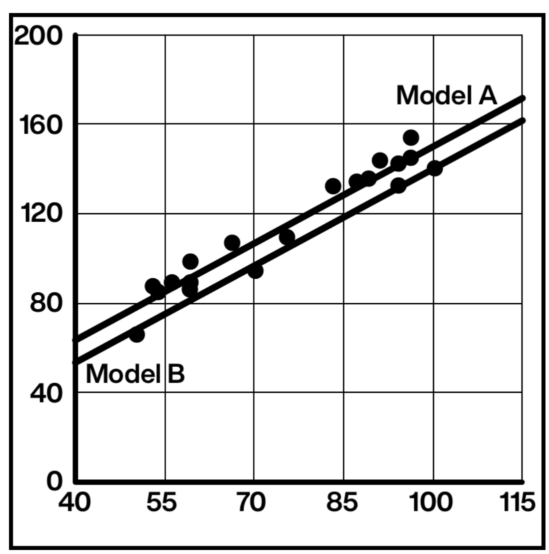

2. Select **all** of the following that describe the association in this scatter plot:

   - ☐ 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.

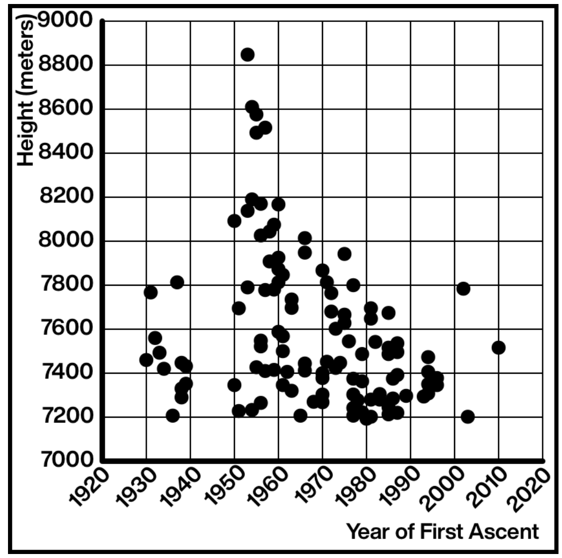


4. Here is a scatter plot of data for some of the tallest mountains on Earth.

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 |
| --- | --- |
| | |

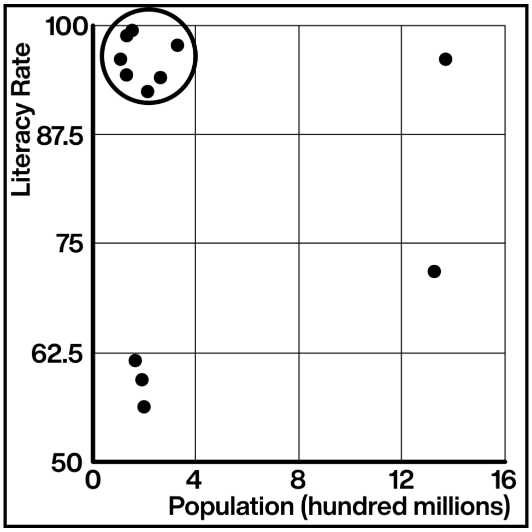
A cone has volume $V$, radius $r$, and a height of $12$ centimeters.

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.

**Unit 8.6, Lesson 7: Practice Problems** **Answer Key**

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)
$\frac{V}{9}$

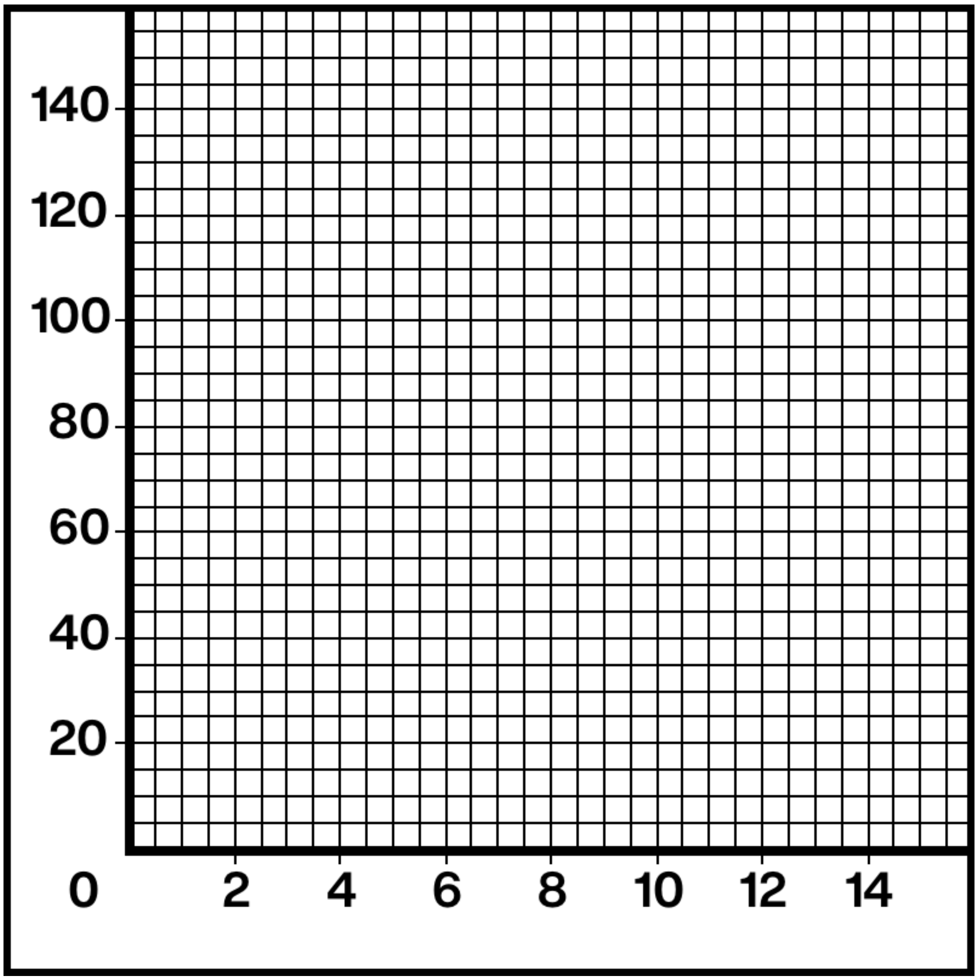
5.2 $9V$

desmos Science Mom Lesson 87

**Unit 8.6, Lesson 8: Practice Problems** Name ______________________

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.

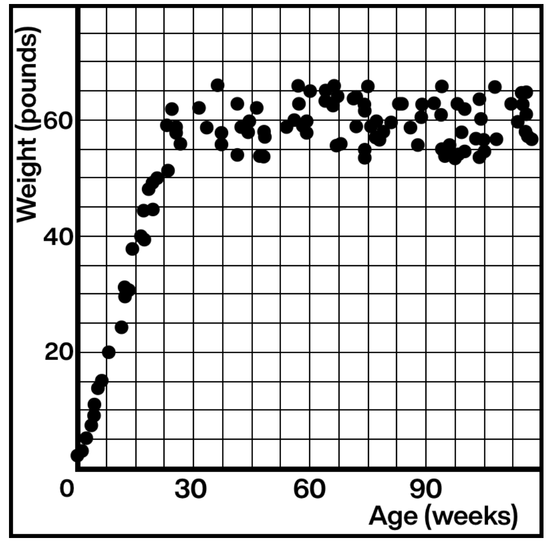
1.4 Is there a relationship between the variables? Explain your thinking.

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

desmos

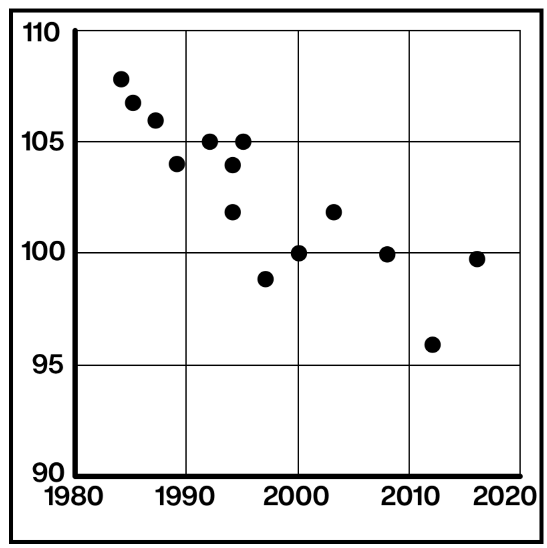
**Unit 8.6, Lesson 8: Practice Problems**

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.

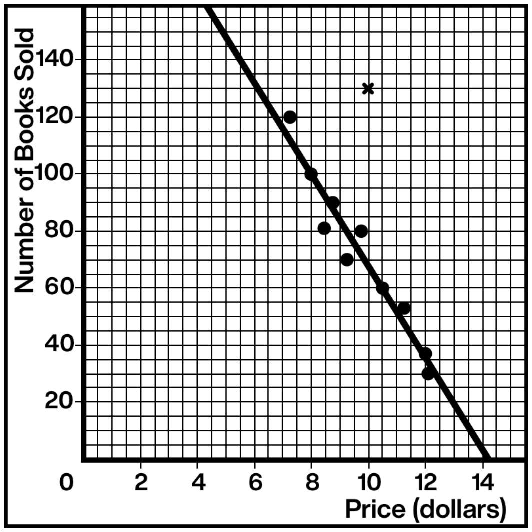
C. The slope is negative.

D. There is no association.

desmos

**Unit 8.6, Lesson 8: Practice Problems** **Answer Key**

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.

**Unit 8.6, Lesson 9: Practice Problems** Name ______________________

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

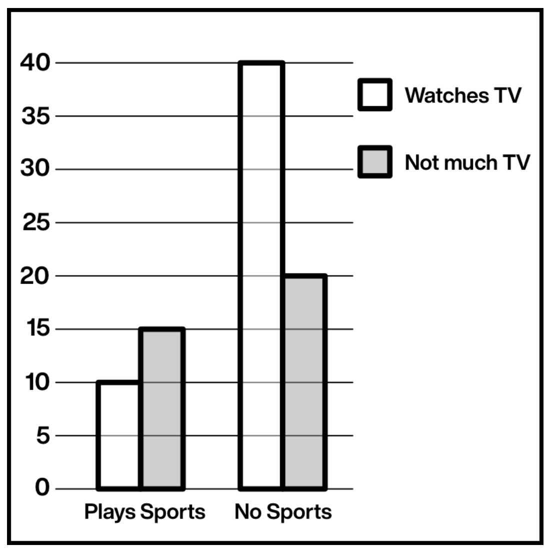
| | **Watches the News Daily** | **Does Not Watch the News Daily** |
|---|---|---|
| **Younger Than 18** | 30 | 80 |
| **18 or Older** | 10 | 5 |

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.

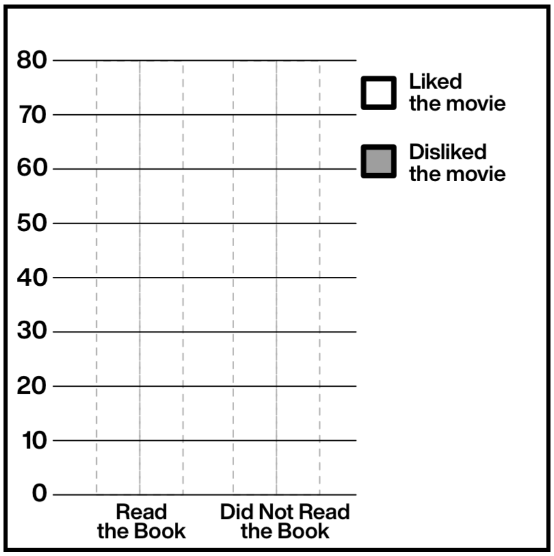
- ☐ More people do not play sports than do.
- ☐ More people watch TV than watch not much TV.
- ☐ 10 people watch TV but don't play sports.
- ☐ There are no people who watch TV and play sports.

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 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 |

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

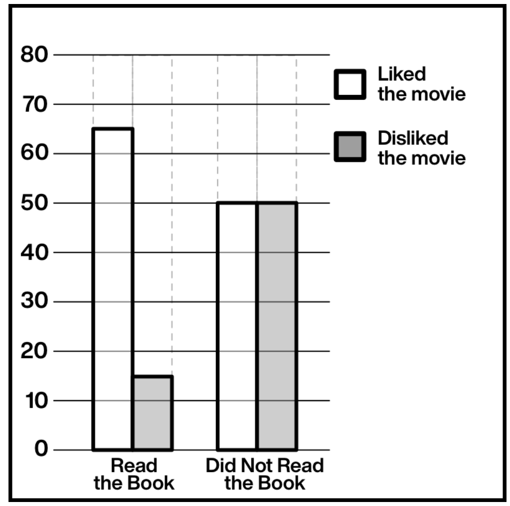
2.1

| | 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

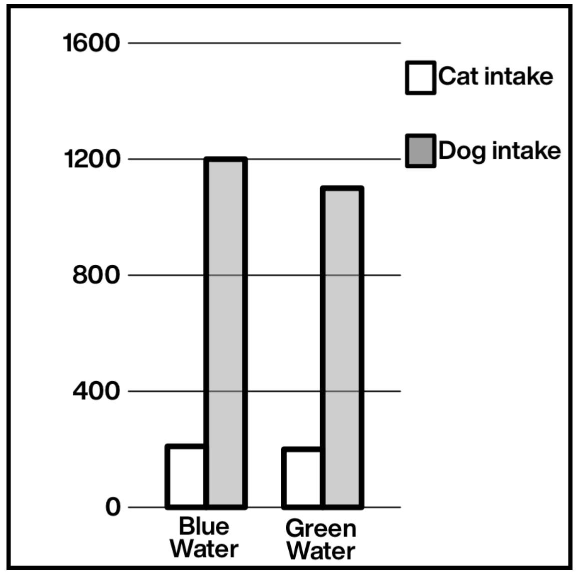
| | Plays an Instrument | Does Not Play an Instrument | Total |
|---|---|---|---|
| **Plays a Sport** | 1 | 11 | 12 |
| **Does Not Play a Sport** | 9 | 4 | 13 |
| **Total** | 10 | 15 | 25 |

**Unit 8.6, Lesson 10: Practice Problems** Name ____________________

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.

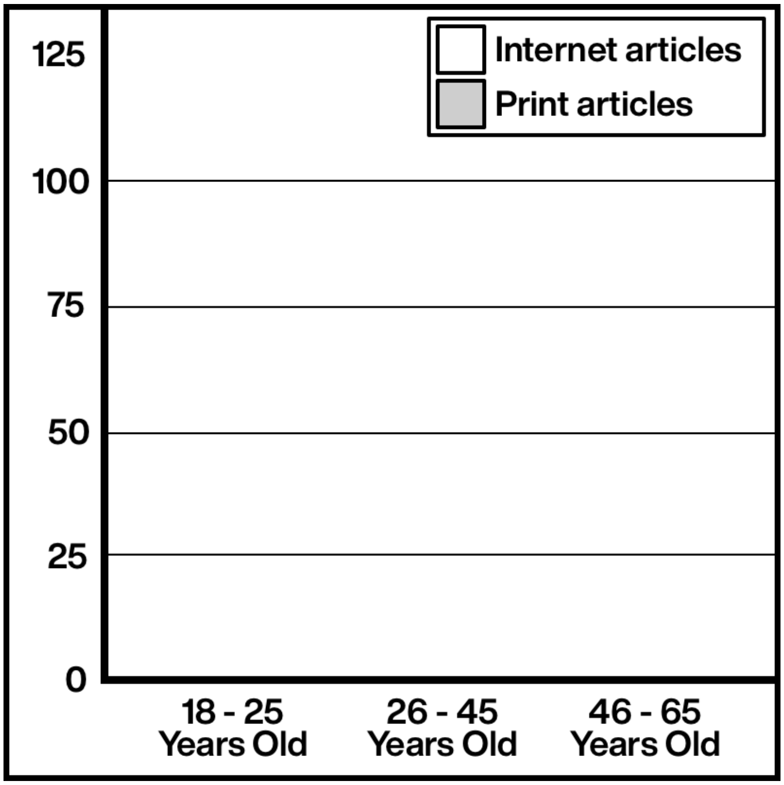
| | Bought Apples | Did Not Buy Apples |
|---|---|---|
| **Bought Lettuce** | 14 | 58 |
| **Did Not Buy Lettuce** | 8 | 29 |

| | 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.

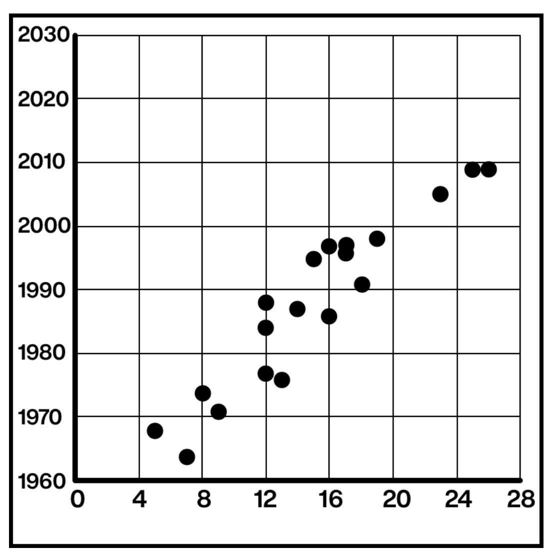
4. Using the data in the scatter plot, what is a reasonable slope of a model that fits this data?

A. –2.5

B. –1

C. 1

D. 2.5

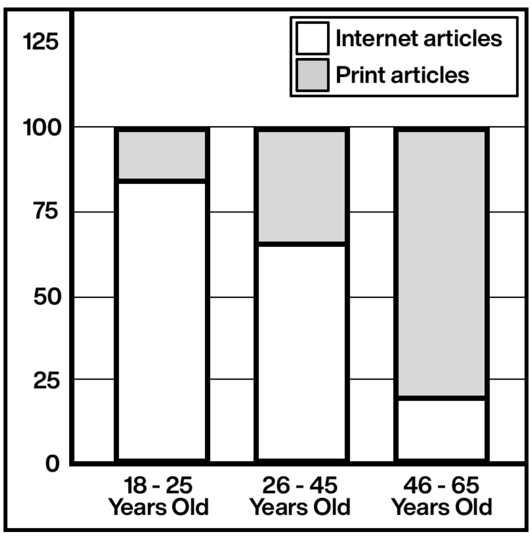


1. No, the relative frequencies of the animals drinking each color of water are about the same, so there is no evidence of association.

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.

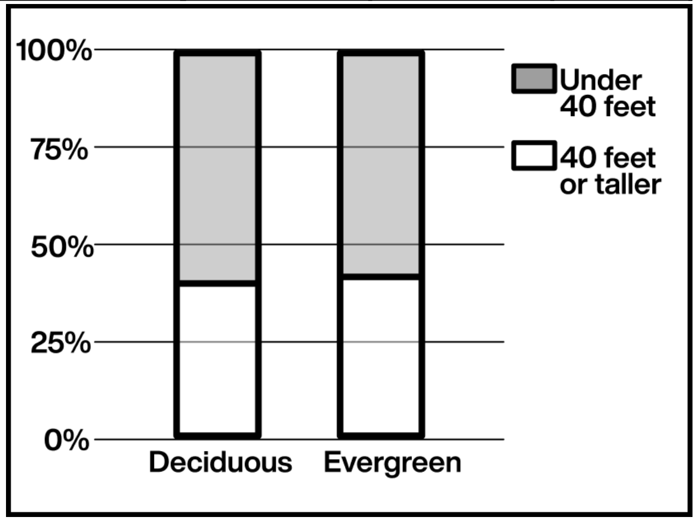
4. (From IM 8.6.06, Desmos 8.6.06)
D. 2.5

**Unit 8.6, Lesson 11: Practice Problems** Name ______________________________

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.

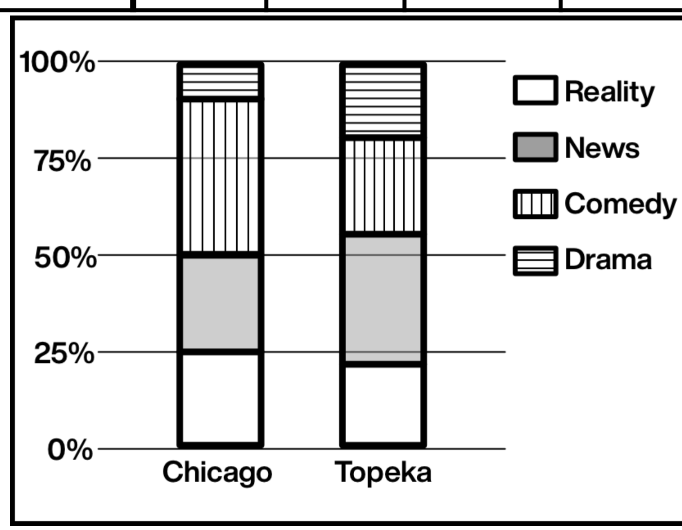
| | Under 40 Feet | 40 Feet or Taller | Total |
|---|---|---|---|
| **Deciduous** | 45 | 30 | 75 |
| **Evergreen** | 14 | 10 | 24 |
| **Total** | 59 | 40 | 99 |




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 |



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.

**Unit 8.6, Lesson 11: Practice Problems**

# Answer Key

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. Topekans watch news and dramas much more than Chicagoans. Chicagoans 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.

desmos **Science Mom Lesson 91**

**Unit 7.7, Lesson 9: Practice Problems** Name ______________________________

## Warm-Up

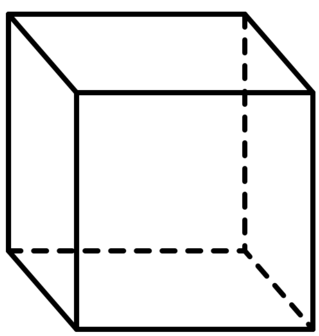
Select all the expressions that are equivalent to $3x - 4 + 2x - 6$.

- ☐ $x - 2$
- ☐ $5x - 2$
- ☐ $5(x - 2)$
- ☐ $5x + 10$
- ☐ $5x - 10$

## Practice

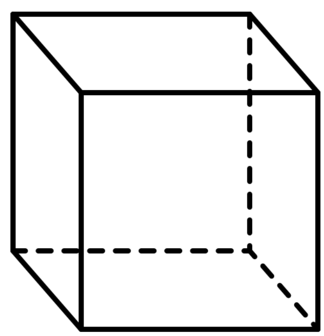
Explain or show how to slice each cube in order to make the described cross section.

1.1 Cross section: **Square**



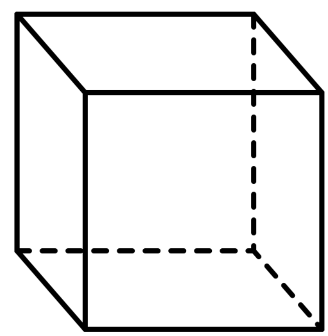
Explain or show your thinking.

1.2 Cross section: **Triangle**



Explain or show your thinking.

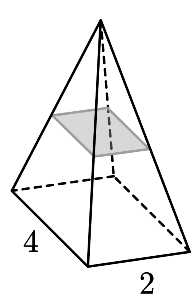
1.3 Cross section: **Rectangle**



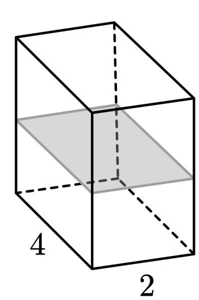
Explain or show your thinking.

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?



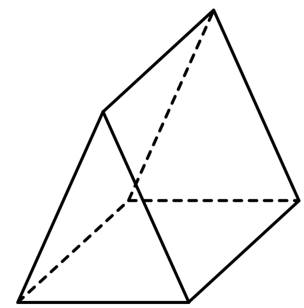

2.2 What will happen to the area of the cross section as you slice the prism closer to the base?



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

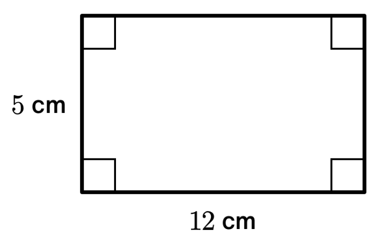
   Sydney says, “I’m not so sure.”

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



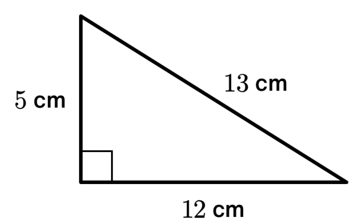
Determine the area of each shape.

4.1



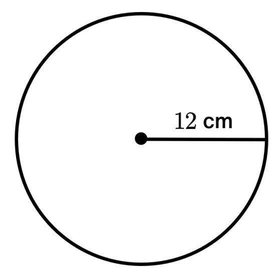

Area =

4.2




Area =

4.3

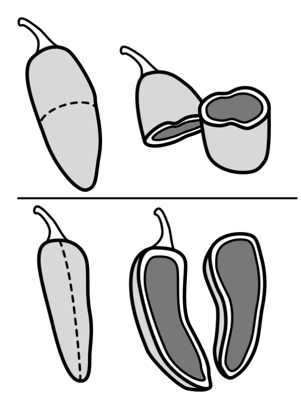



Area =

## 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.

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**Unit 7.7, Lesson 9: Practice Problems** **Answer Key**

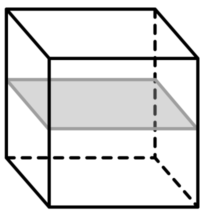
## Warm-Up

✓ $5(x-2)$

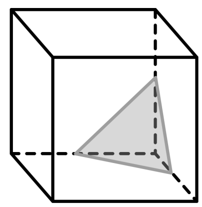
✓ $5x-10$

## Practice

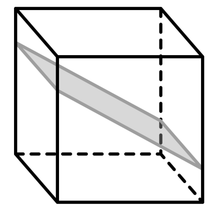
1.1 *Responses vary.*



1.2 *Responses vary.*



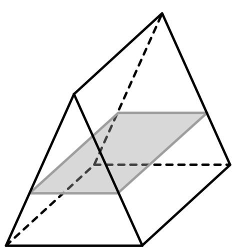
1.3 *Responses vary.*



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

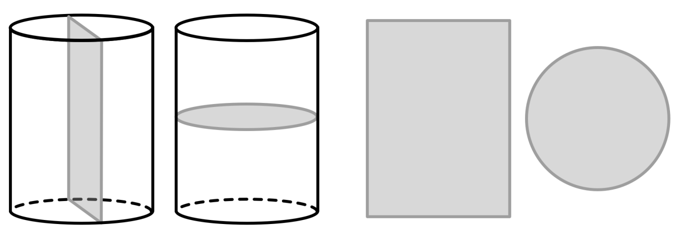
4.2 $30$ square centimeters

4.3 $144\pi$ square centimeters

## Explore

*Responses vary.*

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



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**Unit 7.7, Lesson 10: Practice Problems** Name ____________________

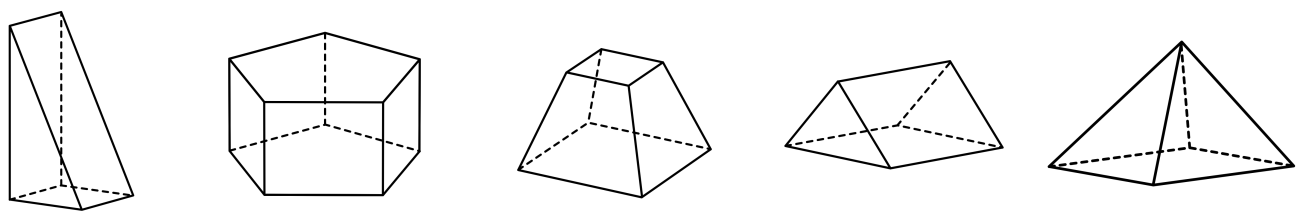
## Warm-Up

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

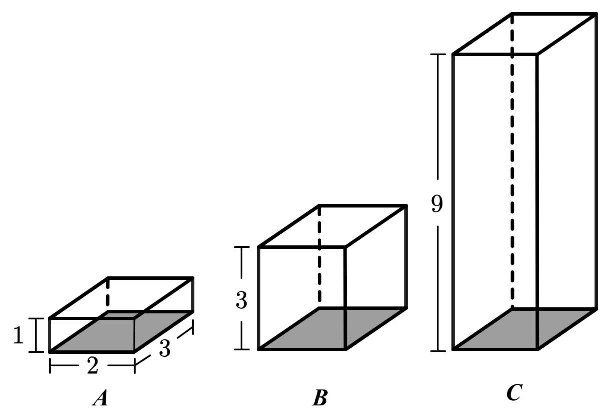
1.1 Circle all the prisms.



1.2 For each prism, shade one of the bases.

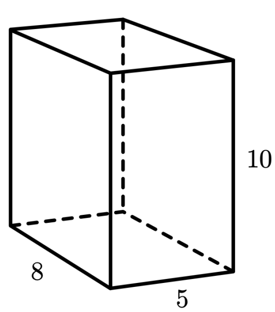
2. Here are three prisms with the same base. Determine the volume of each prism.

| Prism | Volume (cubic units) |
|---|---|
| $A$ | |
| $B$ | |
| $C$ | |

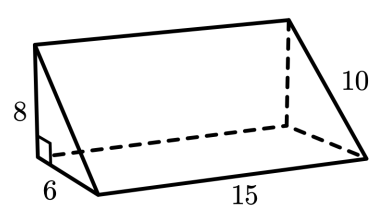



Determine the volume of each prism. Explain or show your thinking.

3.1

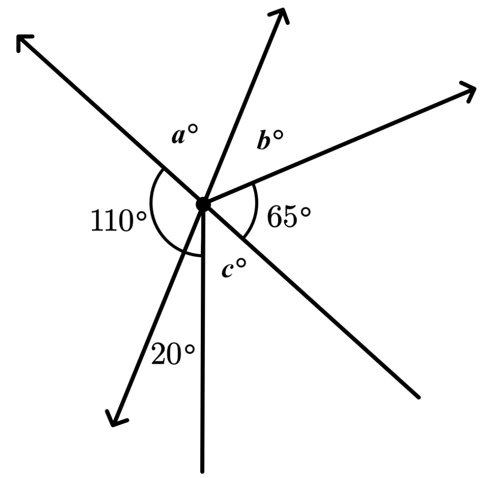



3.2



4. Determine the measure of each angle.

| | |
|---|---|
| $a$ | |
| $b$ | |
| $c$ | |

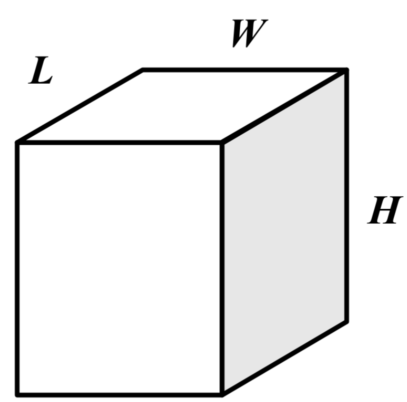



5. Melissa wants to buy a $\$25$ hat. The sales tax in her state is $6.25\%$. How much will Melissa spend on the hat, including the tax?

## 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.

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**Answer Key**

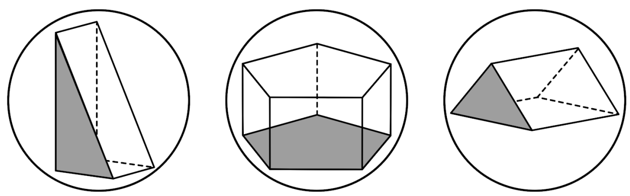
## Warm-Up

✓ $3x - 1$

✓ $-1 + 3x$

## 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 |

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**Unit 7.7, Lesson 11: Practice Problems** Name ______________________

## Warm-Up

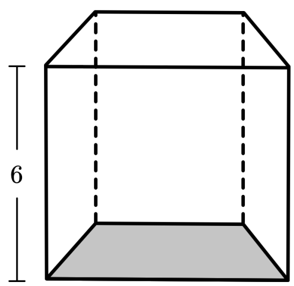
Write each fraction as a decimal.

$\frac{1}{2}=$ $\frac{1}{4}=$ $\frac{3}{4}=$ $\frac{1}{5}=$

## Practice

1. The volume of each of these trapezoidal prisms is 24 cubic units.
   What is the area each prism's base?

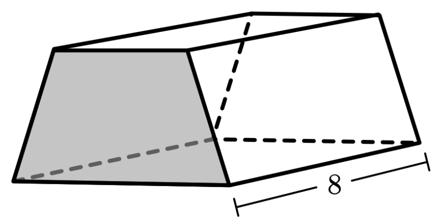
**Prism 1**




Volume: 24 cubic units

Area of the base:

**Prism 2**

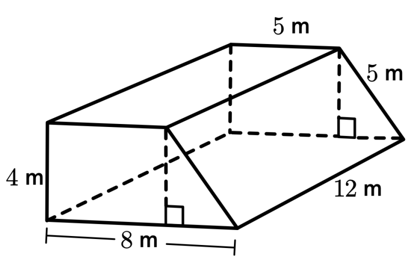



Volume: 24 cubic units

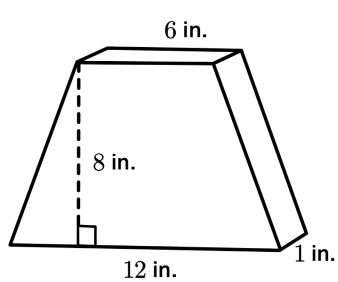
Area of the base:

Determine the volume of each prism. Explain your thinking.

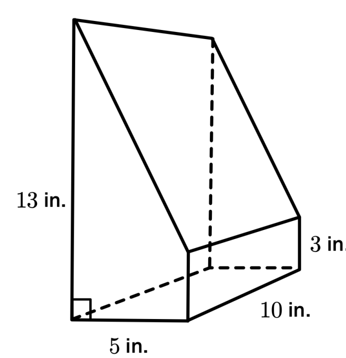
2.1




2.2




2.3



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**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.

Triangle 1

$8$ **cm**

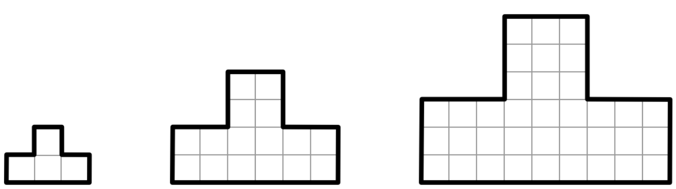
Triangle 2

$8$ **cm**

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?



*A* *B* *C*

## 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.

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**Unit 7.7, Lesson 11: Practice Problems** **Answer Key**

## 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.

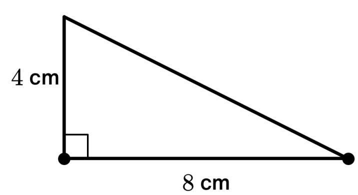
2.2 $72$ cubic inches

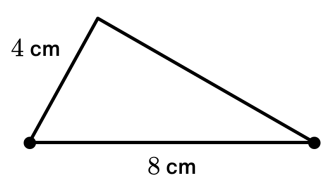
*Explanations vary.* The base of this prism is a trapezoid. The area of the base can be found by rearranging the trapezoid into an $8$-by-$9$-inch rectangle. $72 \cdot 1 = 72$ cubic inches.

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. $40 \cdot 10 = 400$ 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.

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**Unit 7.7, Lesson 12: Practice Problems** Name ______________________

## Warm-Up

Write each fraction as a percentage.

$\frac{1}{4}=$ $\frac{1}{5}=$ $\frac{3}{5}=$ $\frac{3}{10}=$

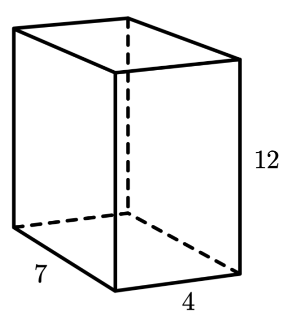
## Practice

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.

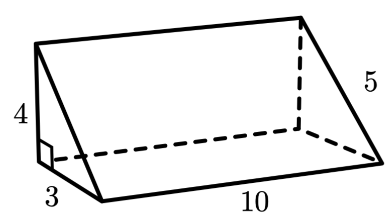
2.1




Volume:

Surface area:

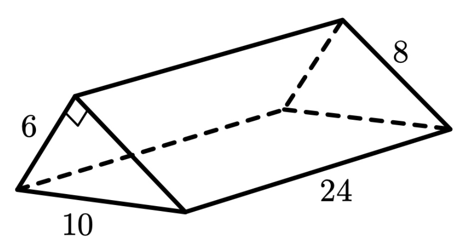
2.2




Volume:

Surface area:

2.3

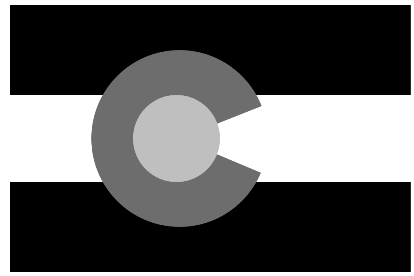



Volume:

Surface area:

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.

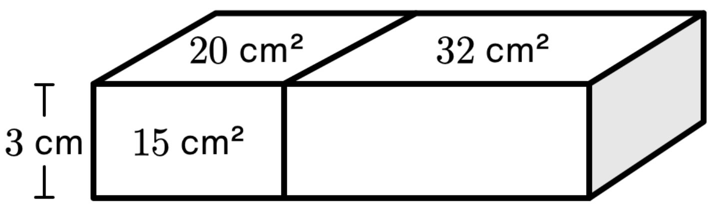


4.1 How much gold fabric do you need to create the flag?

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.

desmos

**Unit 7.7, Lesson 12: Practice Problems** **Answer Key**

## 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.

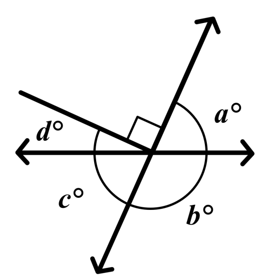
**Surface area:** 132 square units
*Explanations vary.* The prism has five faces. $30 + 40 + 50 + 2 \cdot 6 = 132$ square units.

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%

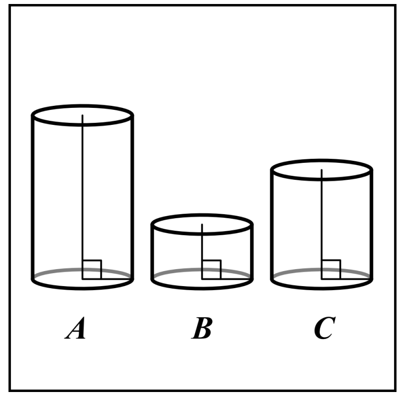
## Explore

**Surface area:** 206 square centimeters
**Volume:** 156 cubic centimeters

**Unit 8.5, Lesson 10: Practice Problems** Name ____________________

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

   Order the cylinders from least volume to greatest volume.

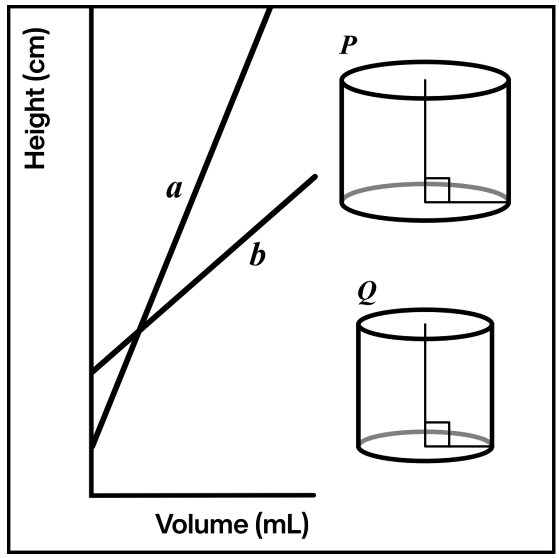



2. Two cylinders, $P$ and $Q$, each started with different amounts of water.

   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: $64\pi$ square units Circle: ________

Area: $16\pi$ square units Circle: ________

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**Unit 8.5, Lesson 10: Practice Problems**

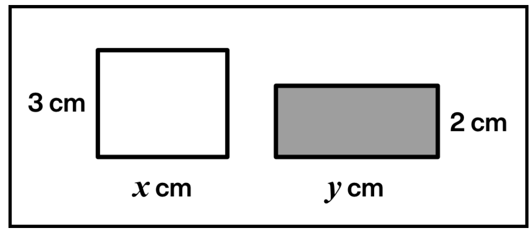
4. The volume of liquid after $t$ seconds in two different containers is represented by the expressions below.

   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 $30$ cm².




5.1 Complete the table.

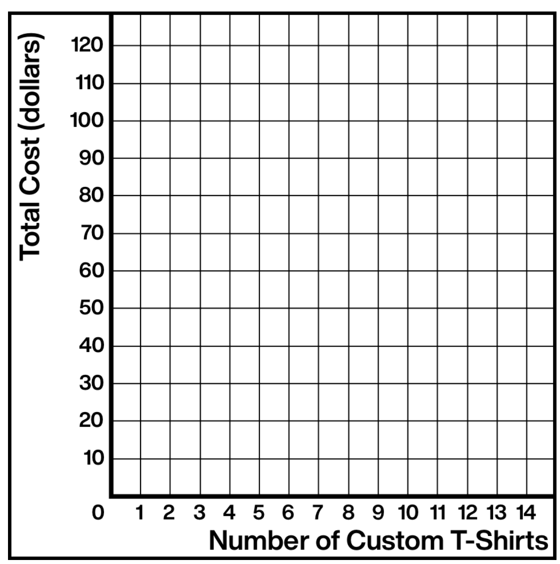
5.2 Write an equation to represent this situation.

| $x$ | $y$ |
|---|---|
| 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?



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**Unit 8.5, Lesson 10: Practice Problems** **Answer Key**

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: $64\pi$ square units | Circle: $C$ |
| Area: $16\pi$ 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)

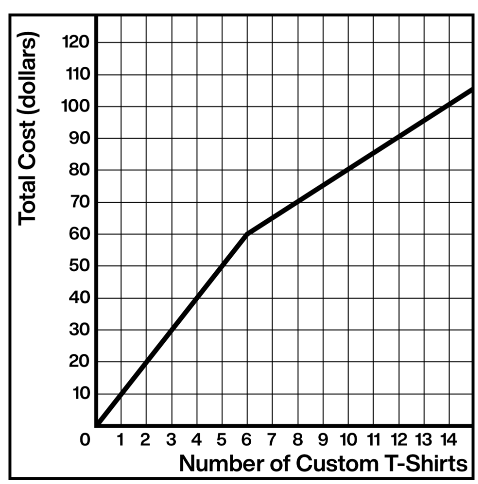
| $x$ | $y$ |
|---|---|
| 6 | 6 |
| 4 | 9 |
| 9 | 1.5 |
| 0 | 15 |

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.

**Unit 8.5, Lesson 11: Practice Problems** Name ____________________

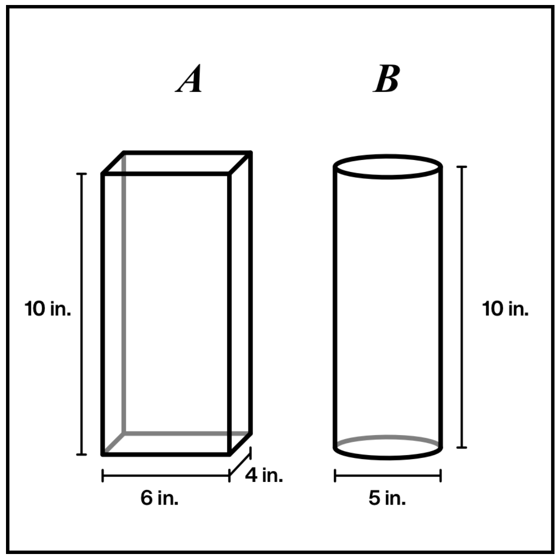
1.1 Sketch a cylinder in the space on the right.

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.

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**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 $\pi$.

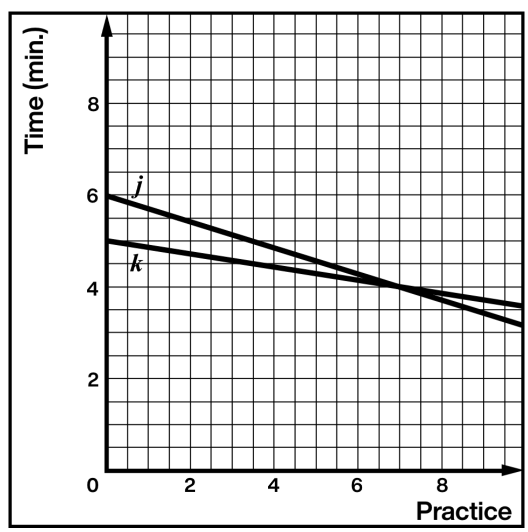
| Radius (cm) | Volume (cubic cm) |
|---|---|
| 1 | |
| 2 | |
| 3 | |

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?

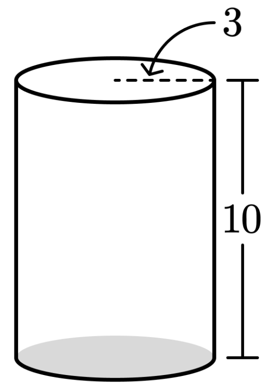
Explain your thinking.

desmos

**Unit 8.5, Lesson 11: Practice Problems**

# Answer Key

1.1 See the image on the right.




1.2 $90\pi$ cubic units

2.1 $2.5$ inches

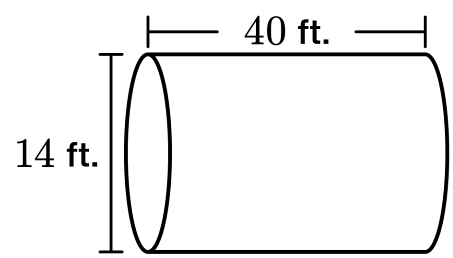
2.2 Base of container $A$. The area of the container $A$'s base is $24$ square inches. The area of the container $B$'s base is about $19.6$ square inches because $\pi(2.5)^2 \approx 19.63$.

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) |
|---|---|
| $1$ | $8\pi \approx 25.12$ **cm³** |
| $2$ | $32\pi \approx 100.48$ **cm³** |
| $3$ | $72\pi \approx 226.08$ **cm³** |

4. The tank can hold about $6154$ cubic feet. (Using $3.14$ as an approximation of $\pi$ 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.

# Science Mom Lesson 97

**Unit 8.5, Lesson 12: Practice Problems** Name ______________________________

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

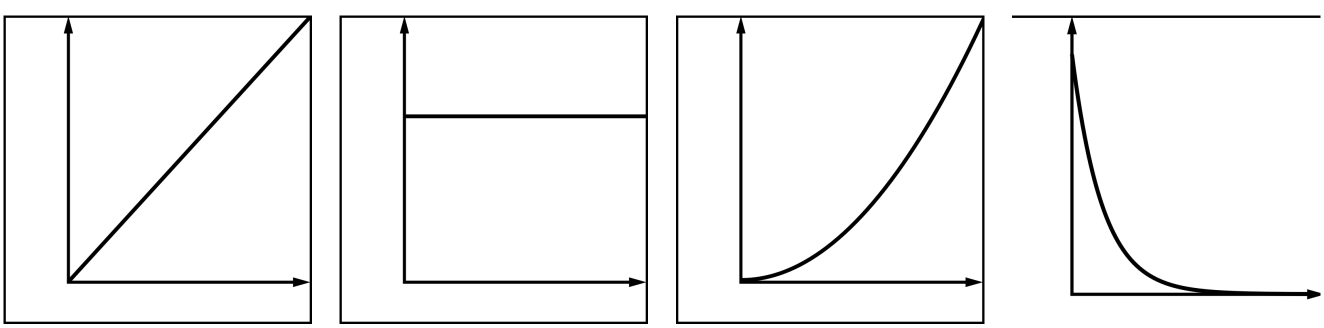
What is the volume of the cylinder? Express your answer in terms of $\pi$.

1.2 What is the volume of the cylinder from problem 1.1 with three times the height? Express your answer in terms of $\pi$.

1.3 What is the volume of the cylinder from problem 1.1 with three times the radius? Express your answer in terms of $\pi$.

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

A. B. C. D.

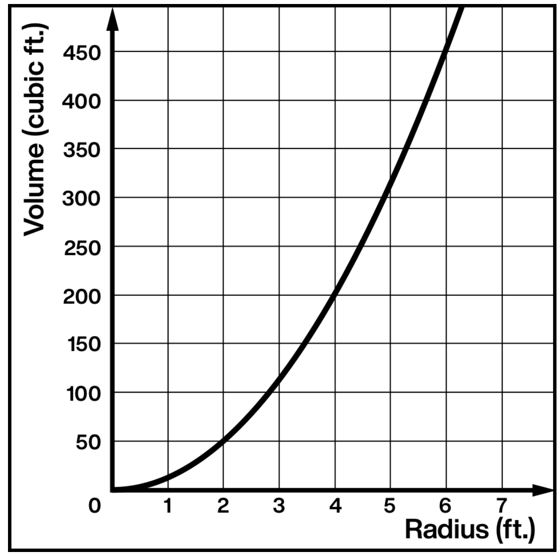


Explain your choice.

desmos

**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 $48\pi$ cm³ and height $h$.

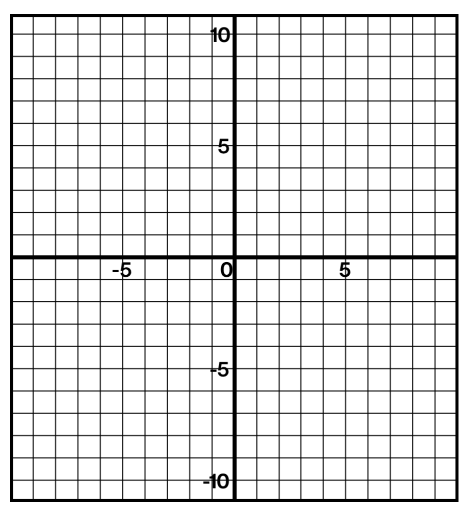
Complete this table for volume of cylinders with the same radius but different heights.

Express your answer in terms of $\pi$.

| Height (cm) | Volume (cubic cm) |
|---|---|
| $h$ | $48\pi$ |
| $2h$ | |
| $5h$ | |
| $\frac{h}{2}$ | |
| $\frac{h}{5}$ | |

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.




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

desmos

**Unit 8.5, Lesson 12: Practice Problems** **Answer Key**

1.1 $45\pi$ cubic centimeters

1.2 $135\pi$ cubic centimeters

1.3 $405\pi$ cubic centimeters

2. Graph A. As the height of water in a cylinder increases, the volume increases by the same scale factor.

3.1 $16\pi$ (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) |
|---|---|
| $h$ | $48\pi$ |
| $2h$ | $96\pi$ |
| $5h$ | $240\pi$ |
| $\frac{h}{2}$ | $24\pi$ |
| $\frac{h}{5}$ | $\frac{48}{5}\pi$ |

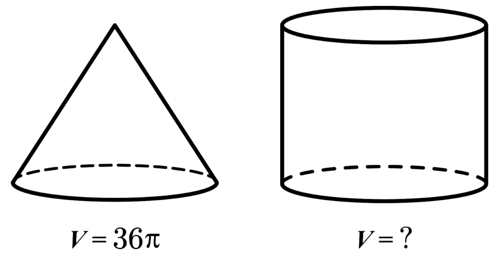
5. (From IM 8.3.10, From Desmos 8.3.10)
- ✓ $(3, 1)$
- ✓ $(1, -3)$
- ✓ $(6, 7)$

desmos Science Mom Lesson 98

**Unit 8.5, Lesson 13: Practice Problems** Name ______________________________

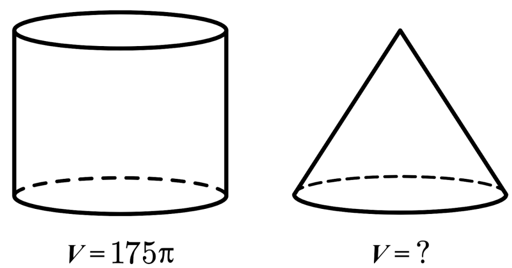
1.1 The volume of this cone is $36\pi$ cubic units.

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




1.2 The volume of this cylinder is $175\pi$ cubic units.

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




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 $\pi$.

Cylinder volume: ________________ Cone volume: ________________

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**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 $\pi$.

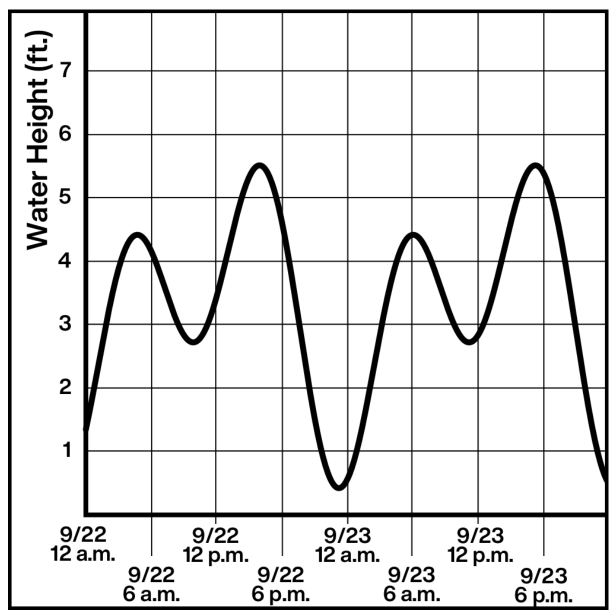
| Radius (m) | Volume (cu. m) |
|---|---|
| 1 | |
| 2 | |
| 3 | |
| 4 | |

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

Explain your thinking.

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 $108\pi$ 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: $62.8$ cm³
Cone: $20.9$ cm³

3.1

| Radius (m) | Volume (cu. m) |
|---|---|
| $1$ | $6\pi$ |
| $2$ | $24\pi$ |
| $3$ | $54\pi$ |
| $4$ | $96\pi$ |

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.

desmos **Science Mom Lesson 99**

**Unit 8.5, Lesson 15: Practice Problems** Name ______________________

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: $288\pi$ cm$^3$ Sphere: _______

Volume: $36\pi$ cm$^3$ Sphere: _______

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

2.1 Calculate the volume of a **sphere** with a diameter of $6$ inches.
Give your answer both in terms of $\pi$ and by using $3.14$ to approximate $\pi$.

In terms of $\pi$: _______________ 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 $\pi$ and by using $3.14$ to approximate $\pi$.

In terms of $\pi$: _______________ 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 $\pi$ and by using $3.14$ to approximate $\pi$.

In terms of $\pi$: _______________ 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?

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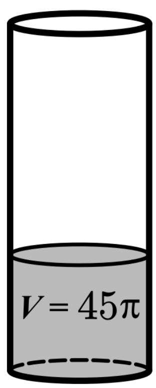
**Unit 8.5, Lesson 15: Practice Problems**

3.1 A cylinder has a volume of $45\pi$ cubic units and a radius of $3$ units. What is its height?

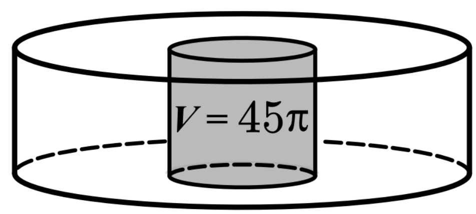
3.2 What is the volume of the cylinder when its height is tripled?

Express your answer in terms of $\pi$.




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

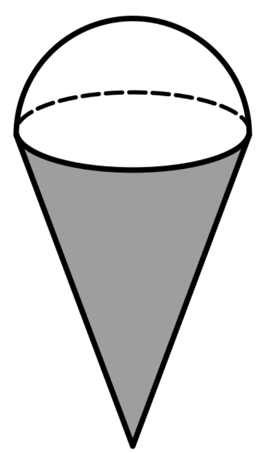
Express your answer in terms of $\pi$.




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?



**Unit 8.5, Lesson 15: Practice Problems** **Answer Key**

1.

Volume: $288\pi$ cm$^3$ Sphere: $C$

Volume: $36\pi$ cm$^3$ Sphere: $B$

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

2.1 $36\pi$ cubic inches
$113.04$ cubic inches

2.2 $54\pi$ cubic inches
$169.56$ cubic inches

2.3 $18\pi$ 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 $135\pi$ cubic centimeters

3.3 $405\pi$ cubic centimeters

4. $12$ centimeters

desmos Science Mom Lesson 100

**Unit 7.7, Lesson 13: Practice Problems** Name ________________

## Warm-Up

Write each decimal or percentage as a fraction.

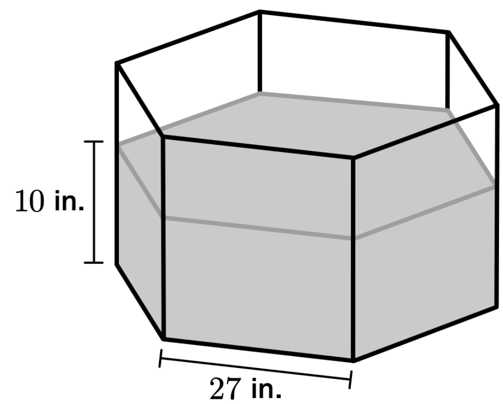
$0.25 =$ $40\% =$ $1\% =$ $0.8 =$

## 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.

desmos

**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?

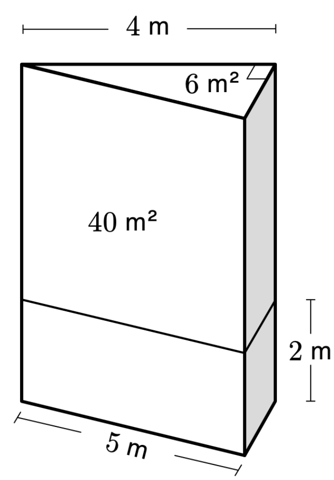
2.2 Write an equation that represents the total cost, $c$, of any item bought in Idaho whose price is $p$ if you include sales tax.

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.

**Unit 7.7, Lesson 13: Practice Problems** **Answer Key**

## 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.* $2\,106$ 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?

desmos

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

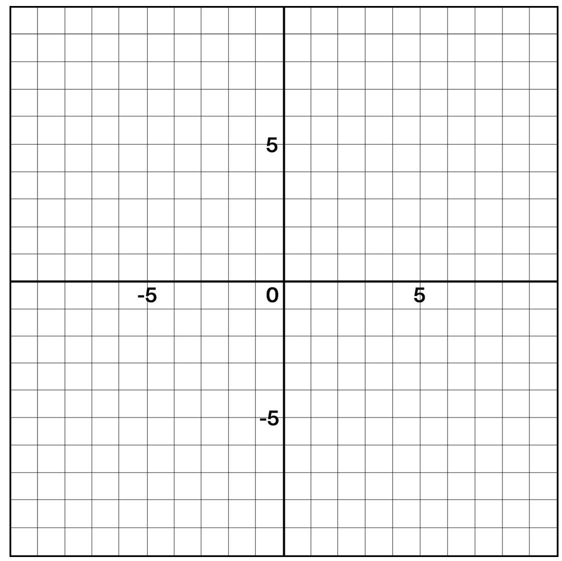
4. The equation $y = 5280x$ gives the number of feet, $y$, in $x$ miles.

   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. $1$

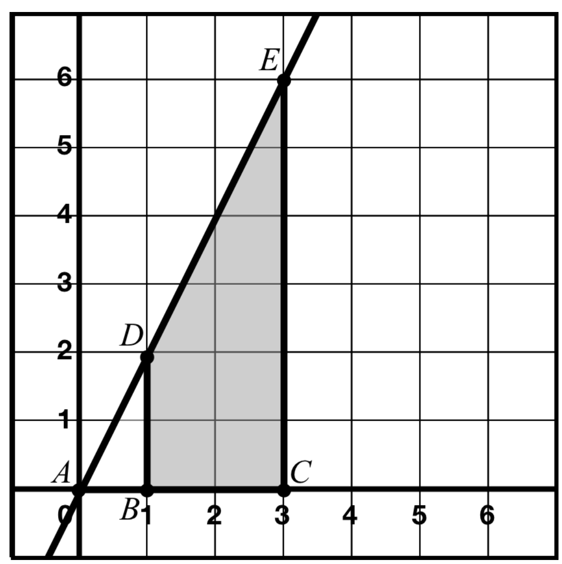
   C. $\frac{4}{3}$

   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 |
|---|---|
| | |



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

# Answer Key

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.

5. $\frac{3}{4}$

6.

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

**Unit 8.7, Lesson 2: Practice Problems** Name ________________________________

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.

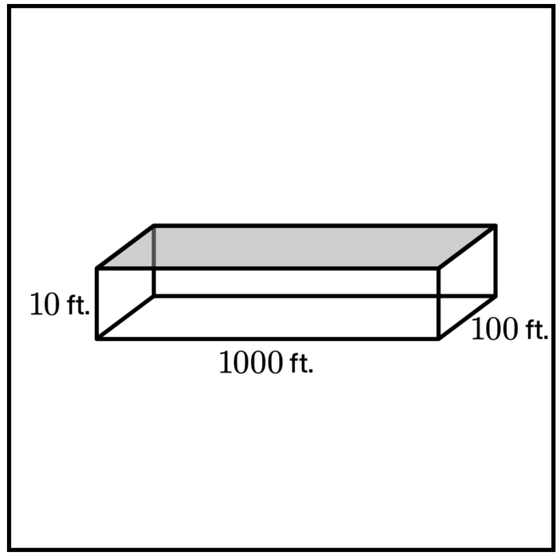
| Expression | Single Power |
|---|---|
| $(3^7)^2$ | |
| $(2^9)^3$ | |
| $(7^6)^3$ | |
| $(11^2)^3$ | |
| $(5^3)^2$ | |
| $(6^5)^7$ | |

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.

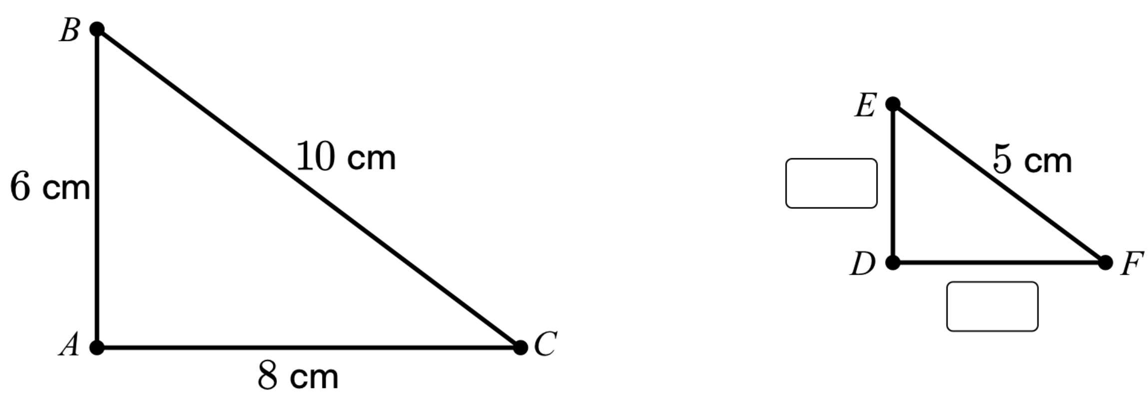
   3.1 What is the area of the surface of the water in the pool?

   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 $DF$.



**Answer Key**

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 |
| --- | --- |
| $(3^7)^2$ | $3^{14}$ |
| $(2^9)^3$ | $2^{27}$ |
| $(7^6)^3$ | $7^{18}$ |
| $(11^2)^3$ | $11^6$ |
| $(5^3)^2$ | $5^6$ |
| $(6^5)^7$ | $6^{35}$ |

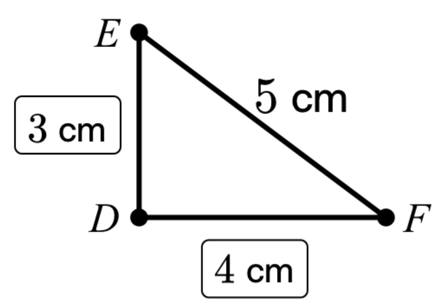
3.1 100 000 square feet

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.



desmos Science Mom Lesson 104

**Unit 8.7, Lesson 4: Practice Problems** Name ______________________

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

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.

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**Unit 8.7, Lesson 4: Practice Problems**

**Answer Key**

1.

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

2.

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

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.

**Unit 8.7, Lesson 5: Practice Problems** Name ______________________________

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 $4^{-3}$.

   - [ ] $-12$
   - [ ] $2^{-6}$
   - [ ] $\frac{1}{4^3}$
   - [ ] $\left(\frac{1}{4}\right) \cdot \left(\frac{1}{4}\right) \cdot \left(\frac{1}{4}\right)$
   - [ ] $12$
   - [ ] $\frac{8^{-1}}{2^2}$

desmos

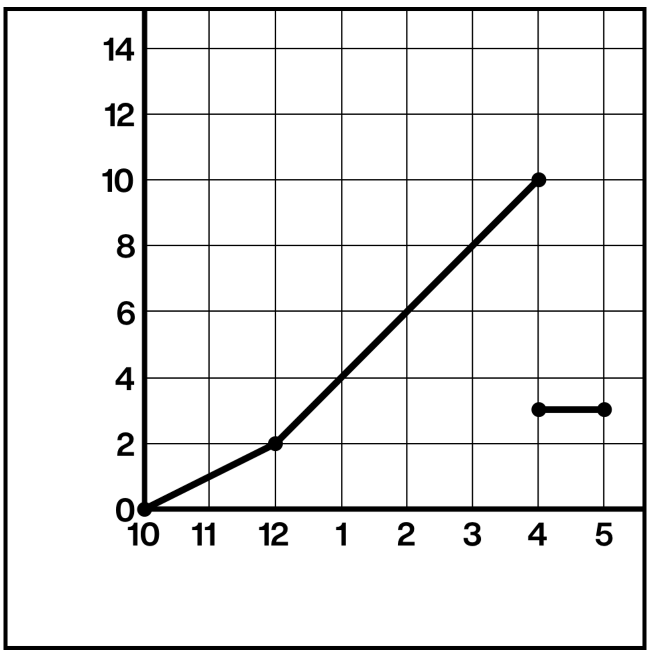
**Unit 8.7, Lesson 5: Practice Problems**

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

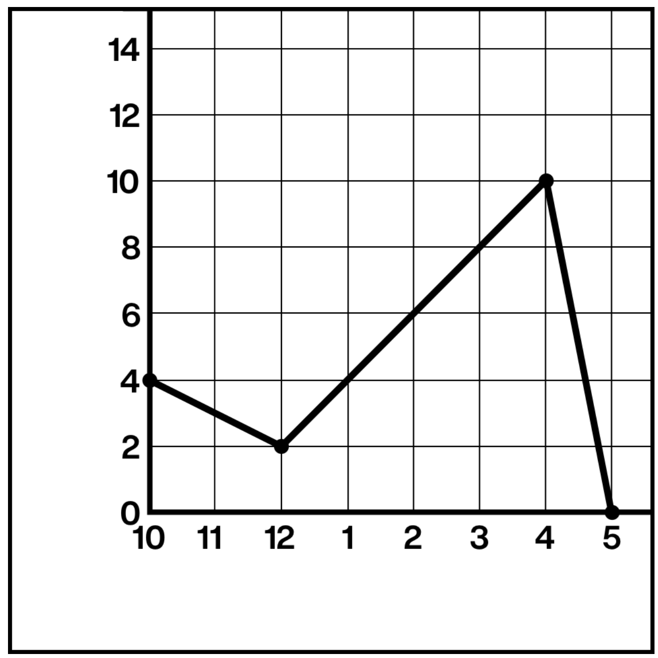
- At $10$ a.m., the gauge is empty.
- Two hours later, the gauge has $2$ centimeters of water in it.
- At $4$ p.m., he finds the gauge has $10$ centimeters of water in it.
- He accidentally knocks the gauge over and spills most of the water, leaving only $3$ centimeters of water.
- At $5$ p.m., there 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.

**Unit 8.7, Lesson 5: Practice Problems** **Answer Key**

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

**Unit 8.7, Lesson 7: Practice Problems** Name ____________________

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

$0.000001$ : _______

$0.001$ : _______

$0.01$ : _______

$1\ 000\ 000$ : _______

$1\ 000\ 000\ 000$ : _______

A. One billion

B. One thousandth

C. One million

D. One hundredth

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 | |

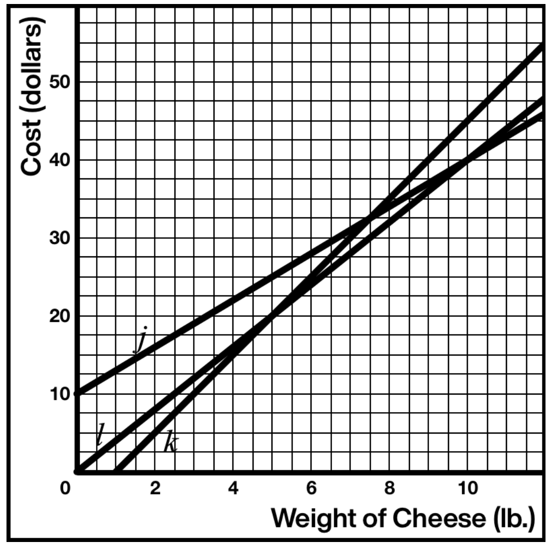
3. Find three different ways to write the number $437{,}000$ as a multiple of a power of $10$.

| Value | As a Multiple of a Power of $10$ |
|---|---|
| $437\ 000$ | |
| $437\ 000$ | |
| $437\ 000$ | |

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.

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**Unit 8.7, Lesson 7: Practice Problems**

# Answer Key

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

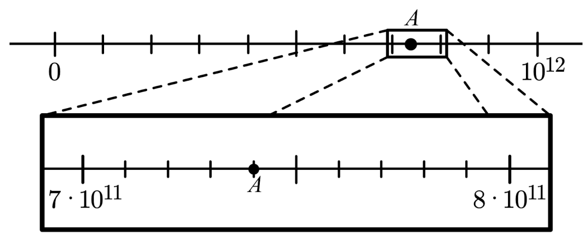
4.4 *Responses vary.* $11$ pounds. Store C is the cheapest for every number of pounds after $10$.

**Unit 8.7, Lesson 8: Practice Problems** Name ______________________

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 |
|---|---|
| $10^{-3} \cdot 10^{-2}$ | |
| $10^{4} \cdot 10^{-1}$ | |
| $\frac{10^{5}}{10^{7}}$ | |
| $\left(10^{-4}\right)^{5}$ | |
| $10^{-3} \cdot 10^{2}$ | |
| $\frac{10^{-9}}{10^{5}}$ | |

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 $10$ |
|---|---|
| $10^{-3} \cdot 10^{-2}$ | $10^{-5}$ |
| $10^{4} \cdot 10^{-1}$ | $10^{3}$ |
| $\frac{10^{5}}{10^{7}}$ | $10^{-2}$ |
| $\left(10^{-4}\right)^{5}$ | $10^{-20}$ |
| $10^{-3} \cdot 10^{2}$ | $10^{-1}$ |
| $\frac{10^{-9}}{10^{5}}$ | $10^{-14}$ |

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

5.

| In Terms of $\pi$ | 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 $b = \frac{41}{5}$

desmos Science Mom Lesson 108

**Unit 8.7, Lesson 9: Practice Problems** Name ______________________

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.

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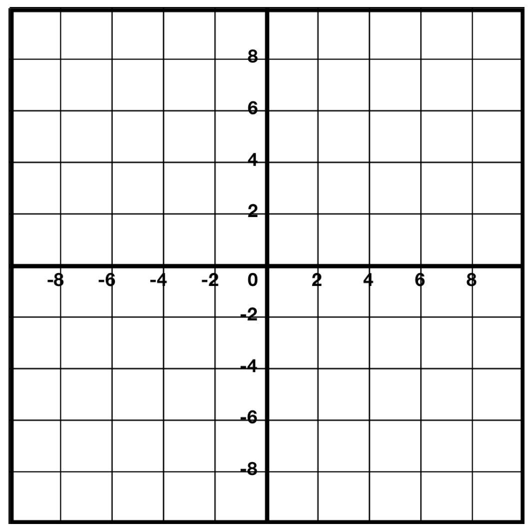
**Unit 8.7, Lesson 9: Practice Problems**

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

- ☐ $-18$
- ☐ $\frac{6}{6^4}$
- ☐ $\frac{1}{6^3}$
- ☐ $(-6) \cdot (-6) \cdot (-6)$
- ☐ $\left(\frac{1}{6}\right) \cdot \left(\frac{1}{6}\right) \cdot \left(\frac{1}{6}\right)$
- ☐ $2^{-3} \cdot 3^{-3}$
- ☐ $\frac{12^6}{2^9}$

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

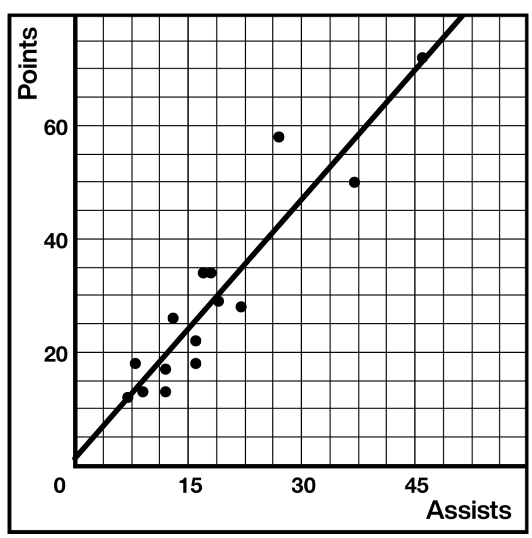
Then write the equation of the line.




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



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**Unit 8.7, Lesson 9: Practice Problems**

## Answer Key

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 |
| $83\ 333.\overline{3}$ | feet |
| $15.7\overline{82}$ | 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 $100 \cdot 100 \cdot 100 = 1\ 000\ 000$.

3. ✓ $\frac{6}{6^4}$

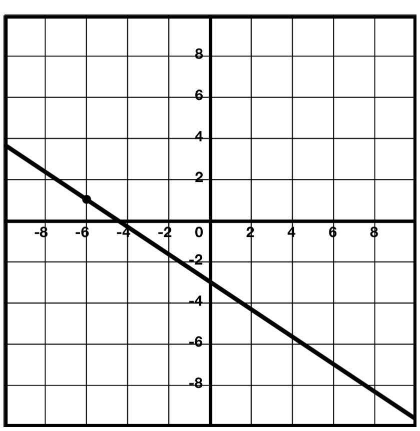
✓ $\frac{1}{6^3}$

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

✓ $2^{-3} \cdot 3^{-3}$

4.

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




5.

✓ Linear Association
✓ Positive Association

desmos Science Mom Lesson 110

**Unit 8.7, Lesson 11: Practice Problems** Name ______________________

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?

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

About how many times greater is one than the other?

2.2 Which number is greater?

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

About how many times greater is one than the other?

2.3 Which number is greater?

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

About how many times greater is one than the other?

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

   The distance from Earth to the Moon is about $2.389 \times 10^5$ miles.
   The distance from Earth to the Sun is about $9.296 \times 10^7$ miles.

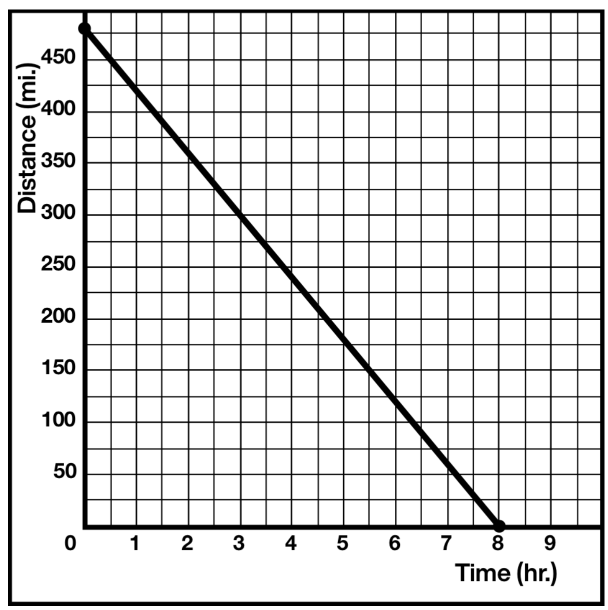
   She decides to put Earth on one corner of her dresser and the Moon in another corner about a foot away.

   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 $4 \cdot 10^{2}$, 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.

**Unit 8.7, Lesson 12: Practice Problems** Name ____________________

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) |
|---|---|
| $5.3 \cdot 10^4 + 4.7 \cdot 10^4$ | |
| $3.7 \cdot 10^6 - 3.3 \cdot 10^6$ | |
| $4.8 \cdot 10^{-3} + 6.3 \cdot 10^{-3}$ | |
| $6.6 \cdot 10^{-5} - 6.1 \cdot 10^{-5}$ | |

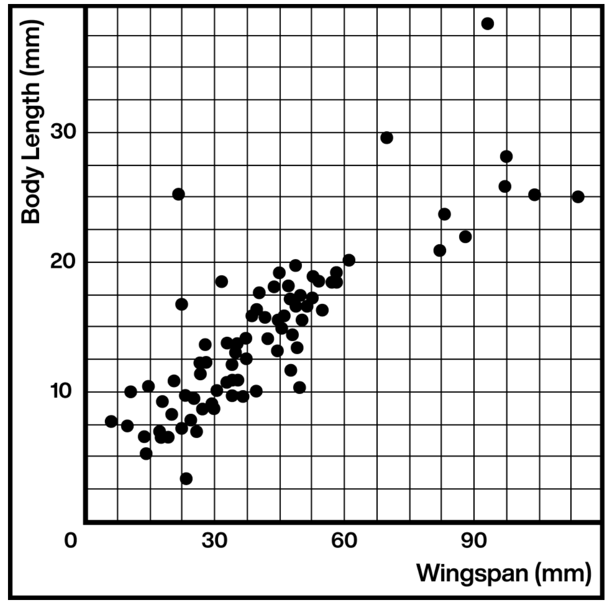
3. Han found a way to compute complicated expressions more easily. Since $2 \cdot 5 = 10$, he looks for pairings of 2s and 5s that he knows equal $10$. Apply Han's technique to compute the expressions in the table.

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 |
|---|---|
| $2^4 \cdot 5 \cdot (3 \cdot 5)^3$ | |
| $\dfrac{2^3 \cdot 5^2 \cdot (2 \cdot 3)^2 \cdot (3 \cdot 5)^2}{3^2}$ | |

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

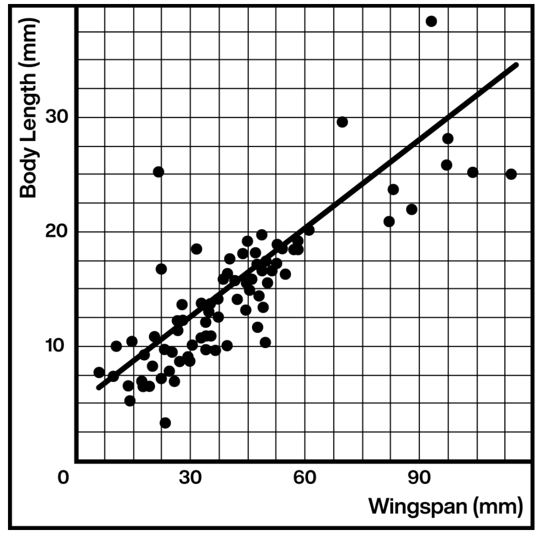
2.

| 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 |
|---|---|
| $2^4 \cdot 5 \cdot (3 \cdot 5)^3$ | $270\,000$ |
| $\dfrac{2^3 \cdot 5^2 \cdot (2 \cdot 3)^2 \cdot (3 \cdot 5)^2}{3^2}$ | $180\,000$ |

4.1 (From IM 8.6.5, Desmos 8.6.05)
*Responses vary.*




4.2 *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 $-28 + 8x$.

desmos Science Mom Lesson 112

**Unit 8.7, Lesson 13: Practice Problems** Name ______________________________

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

   Some useful information:

   - The world's oceans hold roughly $1.4 \times 10^9$ 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.

2. 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.

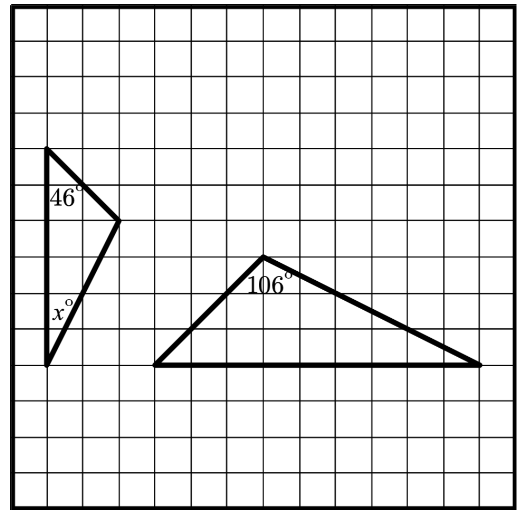
   ☐ Meters across the milky way

   ☐ Total number of cells in all humans

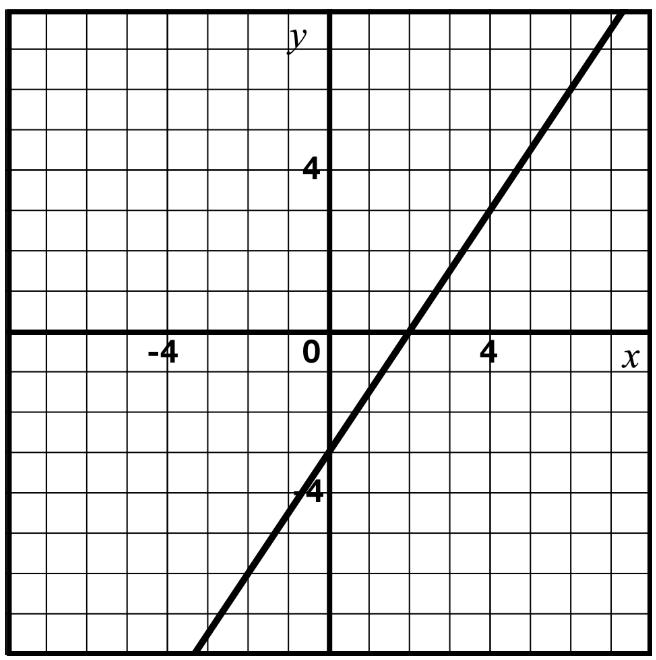
   Explain your thinking.

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 $(4,\ 3)$.

**Unit 8.7, Lesson 13: Practice Problems** **Answer Key**

1. $7 \cdot 10^{19}$
   (The world's oceans hold $1.4 \times 10^{24}$ cubic centimeters of water, which is found by multiplying $1.4 \times 10^{9}$ by $10^{15}$, and then dividing by $2 \times 10^{4}$ to get $0.7 \times 10^{20}$. In scientific notation, this quotient is $7 \times 10^{19}$.)

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 $\left(3.7 \cdot 10^{13}\right) \cdot \left(7 \cdot 10^{9}\right)$. 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)

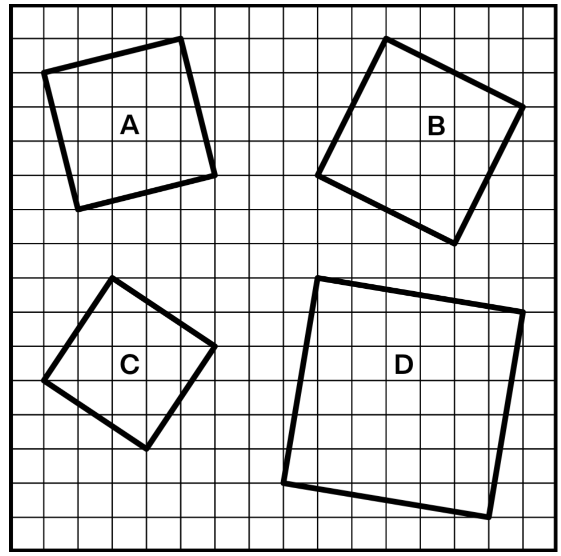
4.2 $y = \frac{3}{2}x + 2$ (or equivalent)

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

**Unit 8.8, Lesson 1: Practice Problems** Name ______________________

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 |

4. Evaluate $(3.1 \times 10^4) \cdot (2 \times 10^6)$. Choose the correct answer.

   A. $5.1 \times 10^{10}$

   B. $5.1 \times 10^{24}$

   C. $6.2 \times 10^{10}$

   D. $6.2 \times 10^{24}$

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 $5.4 \times 10^5$ as $54 \times 10^4$. 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 $3^8$.

   - [ ] $3^6 \cdot 10^2$
   - [ ] $8^3$
   - [ ] $\frac{3^6}{3^{-2}}$
   - [ ] $3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3$
   - [ ] $(3^4)^2$
   - [ ] $(3^2)^4$

**Unit 8.8, Lesson 1: Practice Problems** **Answer Key**

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. $6.2 \times 10^{10}$

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 $5.63 \times 10^5$.

6. ✓ $\frac{3^6}{3^{-2}}$

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

✓ $\left(3^4\right)^2$

✓ $\left(3^2\right)^4$

**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 | |

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.

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

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.

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

- ☐ $\frac{1}{1,000,000}$
- ☐ $\left(\frac{1}{10}\right)^6$
- ☐ $\frac{-1}{1,000,000}$
- ☐ $\frac{1}{10^6}$
- ☐ $10^8 \cdot 10^{-2}$
- ☐ $\frac{1}{10 \cdot 10 \cdot 10 \cdot 10 \cdot 10 \cdot 10}$

**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)
$7.12 \times 10^6$ square kilometers greater.

5.2 The Asian countries.

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

6. (From IM 8.7.5, Desmos 8.7.05)

✓ $\frac{1}{1{,}000{,}000}$

✓ $\left(\frac{1}{10}\right)^6$

✓ $\frac{1}{10^6}$

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

desmos **Science Mom Lesson 115**

**Unit 8.8, Lesson 4: Practice Problems** Name ______________________________

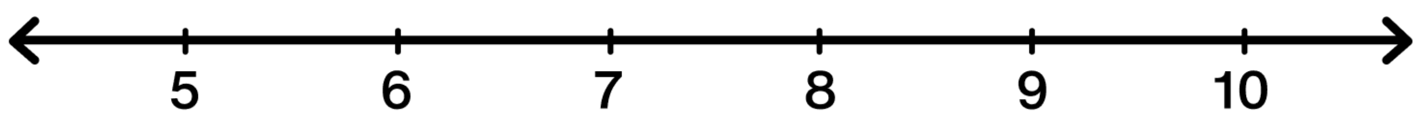
1.1 Explain how you know that $\sqrt{37}$ is a little more than $6$.

1.2 Explain how you know that $\sqrt{95}$ is a little less than $10$.

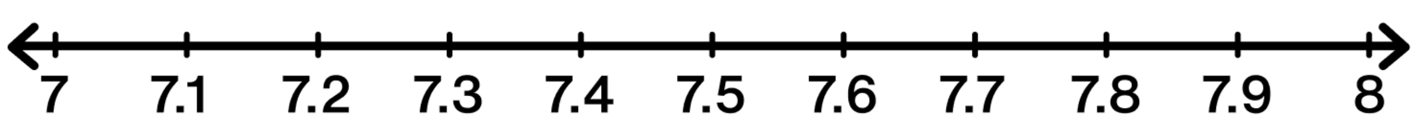
1.3 Explain how you know that $\sqrt{30}$ is between $5$ and $6$.

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.



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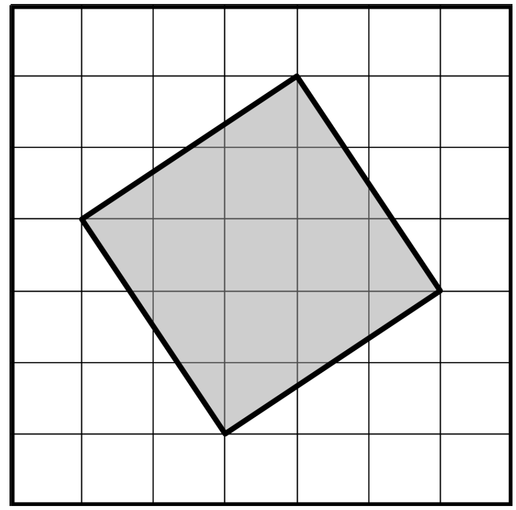
**Unit 8.8, Lesson 4: Practice Problems**

4. Each grid square represents $1$ square unit.

   What is the exact side length of the shaded square?



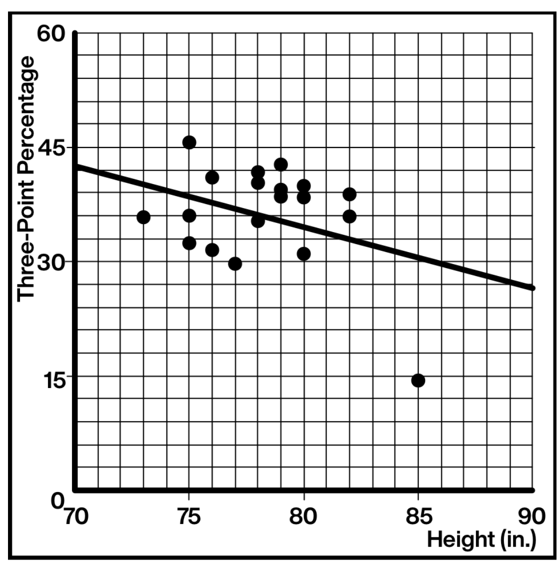
5. For each pair of numbers, circle the larger number. Estimate how many times as large.

| | | |
|---|---|---|
| 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.



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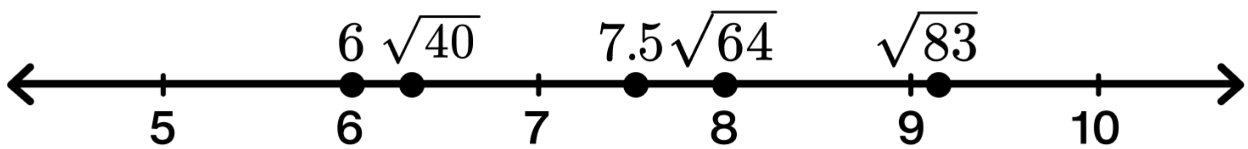
**Unit 8.8, Lesson 4: Practice Problems** **Answer Key**

1.1 $\sqrt{36}$ is exactly $6$, and $\sqrt{37}$ is a little more than that.

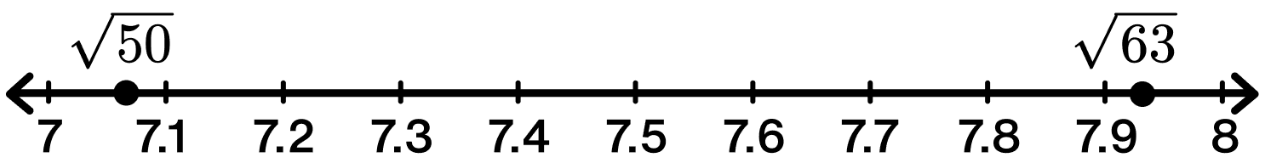
1.2 $\sqrt{100}$ is exactly $10$, and $95$ is a little less than that.

1.3 $\sqrt{25} = 5$ and $\sqrt{36} = 6$. $\sqrt{30}$ is in between.

2.




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.

desmos Science Mom Lesson 116

**Unit 8.8, Lesson 5: Practice Problems** Name ____________________

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 |
|---|---|
| $\sqrt[3]{1}$ | |
| $\sqrt[3]{216}$ | |
| $\sqrt[3]{8\,000}$ | |
| $\sqrt[3]{\frac{1}{64}}$ | |
| $\sqrt[3]{\frac{27}{125}}$ | |
| $\sqrt[3]{0.027}$ | |
| $\sqrt[3]{0.000125}$ | |

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 |
|---|---|
| $\sqrt[3]{27}$ | |
| $\sqrt[3]{530}$ | |
| $\sqrt{48}$ | |
| $\sqrt{121}$ | |
| $\pi$ | |
| $\frac{19}{2}$ | |

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Unit 8.8, Lesson 5: Practice Problems

# Answer Key

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.

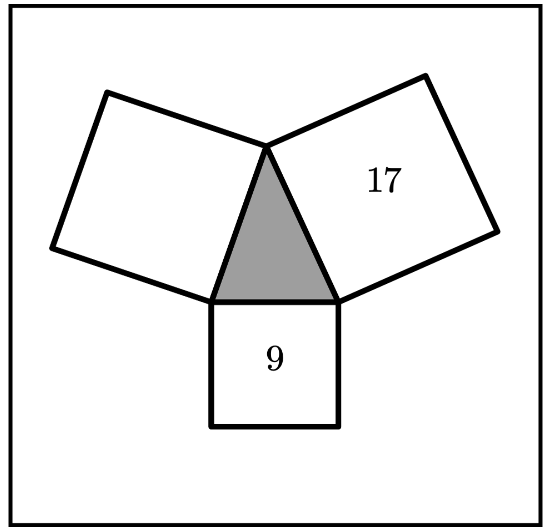
| Number | Order |
|---|---|
| $\sqrt[3]{27}$ | 1 (least) |
| $\sqrt[3]{530}$ | 4 |
| $\sqrt{48}$ | 3 |
| $\sqrt{121}$ | 6 (greatest) |
| $\pi$ | 2 |
| $\frac{19}{2}$ | 5 |

**Unit 8.8, Lesson 6: Practice Problems** Name ______________________

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 $9 + 17 = 26$.

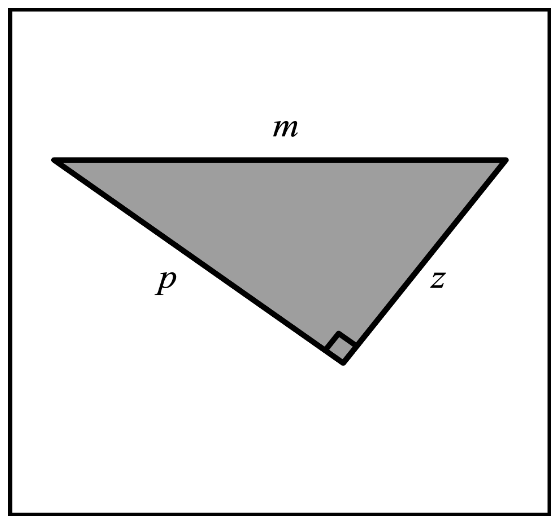
   Do you agree?

   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 $z$.

   - ☐ $m^2 + p^2 = z^2$
   - ☐ $m^2 = p^2 + z^2$
   - ☐ $m^2 = z^2 + p^2$
   - ☐ $p^2 + m^2 = z^2$
   - ☐ $z^2 + p^2 = m^2$
   - ☐ $p^2 + z^2 = m^2$



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.

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**Unit 8.8, Lesson 6: Practice Problems**

# Answer Key

1. No, I disagree.
*Responses vary.*
Priya's pattern only works for right triangles, and this is an acute triangle.

2. ✓ $m^2 = p^2 + z^2$

✓ $m^2 = z^2 + p^2$

✓ $z^2 + p^2 = m^2$

✓ $p^2 + z^2 = m^2$

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 $1.5 \times 10^9$

5.2 Years

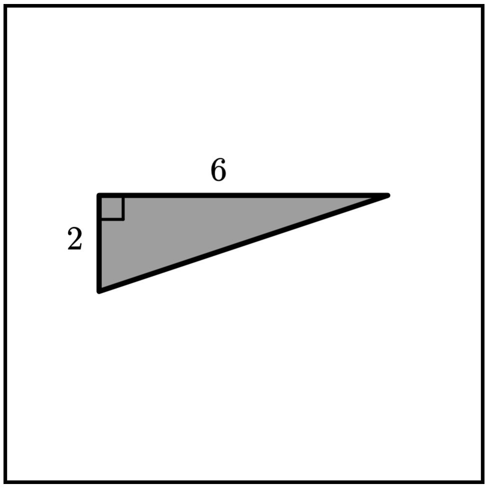
5.3 48 years old

Science Mom Lesson 118

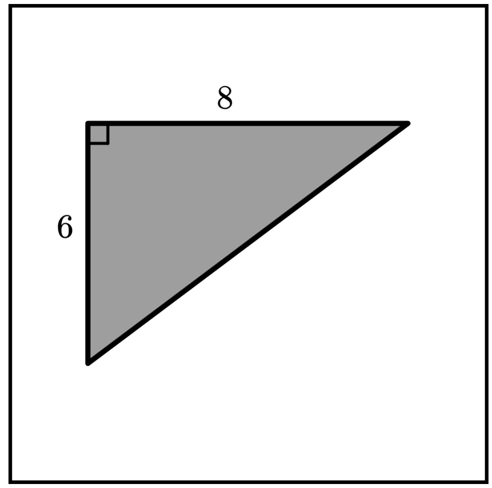
**Unit 8.8, Lesson 7: Practice Problems**

Name ______________________________

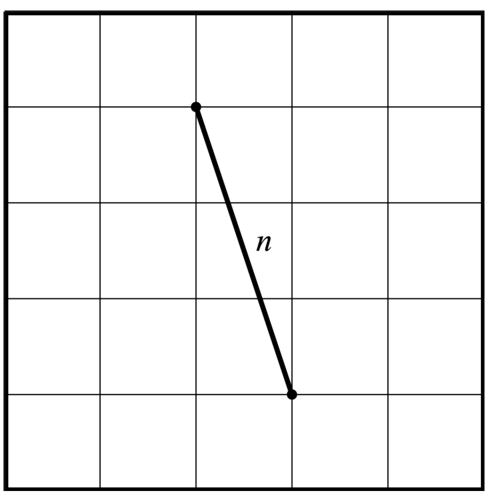
1.1 Find the length of the unlabeled side.



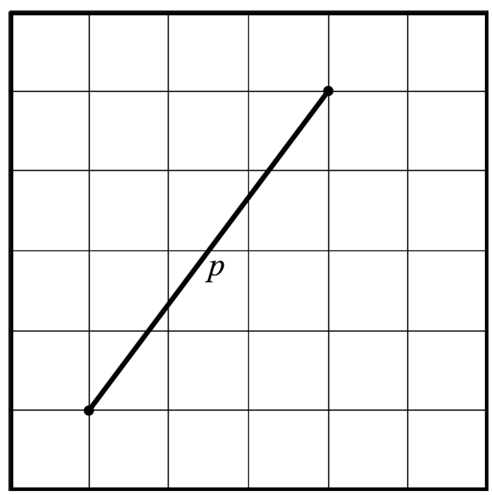

1.2 Find the length of the unlabeled side.




1.3 This segment is $n$ units long.
What is the value of $n$?

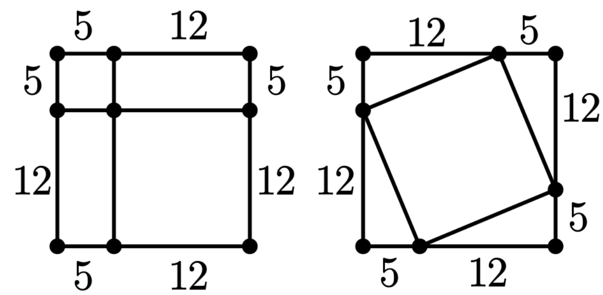



1.4 This segment is $p$ units long.
What is the value of $p$?



**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 $10$ |
|---|---|
| $10^5 \cdot 10^0$ | |
| $\frac{10^9}{10^0}$ | |

**Unit 8.8, Lesson 7: Practice Problems** **Answer Key**

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)

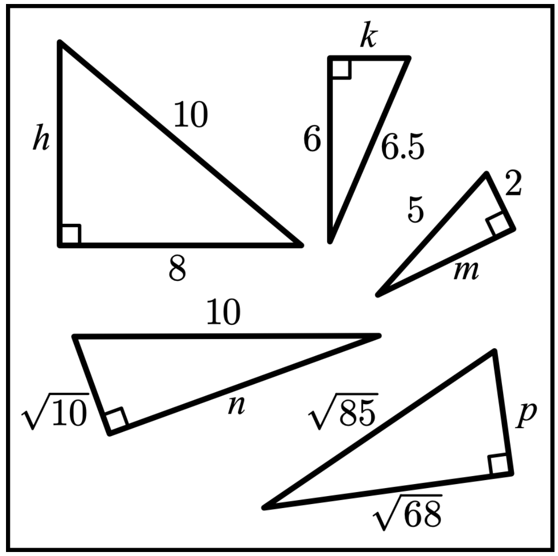
| Expression | Single Power of $10$ |
|---|---|
| $10^5 \cdot 10^0$ | $10^5$ |
| $\frac{10^9}{10^0}$ | $10^9$ |

desmos **Science Mom Lesson 119**

**Unit 8.8, Lesson 8: Practice Problems** Name ______________________

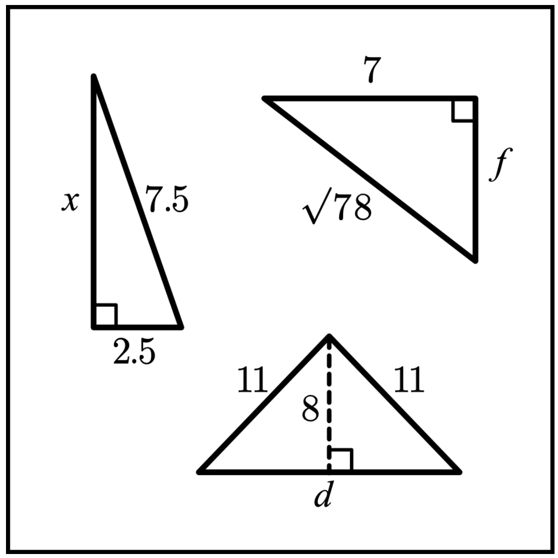
1. Find the exact value of each variable representing a side length in a right triangle.

| 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 |
|---|
| $c^2 =$ |
| $a^2 =$ |
| $b^2 =$ |

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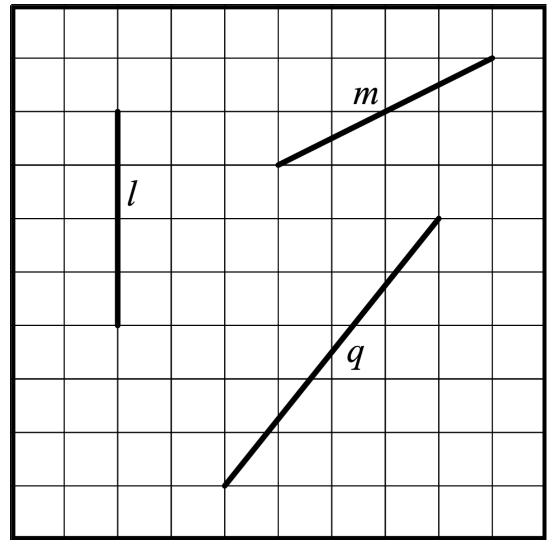
**Unit 8.8, Lesson 8: Practice Problems**

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 $1 \times 10^6$ high school football players and $2 \times 10^3$ professional football players in the United States.

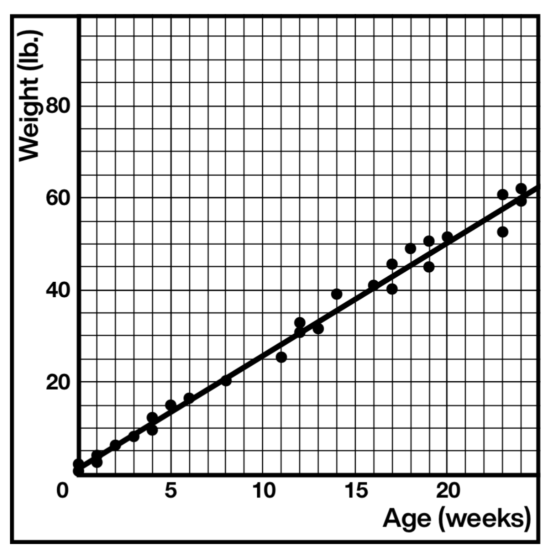
   About how many times more high school football players were there? Explain your thinking.

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?

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 |
|---|
| $c^2 = a^2 + b^2$ |
| $a^2 = c^2 - b^2$ |
| $b^2 = c^2 - a^2$ |

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).

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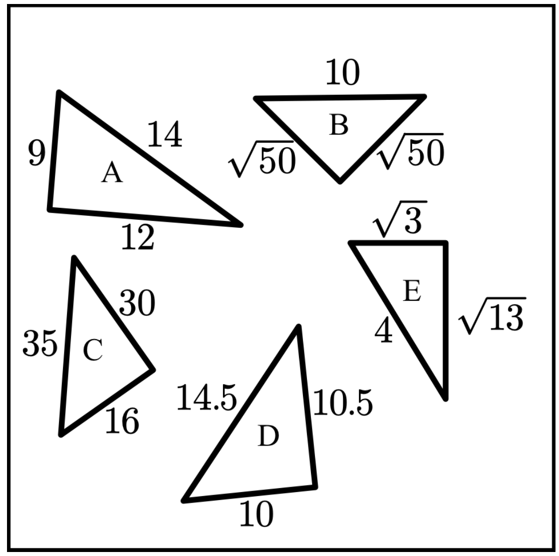
**Unit 8.8, Lesson 9: Practice Problems** Name ______________________

1. Select **all** of the triangles that are definitely right triangles.

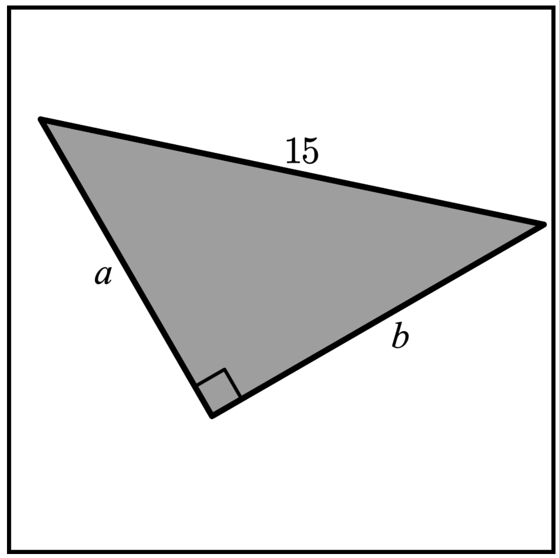
   (Note that not all triangles are drawn to scale.)

   - ☐ *A*
   - ☐ *B*
   - ☐ *C*
   - ☐ *D*
   - ☐ *E*



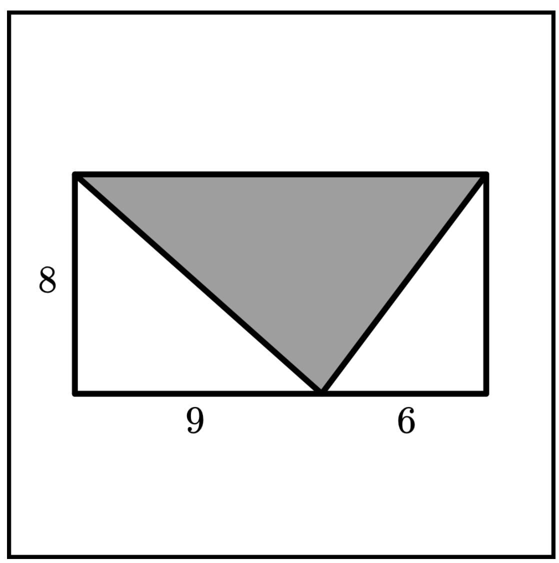

2. A right triangle has a hypotenuse of $15$ centimeters. What are possible lengths for the two legs of the triangle?

| Leg | Length |
|---|---|
| $a$ | |
| $b$ | |




3. Here is a $15$-by-$8$ rectangle divided into triangles. Is the shaded triangle a right triangle?

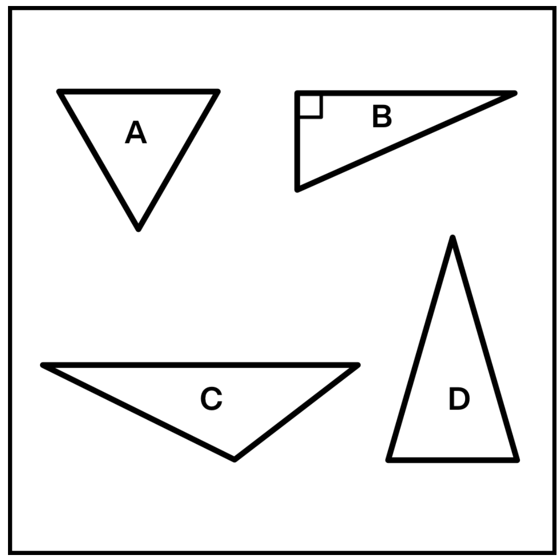
   Explain your thinking.



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.)

**Unit 8.8, Lesson 9: Practice Problems** **Answer Key**

1. ✓ $B$
   ✓ $D$
   ✓ $E$

2. *Responses vary.*

| Leg | Length |
|---|---|
| $a$ | $\sqrt{200}$ cm |
| $b$ | $5$ 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 | $a$ | $b$ | $c$ |
|---|---|---|---|
| $M$ | 12 | 5 | 13 |
| $N$ | 20 | 21 | 29 |

5. (From IM 8.8.6, Desmos 8.8.06)
   ✓ B

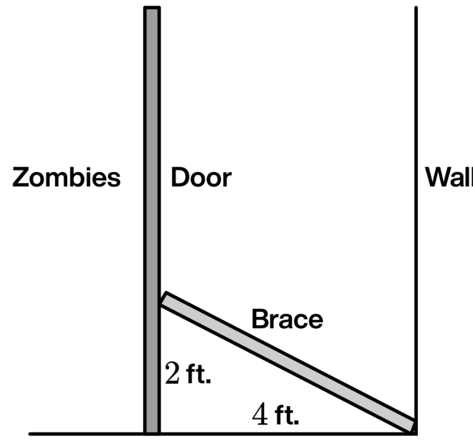
6. (From IM 8.4.5, Desmos 8.4.05)
   $500$ dollars

   *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 $x = 500$.

**Unit 8.8, Lesson 10: Practice Problems** Name ________________________________

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?



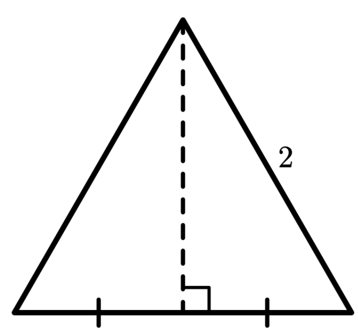

2. At a restaurant, a trash can's opening is rectangular and measures $7$ inches by $9$ inches. The serving trays measure $12$ inches by $16$ inches. Jada says it is impossible for a tray to accidentally fall through the trash can opening because the shortest side of a tray is longer than either side 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 $x$.

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## 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.

   - ☐ $8,\ 7,\ 15$
   - ☐ $4,\ 10,\ \sqrt{84}$
   - ☐ $\sqrt{8},\ 11,\ \sqrt{129}$
   - ☐ $\sqrt{1},\ 2,\ \sqrt{3}$

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. $(4,\ 7)$
   B. $(2,\ 0)$
   C. $(6,\ 5)$
   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?

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**Unit 8.8, Lesson 10: Practice Problems** **Answer Key**

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

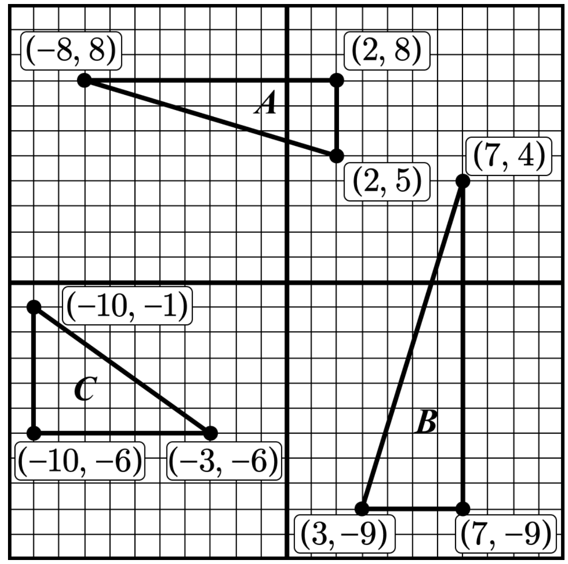
7. (From IM 8.3.10, Desmos 8.3.08)
D. $(5, 4)$

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.

**Unit 8.8, Lesson 11: Practice Problems** Name ______________________

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.

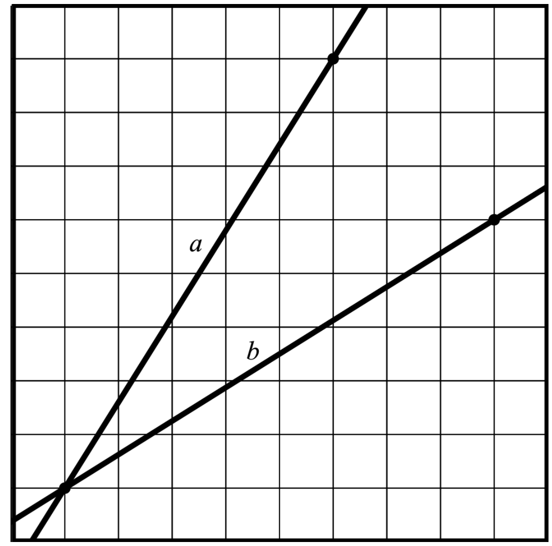
   If you get stuck, try plotting the points on graph paper.

| Points | Distance Between Points |
|---|---|
| $K = (5, 0)$ and $L = (-4, 0)$ | |
| $M = (-21, -29)$ and $B = (0, 0)$ | |

**Unit 8.8, Lesson 11: Practice Problems**

4.1 Which line has a slope of $0.625$?

A. Line $a$
B. Line $b$

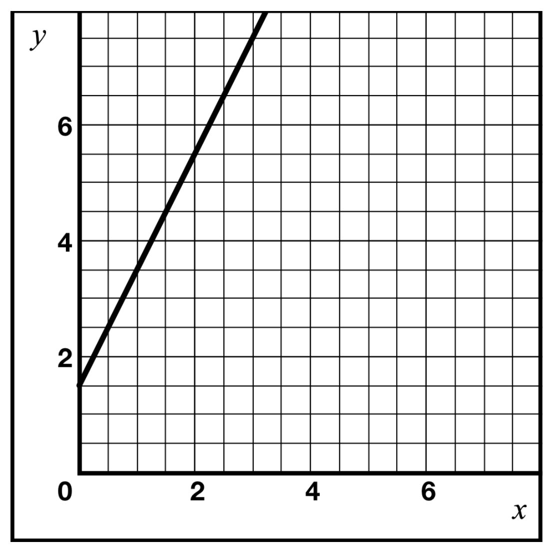



4.2 Which line has a slope of $1.6$?

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 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 |
|---|---|
| $\sqrt{\frac{9}{100}}$ | |
| $\frac{99}{100}$ | |
| $\sqrt{\frac{9}{16}}$ | |
| $\frac{23}{10}$ | |

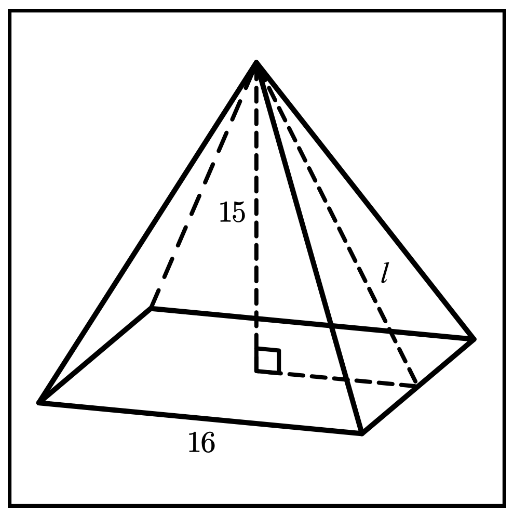
3. Write each expression as a fraction.

| Expression | Fraction |
|---|---|
| $\sqrt{0.81}$ | |
| $0.0276$ | |
| $\sqrt{0.04}$ | |
| $10.01$ | |

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?

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# Answer Key

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.*

$\frac{17}{20} \cdot \frac{5}{5} = \frac{85}{100}$, so $\frac{17}{20}$ 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 $x = 0.13\overline{7}$ as a fraction.

Han says that $0.13\overline{7}$ equals $\frac{13{,}764}{99{,}900}$. "I calculated $1000x = 137.77\overline{7}$ 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 $0.13\overline{7}$ equals $\frac{124}{900}$. "I calculated $10x = 1.37\overline{7}$ 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.

$\frac{2}{3}$ : ______

$\frac{126}{37}$ : ______

A. $3.4\overline{5}$

B. $0.\overline{6}$

C. $3.\overline{405}$

D. $0.\overline{23}$

E. $3.450$

F. $0.\overline{6}$

3.2 Write each decimal as a fraction.

| Decimal | Fraction |
|---|---|
| $0.\overline{75}$ | |
| $0.\overline{3}$ | |

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**Unit 8.8, Lesson 13: Practice Problems**

4. Fill in the blank next to each fraction with the letter of its decimal representation.

$\frac{48}{99}$ : ______

$\frac{5}{99}$ : ______

$\frac{44}{90}$ : ______

$\frac{7}{90}$ : ______

$\frac{5}{9}$ : ______

$\frac{7}{100}$ : ______

A. $0.07$

B. $0.0\overline{7}$

C. $0.\overline{5}$

D. $0.\overline{05}$

E. $0.4\overline{8}$

F. $0.\overline{48}$

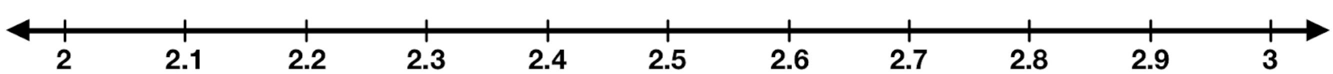
5. Write each decimal as a fraction.

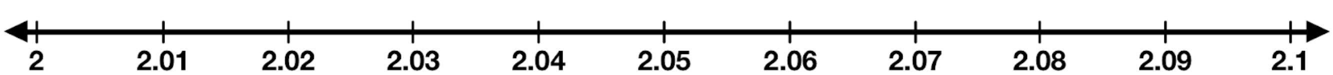
| Decimal | Fraction |
|---|---|
| $0.\overline{7}$ | |
| $0.\overline{2}$ | |
| $0.1\overline{3}$ | |
| $0.\overline{14}$ | |

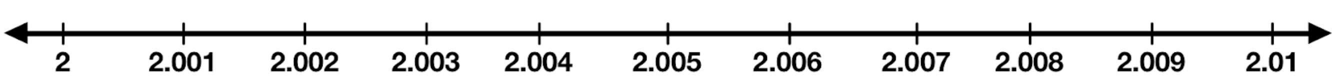
| Decimal | Fraction |
|---|---|
| $0.\overline{03}$ | |
| $0.6\overline{38}$ | |
| $0.52\overline{4}$ | |
| $0.1\overline{5}$ | |

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.



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**Unit 8.8, Lesson 13: Practice Problems**

# Answer Key

1. Both. *Responses vary.* Han and Elena both get fractions that are equal to $0.13\overline{7}$. 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. $0.\overline{48}$

$\frac{7}{90}$ : B. $0.0\overline{7}$

$\frac{5}{99}$ : D. $0.\overline{05}$

$\frac{5}{9}$ : C. $0.\overline{5}$

$\frac{44}{90}$ : E. $0.4\overline{8}$

$\frac{7}{100}$ : 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) |

6. **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 $2.237$.

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**Unit 8.8, Lesson 14: Practice Problems** Name ______________________

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.

- ☐ $\frac{-123}{45}$
- ☐ $\frac{2}{3}$
- ☐ $\sqrt{14}$
- ☐ $\sqrt{99}$
- ☐ $\sqrt{100}$
- ☐ $\sqrt{64}$

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.

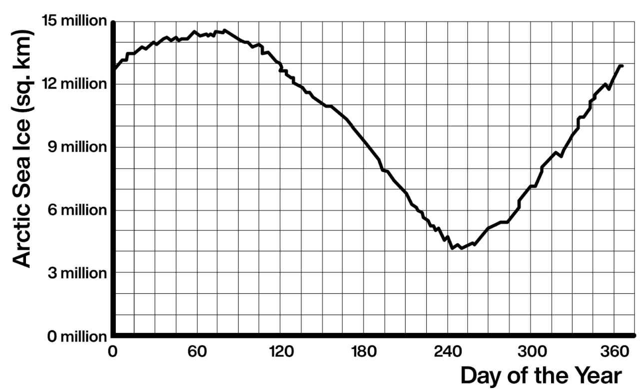
7.1 $(10^2)^{-3}$

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.

**Unit 8.8, Lesson 14: Practice Problems** **Answer Key**

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