# END GAME GOAL SETTING
## Houston County School System Mathematics

| Student Name: | Teacher Name: |
|---|---|

| Grade: 8th | Unit #: One | Unit Title: Transformations, Congruence, and Similarity |
|---|---|---|

**The following Statements and examples show the skills, concepts, and understandings that I will gain before the end of this unit.**

☐ **I can write/solve/explain linear equations in one variable that give one solution, infinitely many solutions or no solutions.**

| | |
|---|---|
| 1. Chad solved the equation $24x + 4 + 2x = 3(10x - 1)$ and is claiming that $x = 2$ makes the equation true. Is Chad correct? Explain why or why not. | 2. Write three different equations that have $x = 5$ as a solution. |
| 3. Give a brief explanation as to what kind of solution(s) you expect the linear equation to have: $5(x + 9) = 5x + 45.$ Transform the equation into a simpler form if necessary. | 4. If the equation $5(3x + 7) - 1 = 3(5x + k) + 4$ has infinitely many solutions, what is the value of k? A. 7 B. 10 C. 27 D. 30 |
| You and your friend have a race. You run three miles per hour and start six miles behind the actual start line. Your friend runs three miles per hour and gets a two-mile head start. After how many hours will you catch up with your friend? | Josh has $40 and is saving $10 a day. Sal has $160 and is spending $5 a day. After how many days will they have the same amount of money? |

☐ **I can solve equations using distributive property, combining like terms, and equations with variables on both sides.**

| | |
|---|---|
| 5. Is each equation equivalent to $-4(3x + 2) = x + 2(x - 1)?$ Write yes or no. <br> • $-12x + 2 = 3x - 1$ <br> • $-15x = 6$ <br> • $-8x = 15x - 2$ | 6. Liam is solving the equation $12a - 4(5a - 1) = 2(3a + 6) - 4a.$ The result of each step of his solution is shown below. $$12a - 4(5a - 1) = 2(3a + 6) - 4a$$ $$12a - 20a + 4 = 6a + 12 - 4a$$ $$-8a + 4 = 2a + 12$$ $$-6a + 4 = 12$$ $$-6a = 8$$ $$a = -\frac{4}{3}$$ Circle the step in which Liam's first error occurred. Describe the error. Then, solve the equation correctly. |
| 7. Mr. Zane wrote two equations on the board: <br> K  3(x – 12) – 3x = 12 <br> L  3(x – 4) + 24 – 3x = 12 <br> Which statement is true about the two equations? <br> A. Equation K has one solution and equation L has no solution. <br> B. Equation L has one solution and equation K has no solution. <br> C. Equation K has no solution and equation L has infinite solutions <br> D. Equation L has no solution and equation K has infinite solutions. | 8. What is the solution to the equation 8.5x + 12 = 6.5x – 18? <br><br> A. −15 <br> B. −3 <br> C. −1.5 <br> D. −0.4 |

☐ **I can show and/or explain how the angle-sum and exterior-angle theorems of a triangle are true. I can identify angle pairs created by parallel lines cut by a transversal and explain which angle pairs are congruent or supplementary and why.**

9. Are the triangles shown below similar? Present an informal argument as to why they are or why they are not.
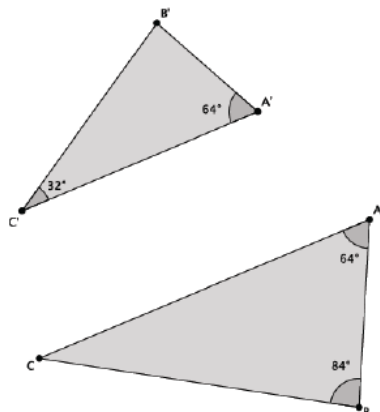


10. In the street map shown, Adams Street, Becker Street, and Cabell Street form a triangle. Dunlop Street connects the intersection of Adams and Becker Streets with Cabell Street. Erving Street connects the intersection of Becker and Cabell Streets with Adams Street.
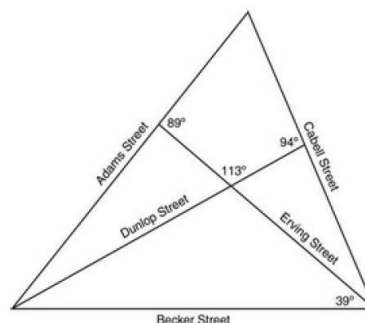


Which two streets intersect to form an angle with a measure of 28°?

11. In the figure below, line *ST* is parallel to line *PR*.
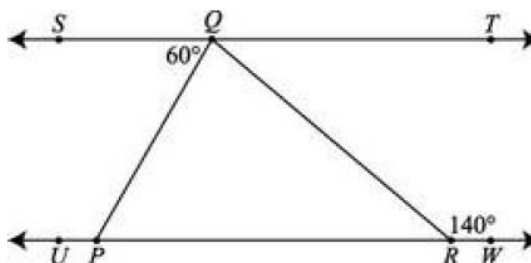


- Determine the measure of ∠*QPR*. Explain what angle relationship(s) you used to find your answer.
- What is the measure of ∠*PQR*? Show your work and explain what angle relationship you used to find your answer.

☐ **I can use the properties of translations, rotations, and reflections on line segments, angles, parallel lines or geometric figures. I can show and explain two figures are congruent using transformations (explaining the series of transformations used).**

12. Translate Δ*XYZ* along $\overrightarrow{AB}$. Label the image of the triangle with $X'$, $Y'$, and $Z'$.
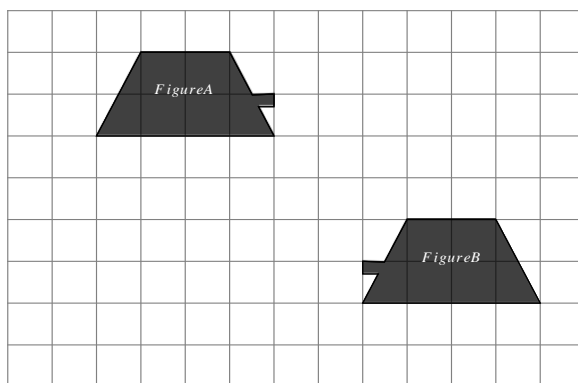   **(Tools needed: ruler and protractor)**
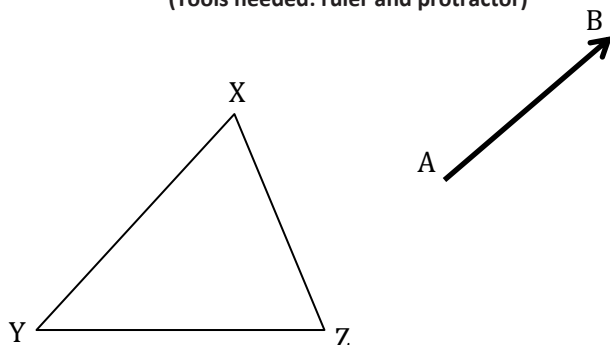


13. Reflect Δ*XYZ* across the line of reflection, *l.* Label the image of the triangle with $X'$, $Y'$, and $Z'$.
   **(Construct perpendicular bisector)**
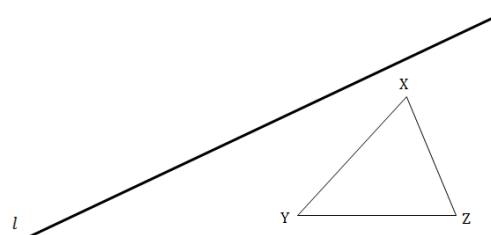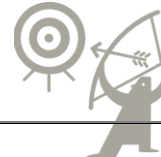
**14.** Figure A has been transformed to Figure B.
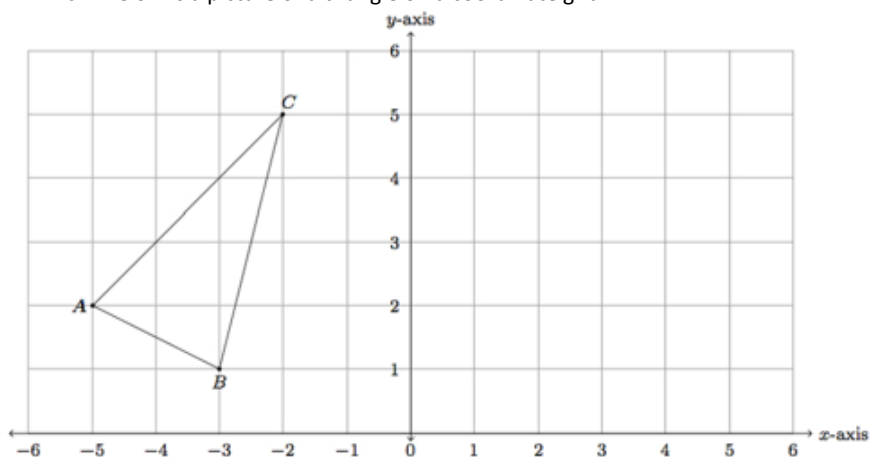
Can Figure A be mapped onto Figure B using only translation?  Explain.  Use drawings, as needed, in your explanation.



☐  **I can determine the new coordinate of a figure given a dilation, translation, rotation, or reflection.**
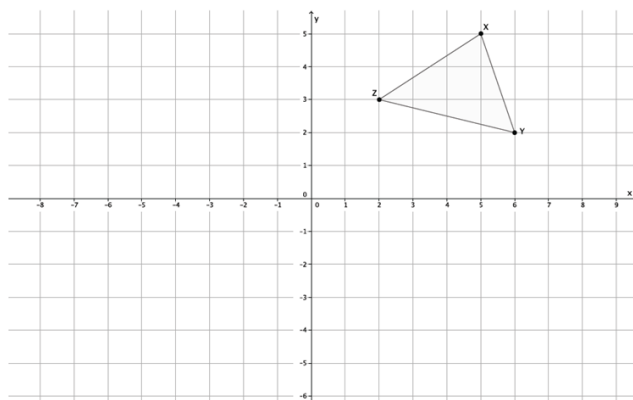
EXAMPLES:

**15.**  Below is a picture of a triangle on a coordinate grid:



a. Draw the reflection of $\triangle ABC$ over the line $x = -2$. Label the image of $A$ as $A'$, the image of $B$ as $B'$ and the image of $C$ as $C'$.

b. Draw the reflection of $\triangle A'B'C'$ over the line $x = 2$. Label the image of $A'$ as $A''$, the image of $B'$ as $B''$ and the image of $C'$ as $C''$.

c. What single rigid transformation of the plane will map $\triangle ABC$ to $\triangle A''B''C''$? Explain.

Rotate $\triangle XYZ$ around the origin clockwise $90°$.  Label the image of the triangle with $X'$, $Y'$, and $Z'$.

☐ **I can describe transformations and/or dilations that produce similar figures and explain similarity of figures in terms of dilation and/or transformation.**

EXAMPLES:

16. Triangle $ABC$ is located at points $A = (-4, 3)$, $B = (3, 3)$, and $C = (2, -1)$ and has been dilated from the origin by a scale factor of 3. Draw and label the vertices of triangle $ABC$. Determine the coordinates of the dilated triangle $A'B'C'$ and draw and label it on the coordinate plane.
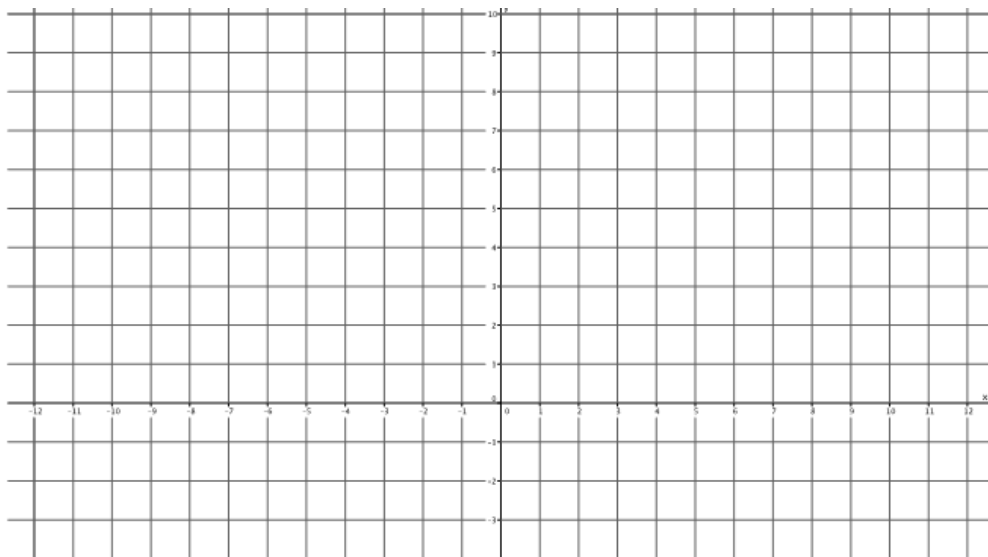


17. Use the diagram below to answer the questions that follow. The length of each segment is as shown: segment $OX$ is 5 units, segment $OY$ is 7 units, segment $XY$ is 3 units, and segment $X'Y'$ is 12.6 units.
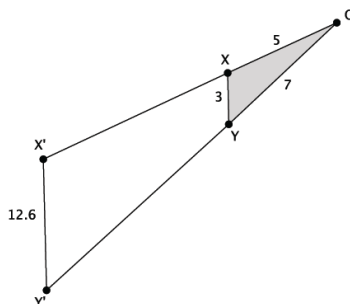


a. Suppose $XY$ is parallel to $X'Y'$. Is triangle $\triangle OXY$ similar to triangle $\triangle OX'Y'$? Explain.
b. What is the length of segment $OX'$? Show your work.
c. What is the length of segment $OY'$? Show your work.

# END GAME GOAL SETTING
## Houston County School System Mathematics

| Student Name: | | Teacher Name: |
|---|---|---|
| Grade: 8th | Unit #: 2 | Unit Title: Exponents and Roots |

**The following Statements and examples show the skills, concepts, and understandings that I will gain before the end of this unit.**

☐ I can find square roots and cube roots of perfect squares and perfect cubes.

Determine the positive square root of the number given. If the number is not a perfect square, determine the integer to which the square root would be closest.

1. $\sqrt{169}$
2. $\sqrt{256}$
3. $\sqrt{81}$
4. $\sqrt{147}$
5. $\sqrt{8}$
6. Which of the numbers in Problems 1–5 are not perfect squares? Explain.

7. Find $\sqrt[3]{216}$
8. Find $\sqrt[3]{125}$

9. What positive value of $x$ makes the following equation true: $x^3 = 64$? Explain.

10. A cube has a volume of 27 in³. What is the measure of one of its sides? Write and solve an equation.

☐ I can explain the difference between a rational and an irrational number.
☐ I can place rational and irrational numbers on a number line.

11. Identify each of the following numbers as rational or irrational. If the number is irrational, explain how you know.

   a. $\sqrt{29}$

   b. $5.\overline{39}$

   c. $\frac{12}{4}$

   d. $\sqrt{36}$

   e. $\sqrt{5}$

   f. $\sqrt[3]{27}$

   g. $\pi = 3.141592\ldots$

12. Is the number 0.646464646 … rational or irrational? Explain.

13. Is the number $\sqrt{125}$ rational or irrational? Explain.

14. Order the numbers in parts (a)–(g) from least to greatest, and place on a number line.
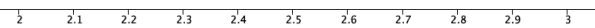
☐ I can write a decimal approximation for an irrational number to a given decimal place and convert a decimal expansion which repeats into a rational number.

15. What is the decimal expansion of the number $\frac{4}{33}$? Is the number $\frac{4}{33}$ rational or irrational? Explain.

16. Brandon stated that 0.66 and $\frac{2}{3}$ are equivalent. Do you agree? Explain why or why not.

Convert each fraction to a decimal. Describe the decimal expansion.

18. $\frac{9}{16}$

19. $\frac{8}{125}$
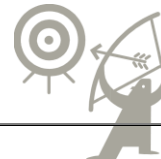
| | |
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| 17. Write the decimal expansion of $\frac{5}{7}$. Based on our definition of rational numbers having a decimal expansion that repeats eventually, is the number rational? Explain. | Convert each repeating decimal to a rational number.<br><br>20. $0.\overline{7}$<br><br><br>21. $0.3\overline{2}$ |

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☐ I can estimate the value of an expression that includes an irrational number and justify my estimation.
☐ I can place rational and irrational numbers on a number line.

| | |
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| 22. Circle the greater number in each of the pairs (a)–(e) below.<br><br>  a.   Which is greater?  8  or  $\sqrt{60}$<br><br>  b.   Which is greater?  4  or  $\sqrt{26}$<br><br>  c.   Which is greater?  $\sqrt[3]{64}$  or  $\sqrt{16}$<br><br>  d.   Which is greater?  $\sqrt[3]{125}$  or  $\sqrt{30}$<br><br>  e.   Which is greater?  $-7$  or  $-\sqrt{42}$<br><br>  f.   Put the numbers 9, $\sqrt{52}$, and $\sqrt[3]{216}$ in order from least to greatest. Explain how you know which order to put them in. | 23. Between which two positive integers does $\sqrt{33}$ lie?<br><br>24. For what integer $x$ is $\sqrt{x}$ closest to 5.4? Explain.<br><br><br>25. Between which two labeled points on the number line would $\sqrt{5}$ be located?<br><br>2  2.1  2.2  2.3  2.4  2.5  2.6  2.7  2.8  2.9  3<br><br>Explain how you know where to place $\sqrt{5}$ on the number line. |

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☐ I can use properties of integer exponents, including zero and negative exponents to evaluate and simplify numerical expressions containing exponents.

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| 26. Jill writes $2^3 \cdot 4^3 = 8^6$ and the teacher marked it wrong. Explain Jill's error. | 27. Find $n$ so that the number sentence below is true:<br>$2^3 \cdot 4^3 = 2^3 \cdot 2^n = 2^9$ |
| 28. Use the definition of exponential notation to demonstrate why $2^3 \cdot 4^3 = 2^9$ is true. | 29. You write $7^5 \cdot 7^{-9} = 7^{-4}$. Keisha challenges you, "Prove it!" Show directly why your answer is correct. |
| 30. Use the properties of exponents to write an equivalent expression that is a product of unique primes, each raised to an integer power.<br><br>$$\frac{6^{21} \cdot 10^7}{30^7}$$ | 31. Let $a$ and $b$ be numbers and $b \neq 0$, and let $m$ and $n$ be positive integers. Simplify each of the following expressions as much as possible: |

| $(-19)^5 \cdot (-19)^{11} =$ | $2.7^5 \times 2.7^3 =$ |
|---|---|
| $\dfrac{7^{10}}{7^3} =$ | $\left(\dfrac{1}{5}\right)^2 \cdot \left(\dfrac{1}{5}\right)^{15} =$ |
| $\left(-\dfrac{9}{7}\right)^m \cdot \left(-\dfrac{9}{7}\right)^n =$ | $\dfrac{ab^3}{b^2} =$ |

☐   I can estimate very large and very small quantities using a single digit times a power of 10.

☐   I can compare two quantities written as a single digit times a power of 10.

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| 32.  The Atlantic Ocean region contains approximately $2 \times 10^{16}$ gallons of water.  Lake Ontario has approximately 8,000,000,000,000 gallons of water.  How many Lake Ontarios would it take to fill the Atlantic Ocean region in terms of gallons of water? | 33.  The average American is responsible for about 20,000 kilograms of carbon emission pollution each year.  Express this number as a single-digit integer times a power of 10. |
| 34.  Write the number 68,127,000,000,000,000 in scientific notation. | 35.  The mass of a proton is:  $$0.0000000000000000000000000001672622 \ kg$$  In scientific notation it is: |
| 36.  The average lifetime of the Z boson is approximately $3 \times 10^{-25}$ seconds and the average lifetime of a *neutral rho meson* is approximately $4.5 \times 10^{-24}$ seconds.  a.   Explain why the neutral rho meson has a longer average lifetime.  b.   Approximately how much longer is the lifetime of a neutral rho meson than a Z boson. | 37.  The mass of a neutron is approximately $1.674927 \times 10^{-27}$ kg.  Recall that the mass of a proton is $1.672622 \times 10^{-27}$ kg.  Explain which is heavier. |

☐   I can perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used.

☐   I can use scientific notation and choose units of appropriate size for measurements of very large or very small quantities (e.g. use millimeters per year for seafloor spreading).

38.  You have been hired by a company to write a report on Internet companies' Wi-Fi ranges.  They have requested that <u>all values be reported in feet using scientific notation</u>.

Ivan's Internet Company boasts that their wireless access points have the greatest range.  Their claim is that you can access their signal up to 2,640 feet from their device.  A competing company, Winnie's Wi-Fi, has devices that extend to up to $2\frac{1}{2}$ miles.

a.   Rewrite the range of each company's wireless access devices in feet using scientific notation and state which company actually has the greater range (5,280 feet = 1 mile).

b.   You can determine how many times greater the range of one Wi-Fi company is than the other by writing their ranges as a ratio. Write and find the value of the ratio that compares the range of Winnie's wireless access devices to the range of Ivan's wireless access devices.  Write a complete sentence describing how many times greater Winnie's Wi-Fi range is than Ivan's Internet range.

39.  Your friend Pat bought a fish tank that has a volume of 175 liters. The brochure for Pat's tank lists a "fun fact" that it would take $7.43 \times 10^{18}$ tanks of that size to fill all the oceans in the world.  Pat thinks the both of you can quickly calculate the volume of the ocean using the fun fact and the size of her tank.

a.   Given that 1 liter $= 1.0 \times 10^{-12}$ cubic kilometers, rewrite the size of the tank in cubic kilometers using scientific notation.

b.   Determine the volume of all the oceans in the world in cubic kilometers using the "fun fact".

40.  The mass of Earth is approximately $5.9 \times 10^{24}$ kg, and the mass of Venus is approximately $4.9 \times 10^{24}$ kg.

a.   Find their combined mass.

b.   Given that the mass of the sun is approximately $1.9 \times 10^{30}$ kg, how many Venuses and Earths would it take to equal the mass of the sun?
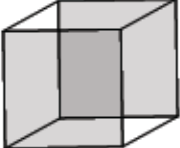
41.  On average, Mercury is about 57,000,000 km from the sun, whereas Neptune is about $4.5 \times 10^9$ km from the sun.  What is the difference between Mercury's and Neptune's distances from the sun?
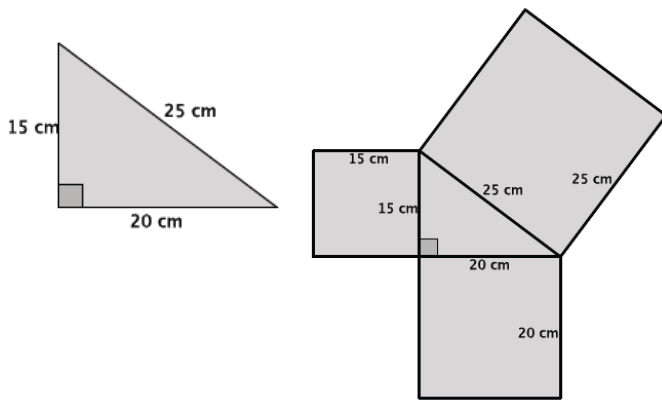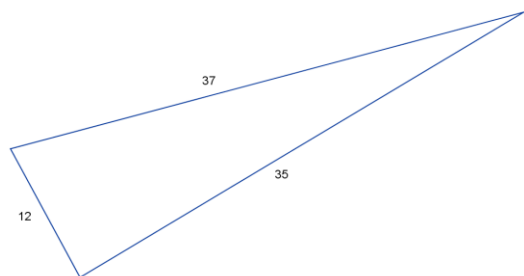
| Student Name: | | Teacher Name: |
|---|---|---|
| Grade: 8th | Unit #: 3 | Unit Title: Geometric Applications of Exponents |

The following Statements and examples show the skills, concepts, and understandings that I will gain before the end of this unit.

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☐ **I can solve equations of the form $x^2 = p$ and $x^3 = p$ using square or cube roots.**

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1. Determine the solution for each of the following equations.

   a. $121 = x^2$

   b. $x^3 = 1000$

   c. $17 + x^2 = 42$

   d. $x^3 + 3x - 9 = x - 1 + 2x$

2. The cube shown has a volume of $216$ cm$^3$.

   i. Write and solve an equation that could be used to determine the length, $l$, of one side. Explain how you solved it.

   $V = 216$ cm$^3$

3. Solve for $x$.
   $$\frac{1}{2}(2x^2 - 10) = 59 \text{Type equation here.}$$

4. $\dfrac{x^9}{x^7} - 49 = 0$; Determine the positive value of $x$ that makes the equation true, and then explain how you solved the equation.

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☐ **I can give or explain a proof of the Pythagorean Theorem and its converse (prove perpendicular sides or right triangle).**

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5. For the right triangle shown below, identify and use squares formed by the sides of the triangle to prove the Pythagorean Theorem.

   25 cm
   15 cm
   20 cm

   15 cm
   15 cm
   25 cm
   25 cm
   20 cm
   20 cm

6. The numbers in the diagram below indicate the lengths of the sides of the triangle. Bernadette drew the following triangle and claims it a right triangle. How can she be sure?

   37
   35
   12

7. After learning the proof of the Pythagorean Theorem using areas of squares, Joseph got really excited and tried explaining it to his younger brother using the diagram to the right. He realized during his explanation that he had done something wrong. Help Joseph find his error. Explain what he did wrong.

$A = 49\text{in}^2$

4 in

7 in

$A = 16\text{in}^2$  4 in

7 in

5 in

$A = 25\text{in}^2$  5 in
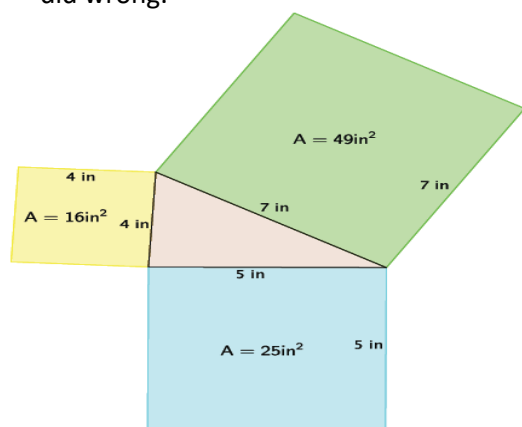
8. Will the lengths 5, 9, and 14 form a right triangle? Explain.

9. Jocelyn said that the triangle below is not a right triangle. Her work is shown below. Explain what she did wrong, and show Jocelyn the correct solution.

45

27

36
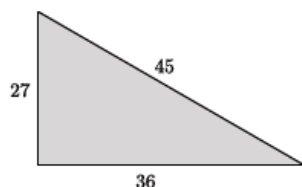
*We need to check if* $27^2 + 45^2 = 36^2$ *is a true statement. The left side of the equation is equal to 2,754. The right side of the equation is equal to 1,296.*

*That means* $27^2 + 45^2 = 36^2$ *is not true, and the triangle shown is not a right triangle.*

☐ **I can apply the Pythagorean Theorem in real-world situations or drawings to find unknown side lengths in right triangles in two and three dimensions.**

10. Determine the length of side $BD$ in the triangle below.

A

13   12   15

D   C
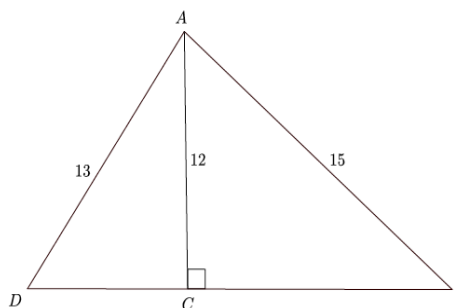
11. The area of the right triangle shown below is 30 ft². The segment $\overline{XY}$ has a length of 5 ft. Find the length of the hypotenuse.

Z

X   Y
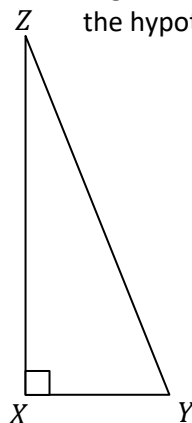
12. Two paths from school to the store are shown below, one that uses Riverside Drive and another which uses Cypress and Central Avenues. Which path is shorter? By about how much? Explain how you know.
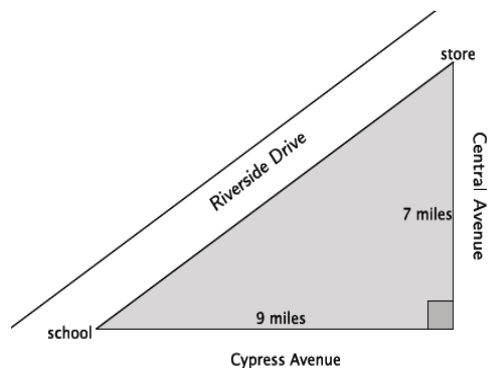
13. Use the Pythagorean Theorem to estimate the length of the unknown side of the right triangle. Explain why your estimate makes sense.
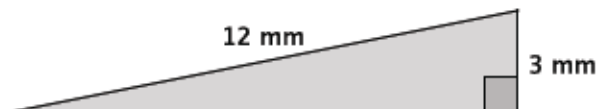
14. The distance between the two points on the surface of the sphere shown below is 10 units. Determine the volume of the sphere. Give an answer in terms of $\pi$ and an approximate answer rounded to a whole number.
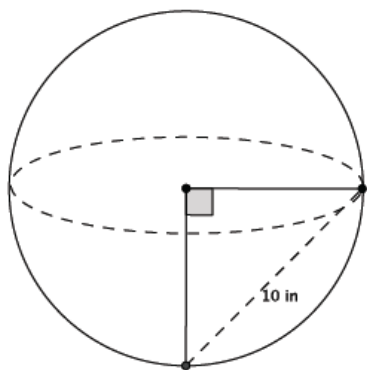
15. Use the diagram of the equilateral triangle shown below to answer the following questions. Show work that leads to your answers.
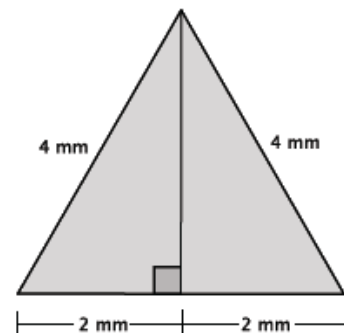
    a.   What is the perimeter of the triangle?

    b.   What is the height, $h$, of the equilateral triangle? Write an exact answer using a square root and approximate answer rounded to the tenths place.

Using the approximate height found in part (b), estimate the area of the equilateral triangle.

16. What length of ladder will be needed to reach a height of 7 feet along the wall when the base of the ladder is 4 feet from the wall?  Round your answer to the tenths place.
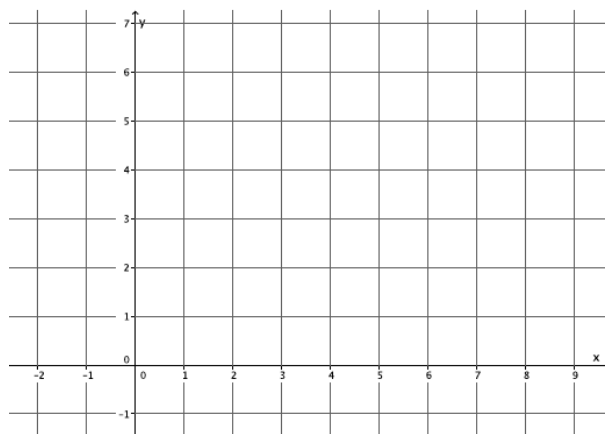
7 feet

4 feet

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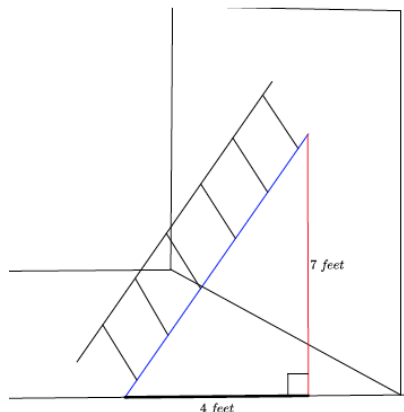
☐ **I can use the Pythagorean Theorem to find the distance between two points on a coordinate system.**

17. What is the distance between points $A$ and $B$?
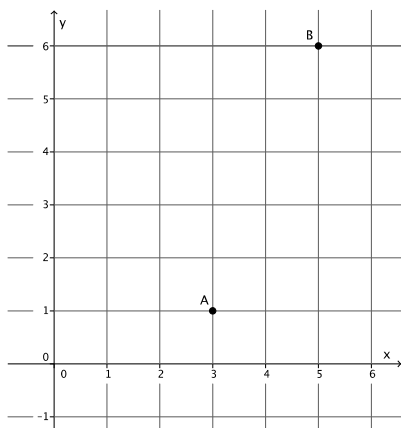
18. Do the segments connecting the coordinates $(-1,6)$, $(4,2)$, and $(7,6)$ form a right triangle?  Show work that leads to your answer.

19. Determine the distance between the following pairs of points.  Round your answer to the tenths place.  Use graph paper if necessary.

   a.   $(7,4)$ and $(-3,-2)$

   b.   $(-5,2)$ and $(3,6)$

20. Determine the distance between points $A$ and $B$ on the coordinate plane.  Round your answer to the tenths place.
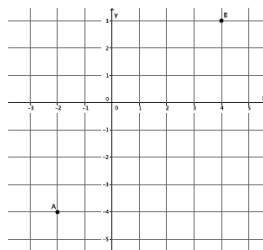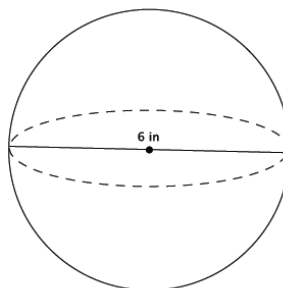
☐ **I know and use the formulas for volumes to solve real world and mathematical problems involving cones, cylinders, and spheres.**

EXAMPLES:

21. Use the diagrams below to determine which has the greater volume in terms of pi, the cone or the cylinder?
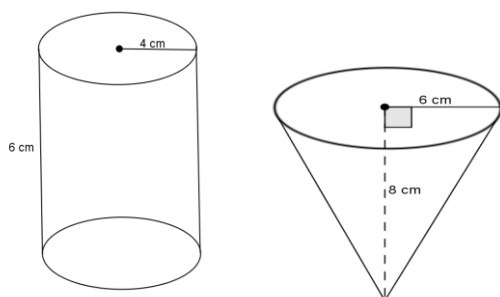


22. What is the volume of the sphere shown below in terms of pi?



23. A cylindrical tank (with dimensions shown below) contains water that is 1-foot deep.  If water is poured into the tank at a constant rate of 20 $\frac{ft^3}{min}$ for 20 min., will the tank overflow?  Use 3.14 to estimate $\pi$.
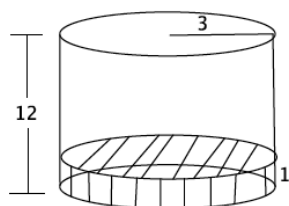


24. Oscar wants to fill with water a bucket that is the shape of a right cylinder.  It has a 6-inch radius and 12-inch height.  He uses a shovel that has the shape of right cone with a 3-inch radius and 4-inch height.  How many shovelfuls will it take Oscar to fill the bucket up level with the top?

25. Determine the volume of the three-dimensional figure shown below.
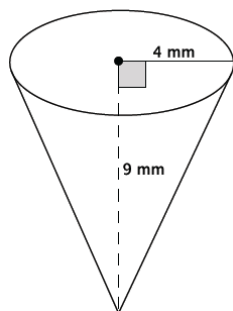
| Student Name: | Teacher Name: |
|---|---|

| Grade: 8th | Unit #: 4 | Unit Title: Functions |
|---|---|---|

The following Statements and examples show the skills, concepts, and understandings that I will gain before the end of this unit.

☐  I can determine if a table, graph, or set of ordered pairs is or is not a function and justify my conclusion.

1. We define $x$ as a year between 2008 and 2013, and $y$ as the total number of smartphones sold that year, in millions.  The table shows values of $x$, and corresponding $y$ values.

| Year $(x)$ | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
|---|---|---|---|---|---|---|
| Number of smartphones in millions $(y)$ | 3.7 | 17.3 | 42.4 | 90 | 125 | 153.2 |

a. How many smartphones were sold in 2009?
b. In which year were 90 million smartphones sold?
c. Is $y$ a function of $x$?  Explain why or why not.

2. Write a brief explanation to a classmate who was absent today about why the table in part (a) is a function and the table in part (b) is not.

a.

| Input $(x)$ | −1 | −2 | −3 | −4 | 4 | 3 | 2 | 1 |
|---|---|---|---|---|---|---|---|---|
| Output $(y)$ | 81 | 100 | 320 | 400 | 400 | 320 | 100 | 81 |

b.

| Input $(x)$ | 1 | 6 | −9 | −2 | 1 | −10 | 8 | 14 |
|---|---|---|---|---|---|---|---|---|
| Output $(y)$ | 2 | 6 | −47 | −8 | 19 | −2 | 15 | 31 |

3. A local grocery store sells 2 pounds of bananas for $1.  Can this situation be represented by a function?  Explain.

4. Can the table shown below represent a function?  Explain.

| Input $(x)$ | 1 | 3 | 5 | 5 | 9 |
|---|---|---|---|---|---|
| Output $(y)$ | 7 | 16 | 19 | 20 | 28 |

5. Examine the graph below.  Could the graph represent the graph of a function?  Explain why or why not.
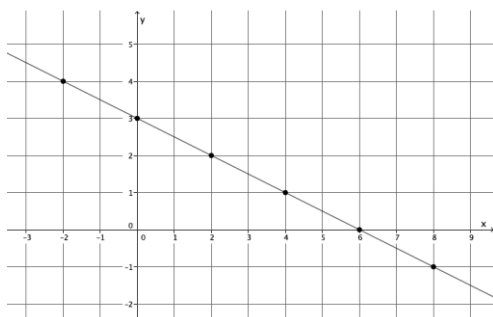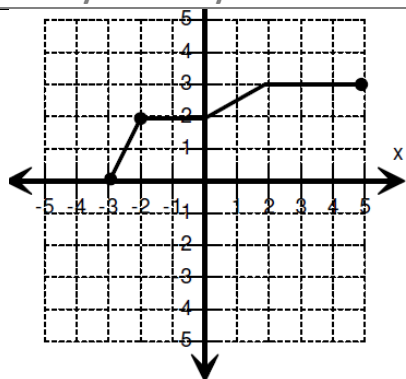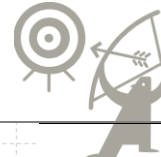


6. Examine the graph below.  Could the graph represent the graph of a function?  Explain why or why not.
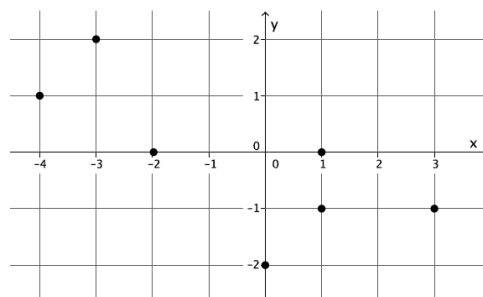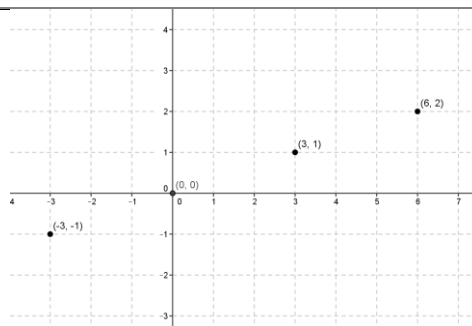


☐  I can distinguish between linear and nonlinear functions given a table, graph, or equation and justify my conclusion.

7. Use the graph below to answer the questions.

8. Is the following graph a graph of a linear function?  How would you determine if it is a linear function?
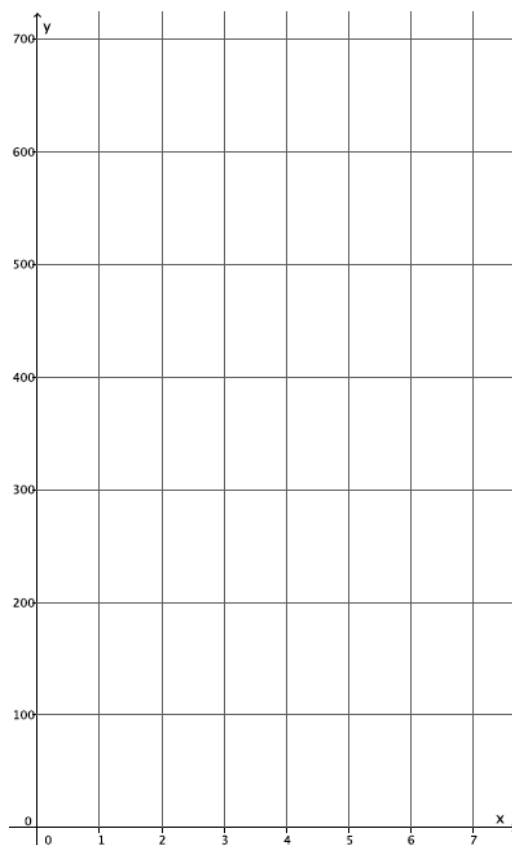
13

a. Is the graph a function? Explain.

b. Is it linear or nonlinear?

9. Graph the equation $y = 180(x - 2)$ for whole numbers. Organize your work using the table below, and then answer the questions that follow.

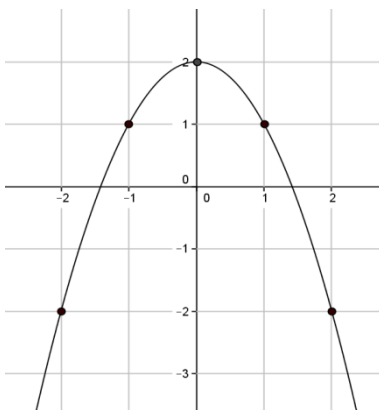| $x$ | $y$ |
|---|---|
| 3 | |
| 4 | |
| 5 | |
| 6 | |



a. Graph the ordered pairs on the coordinate plane.

b. What shape does the graph of the points appear to take?

c. Is this graph a graph of a function? How do you know?

d. Is this a linear equation? Explain.

14

10. Is the function that is represented by this graph linear or non-linear? Explain. Show work that supports your claim.



11. What shape do you expect the graph of the function described by $y = x$ to take? Is it a linear or non-linear function?

---

☐ I can translate linear functions numerically, graphically, verbally, and algebraically

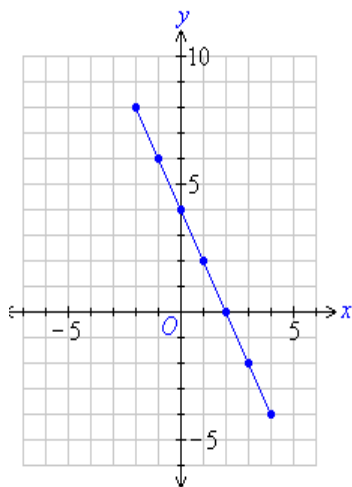12. Complete the function table below. Tell if the table represents a linear or nonlinear function.

| x | −2 | −1 | 0 | 1 | 2 |
|---|---|---|---|---|---|
| y=2x + 5 | | | | | |
| y | | | | | |

13. A particular linear function has the table of values below.

| Input (x) | −4 | −3 | −2 | −1 | 0 | 1 | 2 |
|---|---|---|---|---|---|---|---|
| Output (y) | 12 | 10 | 8 | | | | |

a. Look for a pattern to complete the table above.

b. Can the table shown represent a function? Explain.

14. Create a table to match the given graph.



15. A rental car company offers a rental package for a mid-size car. The cost is comprised of a fixed $30 administrative fee for the cleaning and maintenance of the car plus a rental cost of $35 per day.

Using $x$ for the number of days and $y$ for the total cost in dollars, construct a function to model the relationship between the number of days and the total cost of renting a mid-size car.

a. The same company is advertising a deal on compact car rentals. The linear function $y = 30x + 15$ can be used to model the relationship between the number of days $(x)$ and the total cost $(y)$ of renting a compact car.

What is the fixed administrative fee?

What is the rental cost per day?

16.

Randy began completing the table below to represent a particular linear function. Write an equation to represent the function he used, and complete the table for him.

| Input $(x)$ | $-3$ | $-1$ | $0$ | $\frac{1}{2}$ | $1$ | $2$ | $3$ |
|---|---|---|---|---|---|---|---|
| Output $(y)$ | $-5$ | | $4$ | | | | $13$ |

17. A particular linear function has the table of values below.

| Input $(x)$ | 0 | 5 | 8 | 13 | 15 | 18 | 21 |
|---|---|---|---|---|---|---|---|
| Output $(y)$ | 6 | 11 | 14 | | 21 | | |

a. What is the rule that describes the function?

b. Complete the table using the rule.

| Student Name: | | Teacher Name: |
|---|---|---|
| Grade: 8th | Unit #: 5 | Unit Title: Linear Functions |

The following Statements and examples show the skills, concepts, and understandings that I will gain before the end of this unit.

I can compare two different proportional relationships given different representations.

1. Jeremy rides his bike at a rate of 12 miles per hour. Below is a table that represents the number of hours and miles Kevin rides. Assume both bikers ride at a constant rate.

| Time in hours $(x)$ | Distance in miles $(y)$ |
|---|---|
| 1.5 | 17.25 |
| 2 | 23 |
| 3.5 | 40.25 |
| 4 | 46 |

Which biker rides at a greater speed? Explain your reasoning.

2. Phil can build 3 birdhouses in 5 days.

Assuming he builds birdhouses at a constant rate, write the linear equation that represents the situation.
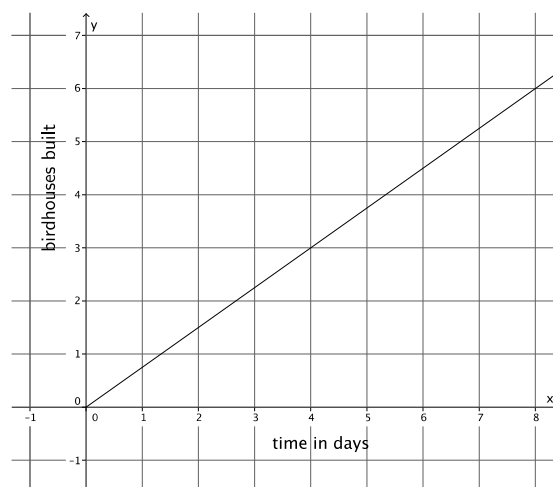


a. The graph represents Karl's constant rate of building the same kind of birdhouses. Who builds birdhouses faster? Explain.

b. Explain your general strategy for comparing proportional relationship.

3. The graph below represents the distance, $y$, Car A travels in $x$ minutes. The table represents the distance, $y$, Car B travels in $x$ minutes. Which car is traveling at a greater speed? How do you know?
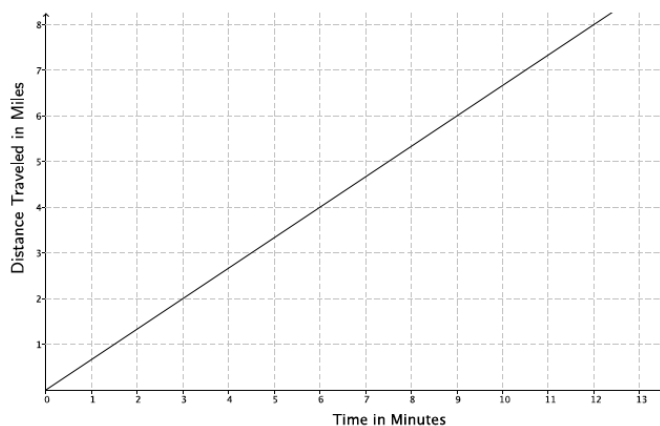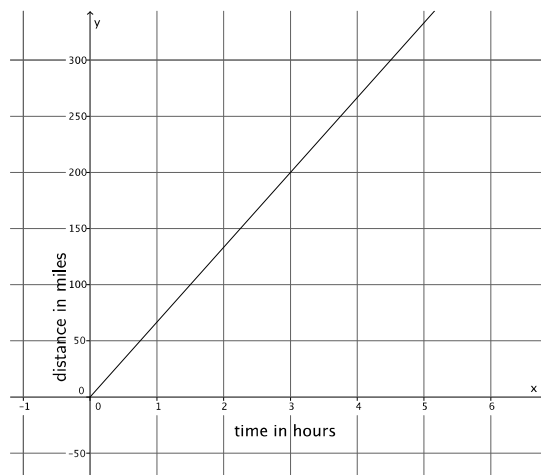


Car A:
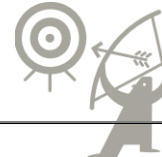
| Car B: | Time in minutes ($x$) | Distance ($y$) |
|---|---|---|
| | 15 | 12.5 |
| | 30 | 25 |
| | 45 | 37.5 |

4.

    a.  Train A can travel a distance of 500 miles in 8 hours.  Assuming the train travels at a constant rate, write the linear equation that represents the situation.

    b.  The graph represents the constant rate of travel for Train B.
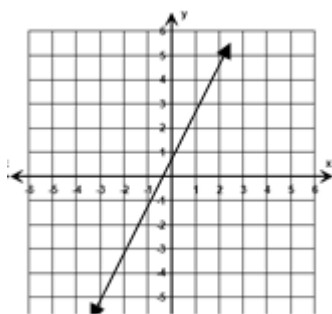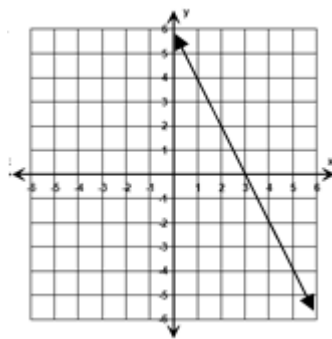
       Which train is faster?  Explain.



☐    I can calculate slope on a graph using similar triangles.

☐    I can explain why slope is the same between any two distinct points on a non-vertical line using similar triangles.

Use a slope triangle to determine the slope of the following linear functions.
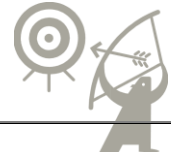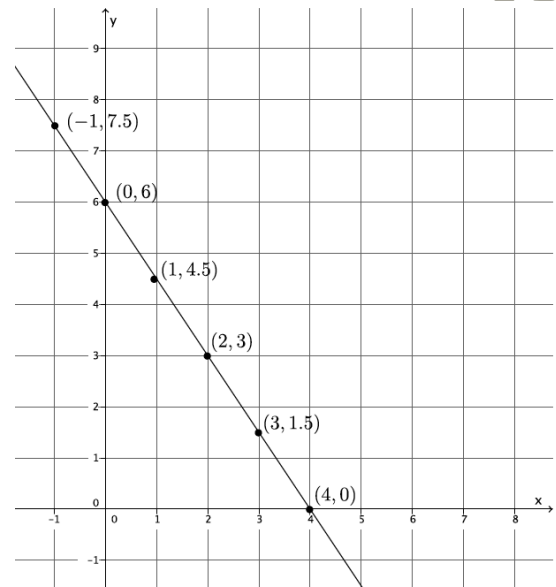


5.  Slope: _____

6.  Slope: _____

7.  Using the graph below, explain why the slope between (0,0) and (6,2) is the same as the slope between (-6, -2) and (-3, -1).
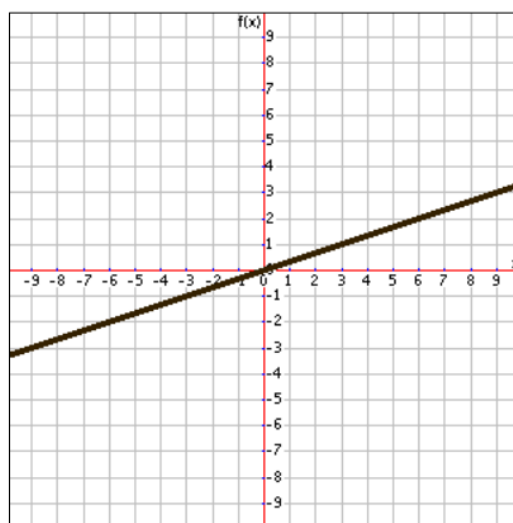
8. Use the graph below to answer parts (a)–(c).

   a. Use any pair of points to calculate the slope of the line.

   b. Use a different pair of points to calculate the slope of the line.

   c. Explain why the slopes you calculated in parts (a) and (b) are equal.



☐ I can derive the equation y = mx and the equation y = mx + b from a linear graph.

9. A bank put $10 into a savings account when you opened the account. Eight weeks later, you have a total of $24. Assume you saved the same amount every week.

   a. If $y$ is the total amount of money in the savings account and $x$ represents the number of weeks, write an equation in the form $y = mx + b$ that describes the situation.

   b. Identify the slope and the $y$-intercept. What do these numbers represent?
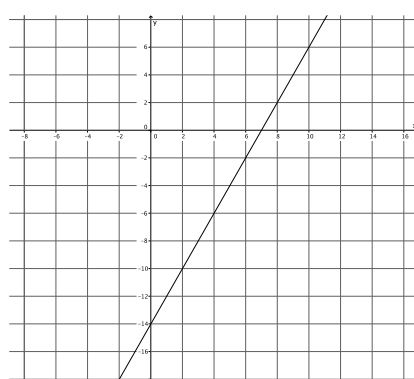
   c. Graph the equation on a coordinate plane.
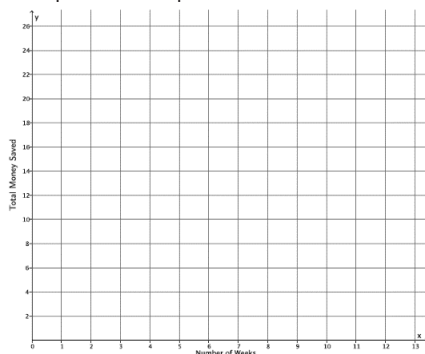


10. Graph the equation $y = 4x - 7$. Name the slope and $y$-intercept.
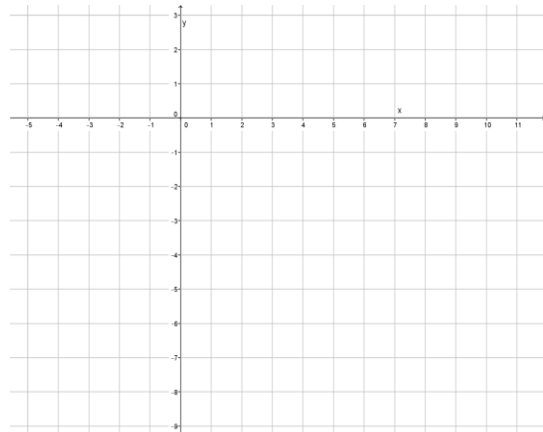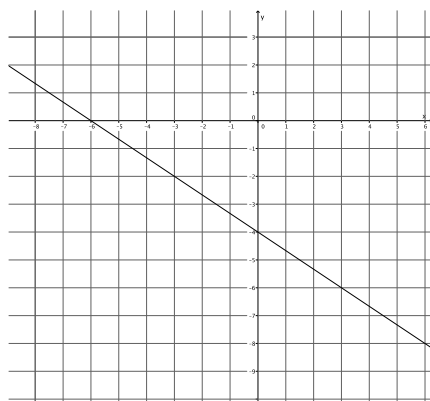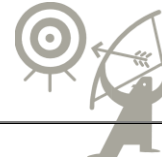
11. Write the equation that represents the line shown.

12.


Write the equation that represents the line shown.

☐   I can distinguish between linear and nonlinear functions given a table, graph, or equation and justify my conclusion.

13. A function has the table of values below that gives temperatures at specific times over a period of 8 hours.

| | |
|---|---|
| 12:00 p.m. | 92°F |
| 1:00 p.m. | 90.5°F |
| 2:00 p.m. | 89°F |
| 4:00 p.m. | 86°F |
| 8:00 p.m. | 80°F |

   a.   Is the function a linear function?  Explain.

   b.   Describe the limitations of $x$ and $y$.

   c.   Is the function discrete or continuous?

   d.   Let $y$ represent the temperature and $x$ represent the number of hours from 12:00 p.m. Write a rule that describes the function of time on temperature.
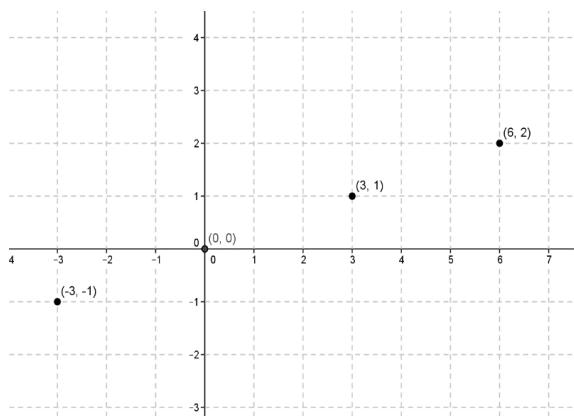
14. A function assigns the inputs and corresponding outputs shown in the table below.

| Input | Output |
|---|---|
| 0.2 | 2 |
| 0.6 | 6 |
| 1.5 | 15 |
| 2.1 | 21 |

   a.   Is the function a linear function? Check at least three pairs of inputs and their corresponding outputs.

   b.   What equation describes the function?

   c.   What will the graph of the function look like? Explain.
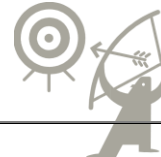
15. Is the following graph a graph of a linear function? How would you determine if it is a linear function?



16. A function assigns the inputs and corresponding outputs shown in the table below.

| Input | Output |
|---|---|
| 3 | 9 |
| 9 | 17 |
| 12 | 21 |
| 15 | 25 |

a. Is the function a linear function? Check at least three pairs of inputs and their corresponding outputs.

b. What equation describes the function?

c. What will the graph of the function look like? Explain.

17. A function assigns the inputs and corresponding outputs shown in the table below.
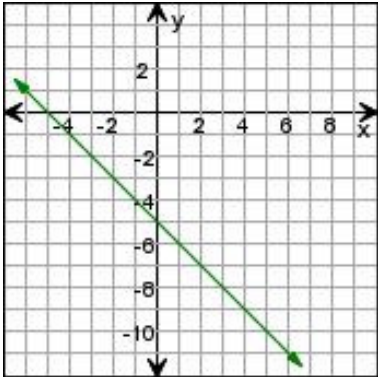
| Input | Output |
|---|---|
| −1 | 2 |
| 0 | 0 |
| 1 | 2 |
| 2 | 8 |
| 3 | 18 |

Is the function a linear function?

**Houston County School System Mathematics**

| Student Name: | Teacher Name: |
|---|---|

| Grade: 8th | Unit #: 6 | Unit Title: Linear Models and Tables |
|---|---|---|

- **I can write the equation of a line (in the form *y* = *mx* + *b*) given a point and a slope, two points, a table, or the graph of the line.**
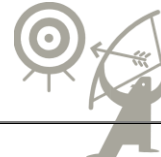
EXAMPLES:

| 1. What is the equation of the line on the following graph? | 2. Complete the table below with the missing values for y. Write the equation of the line that shows the relationship between x and y. |
|---|---|



| x | y |
|---|---|
| −4 | 14 |
| −3 | 11 |
| −2 | 8 |
| −1 | 5 |
| 0 | |
| 1 | |

| 3. Write an equation of the line that passes through the given points. (-2, 8) (-6, 0). | 4. Write an equation of the line that passes through the given point and has the given slope. (-4, 7); m = -5 |
|---|---|

| 5. What is the equation of the line that passes through the point (9,2) and has a y-intercept of (0,5)? | 6. The table gives the population, p, in a region of the country as a function of the years since 2003, t. Write the equation that represents this data. |
|---|---|

| t | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| p | 42,500 | 43,000 | 43,500 | 44,000 |

- **I can explain a real world situation from an equation, table, or graph (explain the rate of change/slope and the y-intercept in the context). (linear only)**
- **I can create the equation, table or graph for a real-life situation. (linear only)**

EXAMPLES:

| 7. A shipping company charges a $4.45 handling fee in addition to $0.27 per pound to ship a package. | 8. A rental car company offers the following two pricing methods for its customers to choose from for a one month rental: |
|---|---|
| | Method 1: Pay $400 for the month, or |
| | Method 2: Pay $0.30 per mile plus a standard maintenance fee of $35. |
| | a. Construct a linear function that models the relationship between the miles driven and the total rental cost for Method 2. Let *x* represent the number of miles driven and *y* represent the rental cost (in dollars). |
| | b. If you plan to drive 1,100 miles for the month, which method would you choose? Explain your reasoning. |

Using $x$ for weight in pounds and $y$ for the cost of shipping in dollars, write a linear function that determines the cost of shipping based on weight.
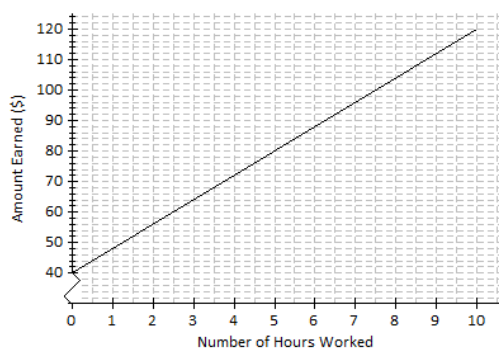
Which line (solid, dotted, or dashed) on the graph below represents the shipping company's pricing method? Explain.
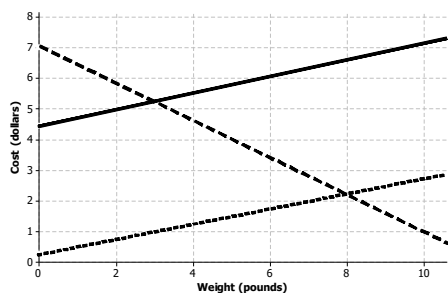


9. Andrew works in a restaurant. The graph below shows the relationship between the amount Andrew earns and the number of hours he works.



If Andrew works for 7 hours, approximately how much does he earn?

Estimate how long Andrew has to work in order to earn $64?

What is the rate of change of the function given by the graph?

Interpret the value within the context of the problem.

10. Li Na is saving money. Her parents gave her an amount to start, and since then she has been putting aside a fixed amount each week. After six weeks, Li Na has a total of $82 made of her own savings in addition to the amount her parents gave her. Fourteen weeks from the start of the process Li Na has $118.

   a. Using $x$ for the number of weeks and $y$ for the amount in savings (in dollars), construct a linear function that describes the relationship between the number of weeks and the amount in savings.

   b. How much did Li Na's parents give her to start?

   c. How much does Li Na set aside each week?

   d. Draw the graph of the linear function below (start by plotting the points for $x = 0$ and $x = 20$).

11. Suppose that the price of gasoline has been falling. At the beginning of last month ($t = 0$) the price was $4.60 per gallon. Twenty days later ($t = 20$) the price was $4.20 per gallon. Assume that the price per gallon, $P$, fell at a constant rate over the twenty days.



23
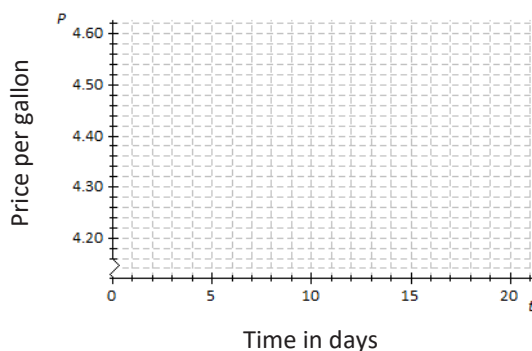
a.   Identify the ordered pairs given in the problem.  Plot both points on the graph above.

b.   Using a straight-edge, draw the line that contains the two points.

c.   What is the rate of change?  What does it mean within the context of the problem?

d.   What is the function that models the relationship between the number of days and the price per gallon?

e.   What was the price of gasoline after 9 days?

f.   After how many days was the price $4.32?

- **I can describe a relationship as increasing or decreasing, linear or nonlinear, from an equation, table or graph.**

EXAMPLES:

12.  A home was purchased for $275,000.  Due to a recession, the value of the home fell at a constant rate over the next 5 years.

   a.   Sketch a graph of a function that models the situation.
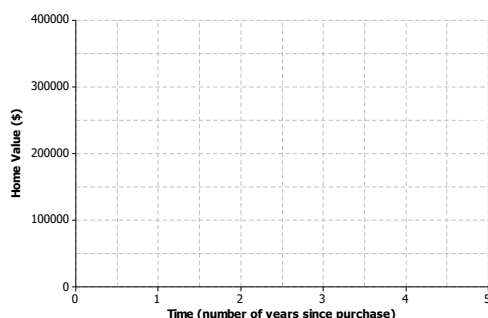


   b.   Based on your graph, how is the home value changing with respect to time?

13.  The graph below shows the volume of water for a given creek bed during a 24-hour period.  On this particular day, there was wet weather with a period of heavy rain.
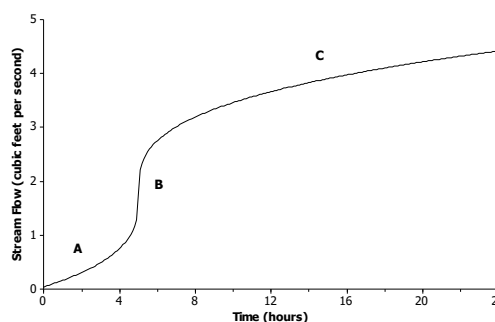


Describe how each part (A–C) of the graph relates to the scenario.

14.  The graph below displays the first hour of Sam's bike ride.
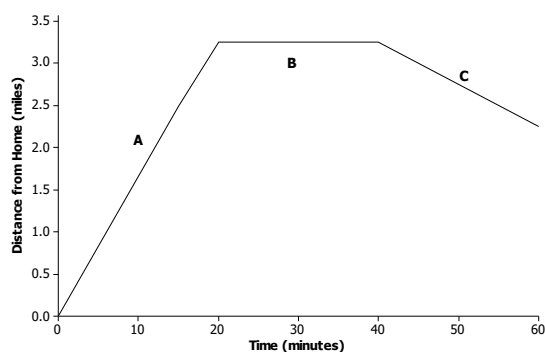


Match each part of the graph (A–C) to its verbal description.  Explain the reasoning behind your choice.

   i.    Sam rides his bike to his friend's house at a constant rate.

   ii.   Sam and his friend bike together to an ice cream shop that is between their houses.

15.  Different breeds of dogs have different growth rates.  A large breed dog typically experiences a rapid growth rate from birth to age 6 months.  At that point, the growth rate begins to slow down until the dog reaches full growth around 2 years of age.

   a.   Sketch a graph that represents the weight of a dog from birth to 2 years of age.
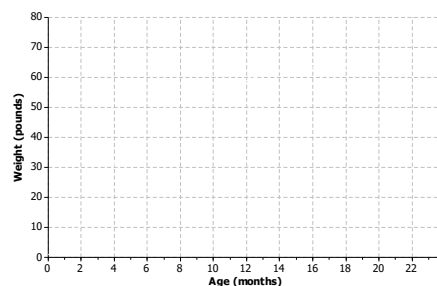


   b.   Is the function represented by the graph linear or nonlinear?  Explain.

24
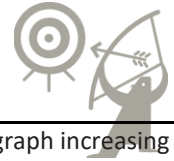
| iii.   Sam plays at his friend's house. | c.   Is the function represented by the graph increasing or decreasing?  Explain. |
|---|---|

- **I can construct and interpret scatter plots.**
- **I can describe the relationships shown in a scatter-plot (identifying patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association).**

EXAMPLES:

16.  The table below shows the price and overall quality rating for 15 different brands of bike helmets.

Data Source:  www.consumerreports.org

| Helmet | Price (dollars) | Quality Rating |
|---|---|---|
| A | 35 | 65 |
| B | 20 | 61 |
| C | 30 | 60 |
| D | 40 | 55 |
| E | 50 | 54 |
| F | 23 | 47 |
| G | 30 | 47 |
| H | 18 | 43 |
| I | 40 | 42 |
| J | 28 | 41 |
| K | 20 | 40 |
| L | 25 | 32 |
| M | 30 | 63 |
| N | 30 | 63 |
| O | 40 | 53 |

Construct a scatter plot of price ($x$) and quality rating ($y$).

Do you think that there is a statistical relationship between price and quality rating?  If so, describe the nature of the relationship.

17.  The scatter plot below was constructed using data on length in inches ($x$) and weight in pounds ($y$) for a sample of alligators.  Write a few sentences describing the relationship between weight and length for these alligators.  Are there any noticeable clusters or outliers?
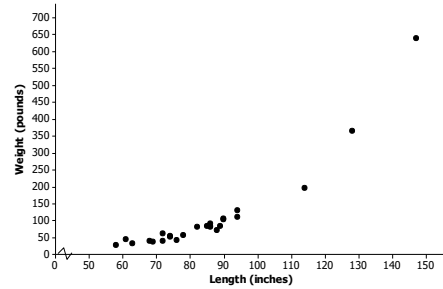


18.  The scatter plot below was constructed using data on age in years ($x$) and price in dollars ($y$) for a sample of Honda Civics.  Write a few sentences describing the relationship between price and age for these cars.  Are there any noticeable clusters or outliers?
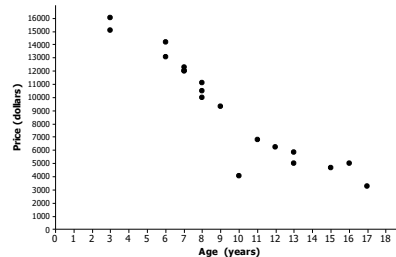


- **I can sketch a line of best fit on a scatter plot**
- **I can justify the location of my line of best fit and explain why or why not a given line is a good fit.**

EXAMPLES:

19. Look at the scatter plot below. A line is drawn to fit the data. The plot in the Exit Ticket had the mean July temperatures for the cities on the horizontal axis.

**July Rainfall and Temperatures in Selected Midwestern Cities**
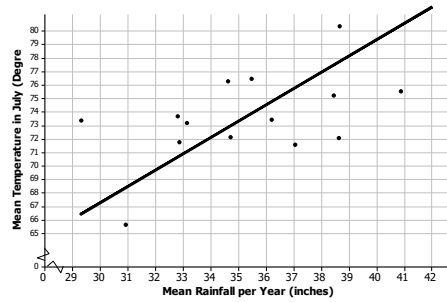


a. The line has been drawn to model the relationship between the amount of rain and the temperature in those midwestern cities. Use the line to predict the mean July temperature for a midwestern city that has a mean of 32 inches of rain per year.

b. For which of the cities in the sample will the line do the worst job of predicting the mean temperature? The best? Explain your reasoning with as much detail as possible.

20. The scatter plot below shows the results of a survey of eighth-grade students who were asked to report the number of hours per week they spend playing video games and the typical number of hours they sleep each night.

**Mean Hours Sleep per Night vs. Mean Hours Playing Video Games per Week**
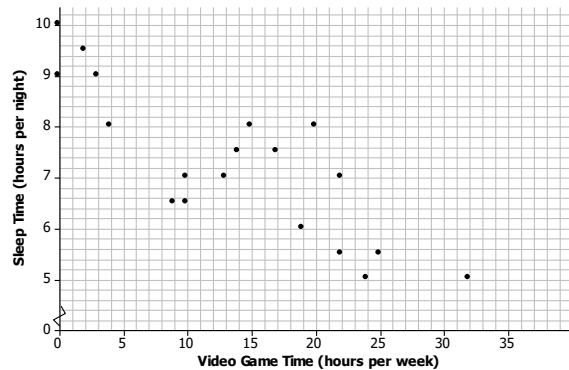


a. What trend do you observe in the data?

b. Draw a line that seems to fit the trend in the data and find its equation. Use the line to predict the number of hours of sleep for a student who spends about 15 hours per week playing video games.
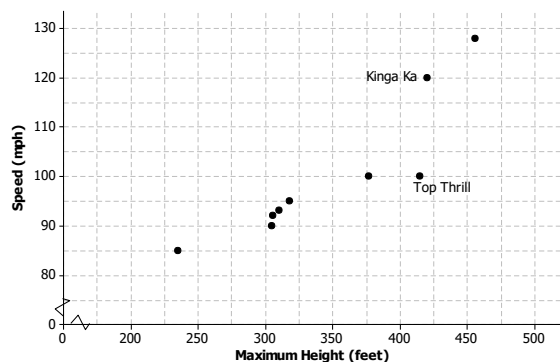
Student Notes/Comments/Questions:
- **I can write the equation of a line of best fit and use it to make predictions.**
- **I can explain what the slope and y-intercept mean in terms of the situation.**

EXAMPLES:

21. A scatter plot of the height and speed of some of the world's fastest roller coaster rides is indicated below. Draw a line that you think is a good fit for the data.



Find the equation of your line. Show your steps.

For the two roller coasters identified in the scatter plot, find the approximate difference between the observed speeds and the predicted speeds using the line.

22. Cynthia and her father planted a tree in their front yard 8 years ago. The tree was 2 meters in height when it was planted. The scatterplot below shows how the height of the tree increased each year.

**Tree Height Over Time**
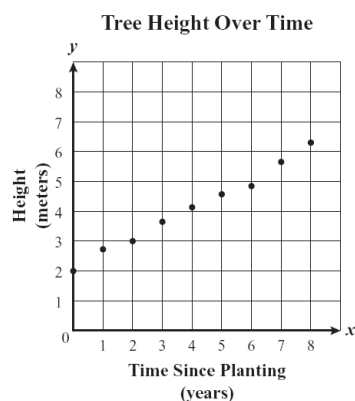


Draw a line of best fit and write the equation of your line.

Use your equation to determine the height of the tree after 20 years.

23. The scatter plots below show different lines that students used to model the relationship between body mass (in pounds) and bite force (in pounds) for crocodiles.
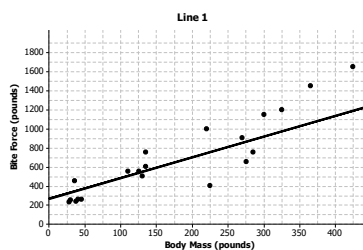
   a. Match each graph to one of the equations below and explain your reasoning. Let $B$ represent bite force (in pounds) and $W$ represent body mass (in pounds).
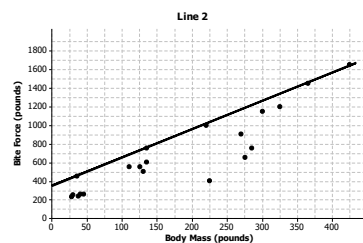
| Equation 1 | Equation 2 | Equation 3 |
|---|---|---|
| $B = 3.28W + 126$ | $B = 3.04W + 351$ | $B = 2.16W + 267$ |

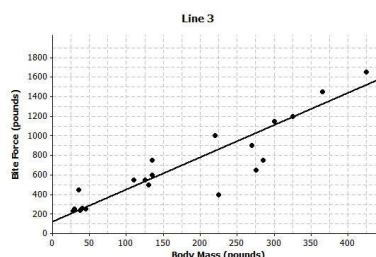| Equation: | |
|---|---|
| |  |
| **Equation:** |  |

| Equation: | Line 3<br> |
|---|---|
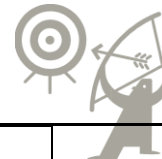
Which of the lines do you think would be a better fit for the trend in the data?  Explain your thinking.

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- **I can construct two-way frequency and relative frequency tables to summarize bivariate categorical data (two variables collected from the same subjects).**

EXAMPLES:

24. Every student at Abigail Douglas Middle School is enrolled in exactly one extracurricular activity.  Data on extracurricular activity and gender were recorded for all 254 eighth-grade students at the school by the school counselor.

The counselors' findings for the 254 eighth-grade students are:

- Of the 80 students enrolled in band, 42 are male.
- Of the 21 students enrolled in art, 9 are female.
- Of the 65 students enrolled in choir, 20 are male.
- Of the 88 students enrolled in sports, 30 are female.

Complete the table below.

| | | Extracurricular Activities | | | | |
|---|---|---|---|---|---|---|
| | | Band | Choir | Sports | Art | Total |
| Gender | Female | | | | | |
| | Male | | | | | |
| | Total | | | | | |

Write a sentence explaining the meaning of the frequency 38 in this table.

25. A group of students were asked to report their gender and how many times a day they typically wash their hands.  Of the 738 males, 66 said they wash their hands at most once a day, 583 said two to seven times per day, and 89 said eight or more times per day.  Of the 204 females, two said they wash their hands at most once a day, 160 said two to seven times per day, and 42 said eight or more times per day.

    a.  Summarize these data in a two-way table with rows corresponding to the three different frequency-of-hand-washing categories and columns corresponding to gender.

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

    b.  Do these data suggest an association between *gender* and *frequency of hand washing*?  Support your answer with appropriate calculations.

- **From two-way frequency and relative tables, I can describe, interpret, and justify inferences in patterns of association between the two variables.**

EXAMPLES:

26. This table summarizes the results of the survey data for the two variables, gender and the students' T-shirt sizes. Is there an association between gender and T-Shirt size? Explain.

|  |  | School T-Shirt Sizes |  |  |  |  |
|---|---|---|---|---|---|---|
|  |  | Small | Medium | Large | X-Large | Total |
| Gender | Female | 47 | 35 | 13 | 2 | 97 |
|  | Male | 11 | 41 | 42 | 9 | 103 |
|  | Total | 58 | 76 | 55 | 11 | 200 |

27. A random sample of 100 eighth-grade students is asked to record two variables, whether they have a television in their bedroom and if they passed or failed their last math test. The results of the survey are summarized below.

  - 55 students have a television in their bedroom.
  - 35 students do not have a television in their bedroom and passed their last math test.
  - 25 students have a television and failed their last math test.
  - 35 students failed their last math test.

Complete the two-way table.

|  | Pass | Fail | Total |
|---|---|---|---|
| Television in Bedroom |  |  |  |
| No Television in Bedroom |  |  |  |
| Total |  |  |  |

Calculate the row **relative frequencies** and enter the values in the table above. Round to the nearest thousandth.

Is there evidence of association between the variables? If so, does this imply there is a cause-and-effect relationship? Explain.

| Student Name: | | Teacher Name: |
|---|---|---|
| Grade: 8th | Unit #: 7 | Unit Title: Systems of Equations |

**The following Statements and examples show the skills, concepts, and understandings that I will gain before the end of this unit.**

☐ **I can solve and explain (in terms of the situation) a system of linear equations graphically, including those that have no solution or infinitely many solutions.**

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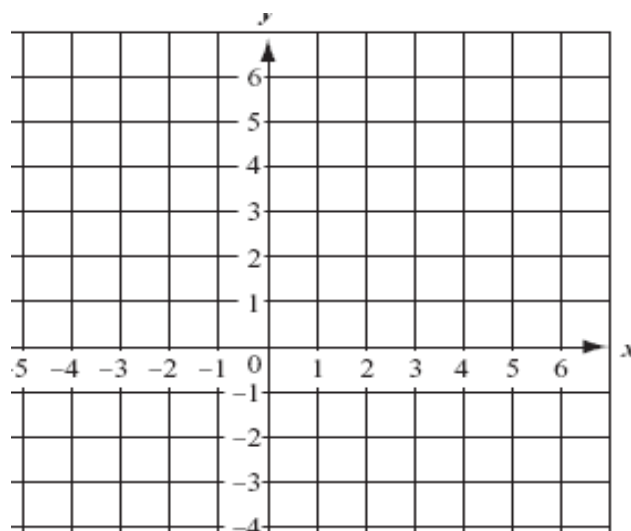1. Sketch the graphs of the linear system on a coordinate plane:
$$\begin{cases} 2y + x = 12 \\ y = \frac{5}{6}x - 2 \end{cases}$$
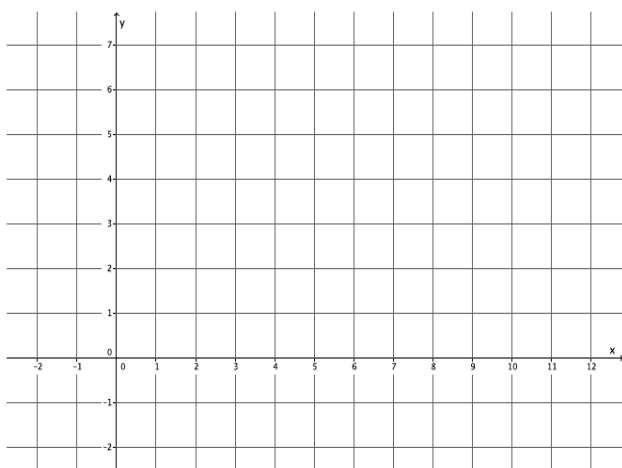


   a. Name the ordered pair where the graphs of the two linear equations intersect.

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2. Sketch the graphs of the linear system on a coordinate plane:
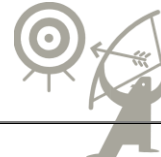$$\begin{cases} -2x + 3y = 18 \\ 2x + 3y = 6 \end{cases}$$



   a. Name the ordered pair where the graphs of the two linear equations intersect.

   b. Verify that the ordered pair named in part (a) is a solution to $-2x + 3y = 18$.

   c. Verify that the ordered pair named in part (a) is a solution to $2x + 3y = 6$.

---

3. Given the graphs of a system of linear equations below, is there a solution to the system that we cannot see on this portion of the coordinate plane? That is, will the lines intersect somewhere on the plane not represented in the picture? Explain.
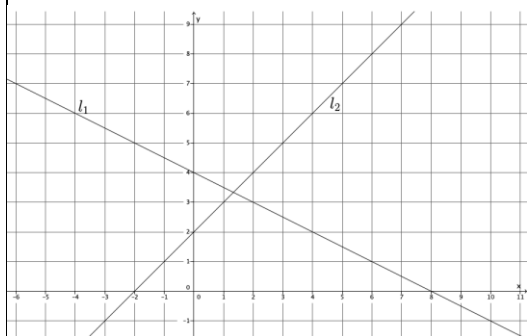


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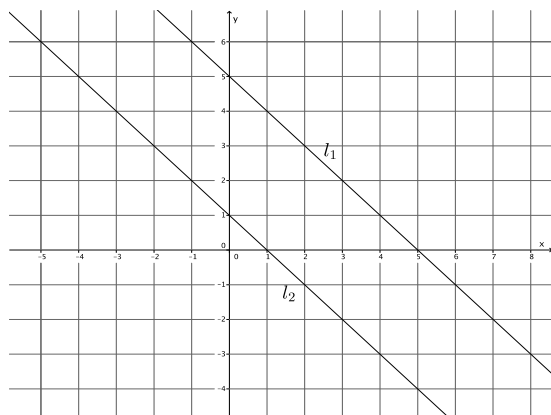
4. Given the graphs of a system of linear equations below, is there a solution to the system that we cannot see on this portion of the coordinate plane? That is, will the lines intersect somewhere on the plane not represented in the picture? Explain.
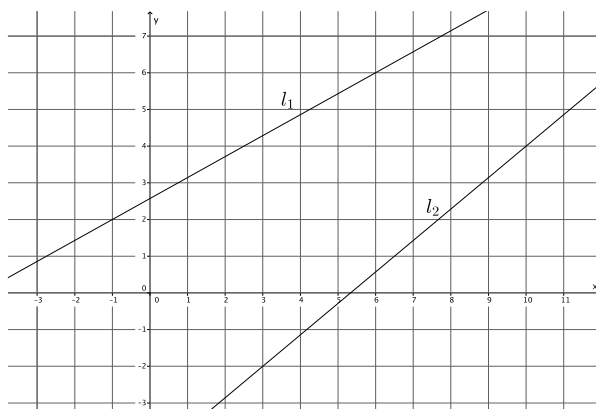
5. Line $l_1$ and line $l_2$ are shown on the graph below.  Use the graph to answer parts (a)–(d).



     a. What is the $y$-intercept of $l_1$?

     b. What is the $y$-intercept of $l_2$?

     c. Write a system of linear equations representing lines $l_1$ and $l_2$.

     d. Use the graph to estimate the solution to the system.

☐ I can solve and explain (in terms of the situation) a system of linear equations **algebraically**, including those that have no solution or infinitely many solutions.

6. Determine the solution, if it exists, for each system of linear equations.

- $\begin{cases} \frac{1}{2}x + 5 = y \\ 2x + y = 1 \end{cases}$

- $\begin{cases} y = -2x + 6 \\ 3y = x - 3 \end{cases}$

- $\begin{cases} y = 2x - 2 \\ 2y = 4x - 4 \end{cases}$

7. Determine the nature of the solution to each system of linear equations.  If the system has a solution, find it algebraically.

- $\begin{cases} y = \frac{3}{7}x - 8 \\ 3x - 7y = 1 \end{cases}$

- $\begin{cases} 2x - 5 = y \\ -3x - 1 = 2y \end{cases}$

- $\begin{cases} x = 6y + 7 \\ x = 10y + 2 \end{cases}$

8. Given the equation, $3x + 9y = -8$, write a second linear equation to create a system that

     a. Has exactly one solution.  Explain your reasoning.

     b. Has no solution.  Explain your reasoning.

     c. Has infinitely many solutions.  Explain your reasoning.

     d. Interpret the meaning of the solution, if it exists, in the context of the graph of the following system of equations.
$\begin{cases} -5x + 2y = 10 \\ 10x - 4y = -20 \end{cases}$

☐ I can solve real-world problems involving a system of linear equations.

9. There are 356 eighth-grade students at Euclid's Middle School.  Thirty-four more than four times the number of girls is equal to half the number of boys.  How many boys are in eighth grade at Euclid's Middle School?  How many girls?

10. A family member has some five-dollar bills and one-dollar bills in her wallet.  Altogether she has 18 bills and a total of $62.  How many of each bill does she have?

11. A friend bought 2 boxes of pencils and 8 notebooks for school, and it cost him $11.  He went back to the store the same day to buy school supplies for his younger brother.  He spent $11.25 on 3 boxes of pencils and 5 notebooks.  How much would 7 notebooks cost?

12. The length of a rectangle is 4 times the width.  The perimeter of the rectangle is 45 inches.  What is the area of the rectangle?

13. One angle measures 54 more degrees than 3 times another angle.  The angles are supplementary.  What are their measures?

14. The sum of the ages of two brothers is 46.  The younger brother is 10 more than a third of the older brother's age.  How old is the younger brother?