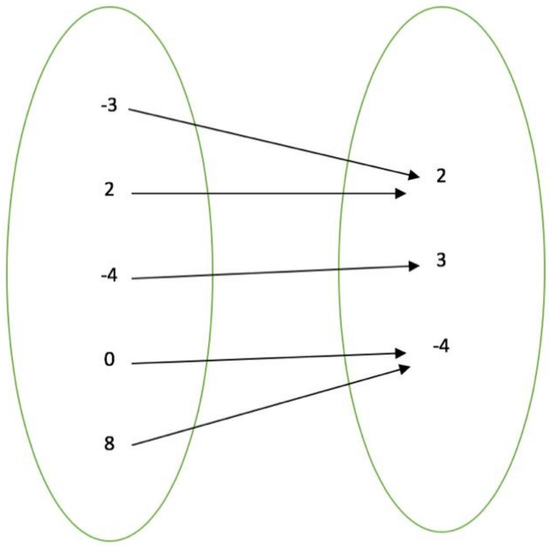
# Algebra 2 Module 3 Introduction to Functions

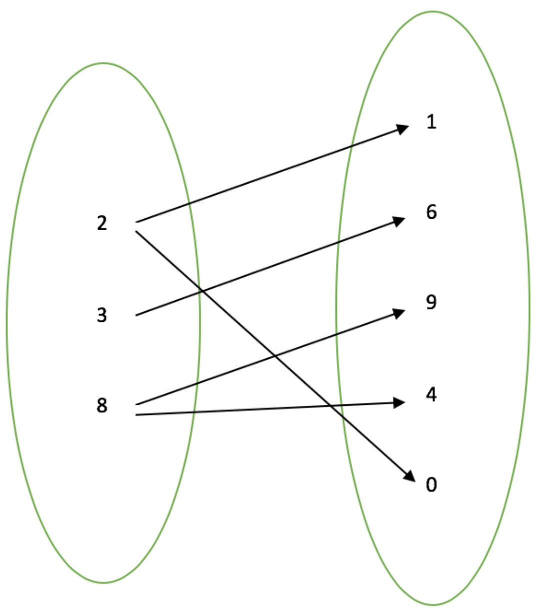
## Section 3.1 Relations and Functions

### Practice Problems 3.1

1. Make a table using the mapping below. Is it a function? Explain why or why not.




2. Graph the mapping below using ordered pairs. Is it a function? Explain why or why not.



Find the output for the function machine given the following inputs. If there is no solution explain why.

3. $x = 5$

$y = \frac{x+10}{3}$

$y = ?$

4. $t = 12$

$g(t) = \frac{3(15-t)}{4}$

$g(12) =$

5. $x = 5$

$y = \frac{2(x+1)}{x-5}$

$y = ?$

6. $m = -1$

$g(m) = \frac{m}{m-5}$

$g(-1) = ?$

Complete the function tables and write the rule using function notation. (Write the equation.)

7.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| -10 | -5 | 0 | 3 | 4 | 5 | 10 | $x$ |
| -30 | -15 | | 9 | | | | $g(x)$ |

8.

| | | | | | |
|---|---|---|---|---|---|
| $t$ | -10 | -5 | 0 | 3 | 12 |
| $h(t)$ | -8 | -3 | 2 | | |

9.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| $m$ | -8 | -2 | 0 | 2 | 5 | 6 | 10 |
| $t(m)$ | -11 | 1 | 5 | | 15 | 17 | |

Tell whether or not each relation is a function and explain why or why not.

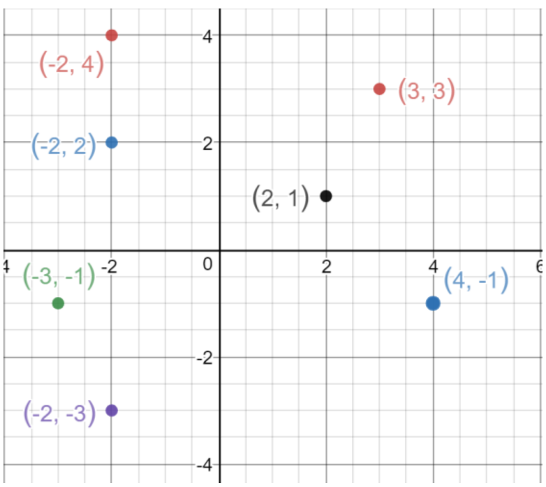
10.

| | | | | | | |
|---|---|---|---|---|---|---|
| $x$ | 7 | -2 | 0 | 9 | -3 | 6 |
| $y$ | 2 | -3 | 4 | 2 | 10 | 0 |

11.

| $x$ | $y$ |
|---|---|
| -3 | 6 |
| -4 | 8 |
| 2 | 4 |
| 4 | 3 |
| 2 | 1 |

12.

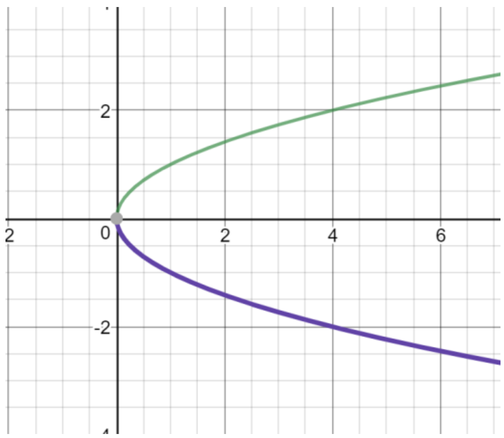



13.

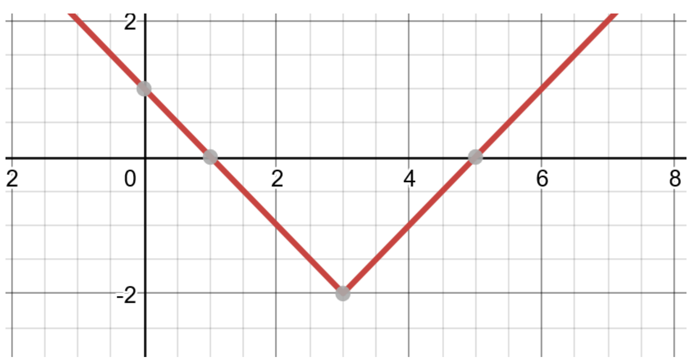
| $t$ | 4 | 6 | -3 | -1 | -2 | 0 | 4 |
|---|---|---|---|---|---|---|---|
| $h(t)$ | -2 | -3 | -2 | -1 | 4 | 6 | 8 |

14.

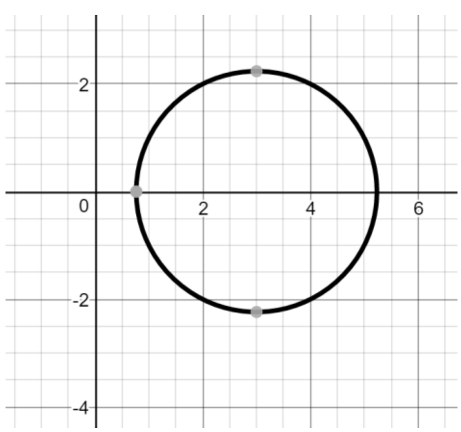
$y = \pm\sqrt{x}$




15. $y = |x - 3| - 2$




16. $5 = (x - 3)^2 + y^2$



Find the outputs given the following inputs. If it is not possible explain why.

17. Find $f(x) = \frac{x+4}{x-2}$ when $x = 2, -2, 7$.

18. Find $g(x) = 5 - x^2$ when $x = 4, 0, -4$.

19. If $g(t) = 3t - 1$, find $g(5)$, $g(-2)$, $g(0)$.

20. What is incorrect using function notation for $h(n) = 5x - 6.2$?

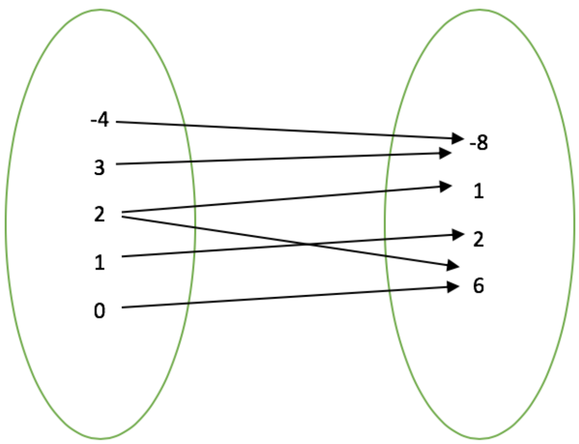
## Section 3.2 Domain and Range

### Practice Problems 3.2

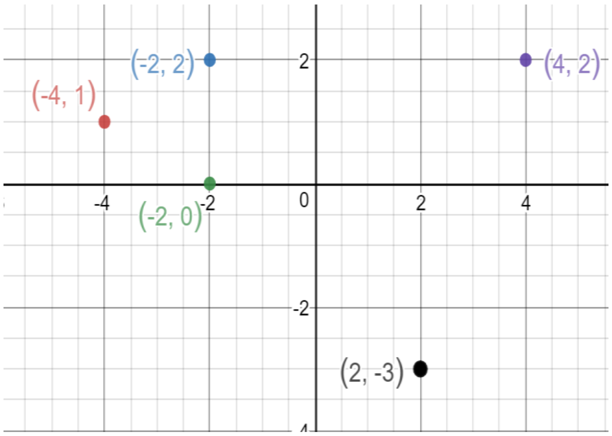
1. List the domain and range of the function.

| | | | | | |
|---|---|---|---|---|---|
| $x$ | 7 | 5 | 4 | 0 | -1 |
| $y$ | 3 | 2 | 8 | -2 | 2 |

2. List the domain and range of the mapping.




3. List the domain and range of the graph.



For Problem 4-7, find the domain and range of the functions using inequality notation.

4. $f(x) = x^2 - 2$

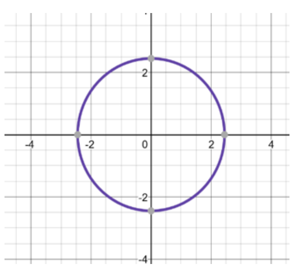
5. $g(x) = x^3$

6. $h(x) = 2x - 5$

7. $f(t) = \frac{8}{t-2}$

For Problem 8-16, find the domain and range of each graph using interval notation.

8.

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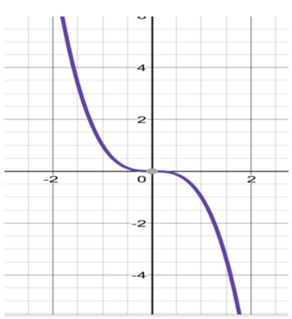

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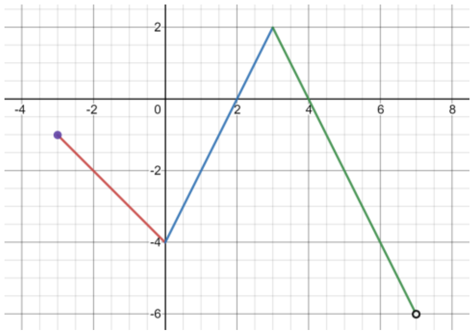


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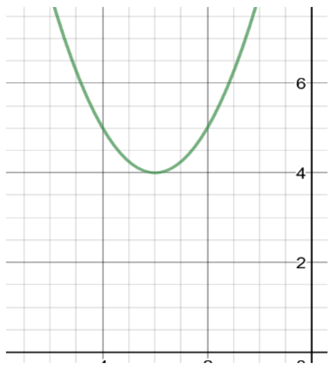


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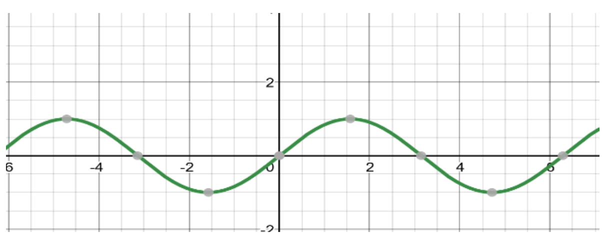


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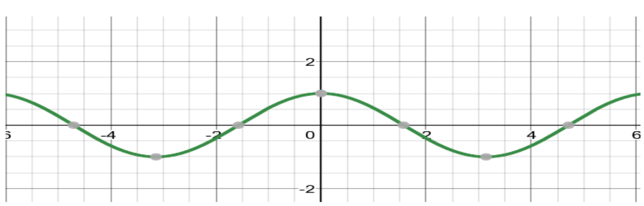

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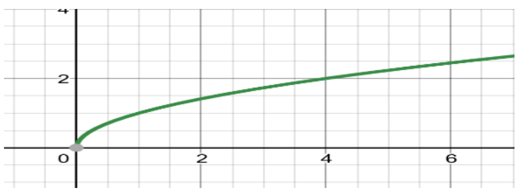


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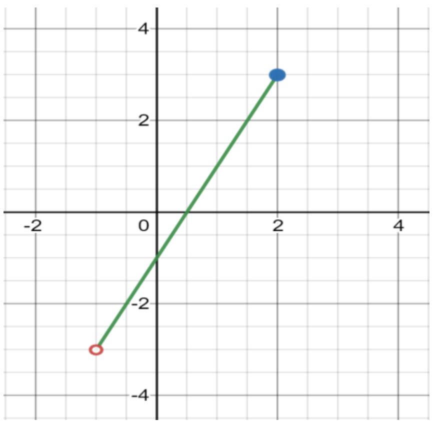


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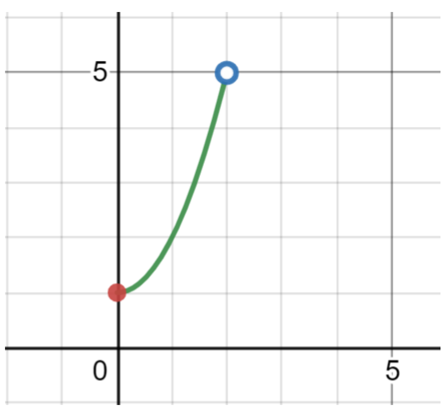
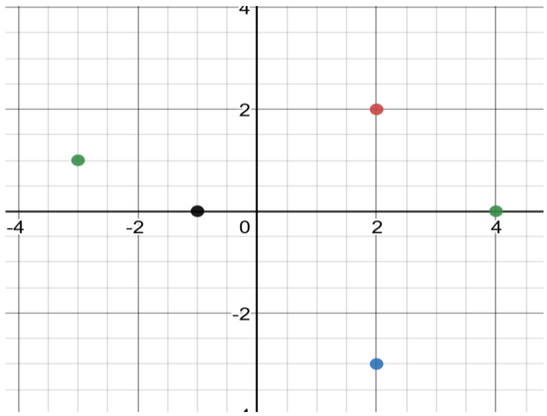


17. List the members of the domain and range.




18. The conversion from Fahrenheit to Centigrade can be done using the formula $C = \frac{5}{9}(F° - 32)$.

a. What is the formula to convert Centigrade to Fahrenheit?

b. How many degrees Centigrade is 68° Fahrenheit?

19. Dr. Schaublin conducts a test in 2 hours. Dr. Fedrizzi conducts the same test in 3 hours. If the two doctors work together, how long will it take to conduct the test?

20. Jared makes a poster for display at the state science fair on low light therapy. It must be a maximum of 3' x 4'. Jared has a 6" border all the way around it. What is the area left in the middle for the presentation?

## Section 3.3 Odd and Even Functions

### Practice Problems 3.3

For Problem 1-6, determine whether the functions are even, odd, or neither.

1. $g(x) = \sqrt{x^2 + 1}$

2. $h(x) = |x| + 5$

3. $s(x) = 2x^3 - 2x$

4. $t(x) = \frac{x}{x-1}$

5. $m(t) = t^2 + 3t + 1$

6. $n(t) = t^2 - 4$

For Problem 7-10, tell whether the equation of each parent function is even, odd, or neither and explain why.

7. $f(x) = x$

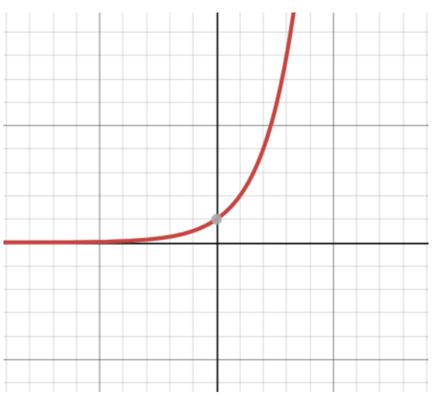
8. $f(x) = x^2$

9. $f(x) = x^3$

10. $f(x) = |x|$

For Problem 11-14, tell whether the graph of each parent function is even, odd, or neither and explain why.

11.



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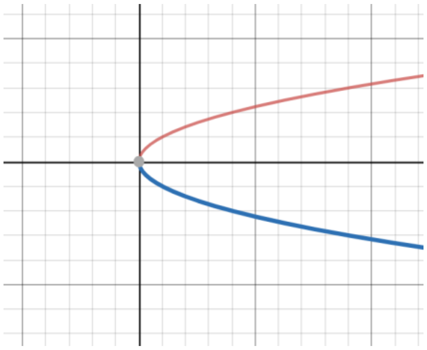

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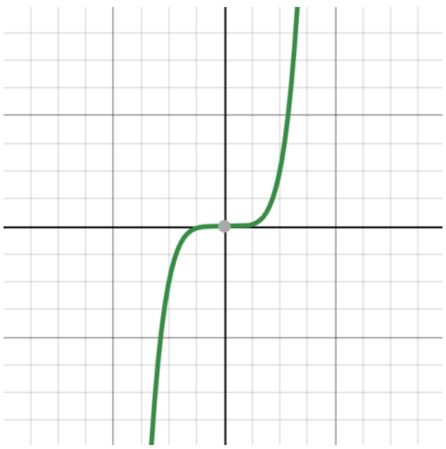

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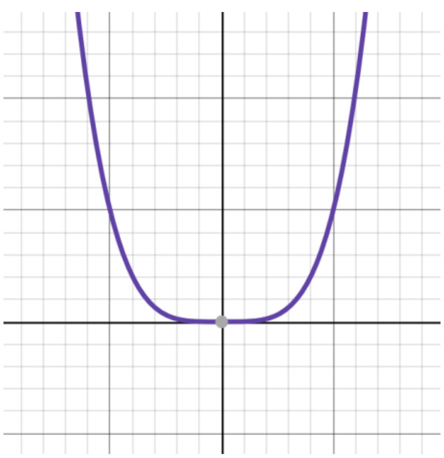
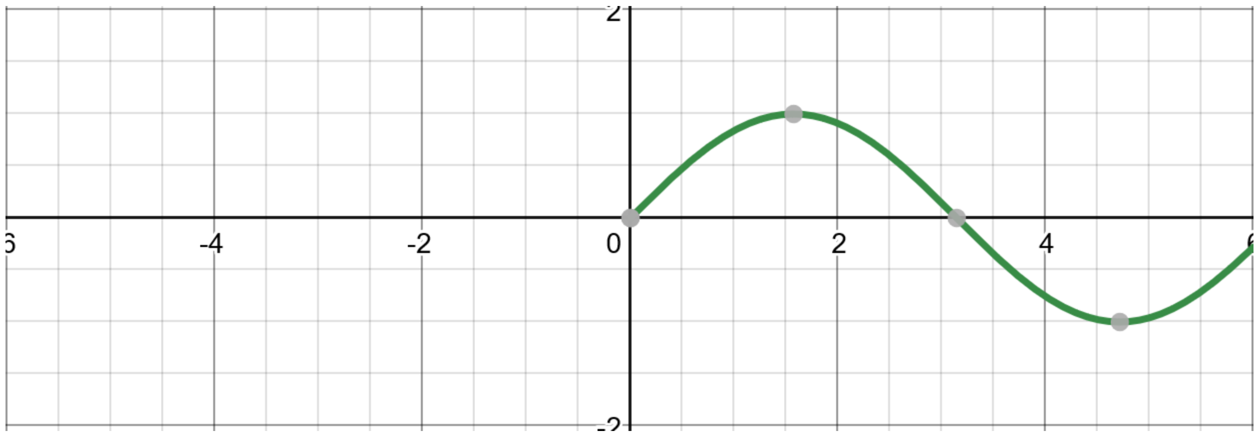


Draw the reflection of the graph about the origin for the interval $-6 \leq x \leq 0$ for Problem 15-18.

15.

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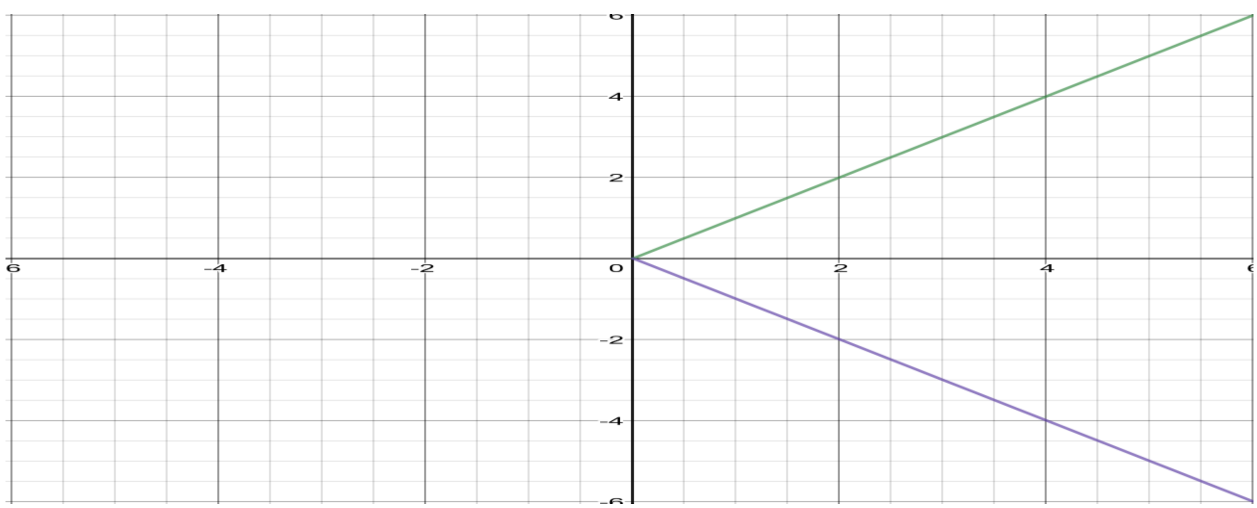

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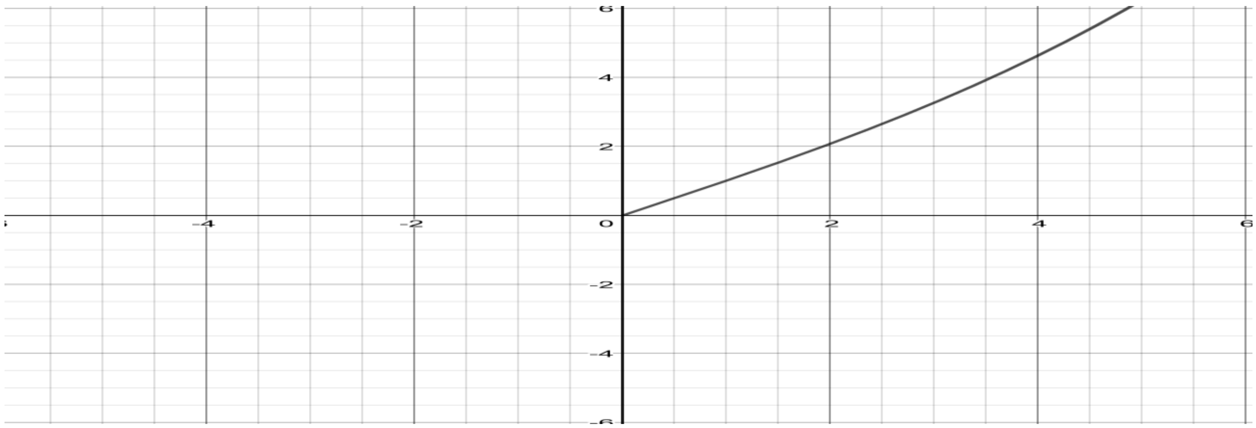
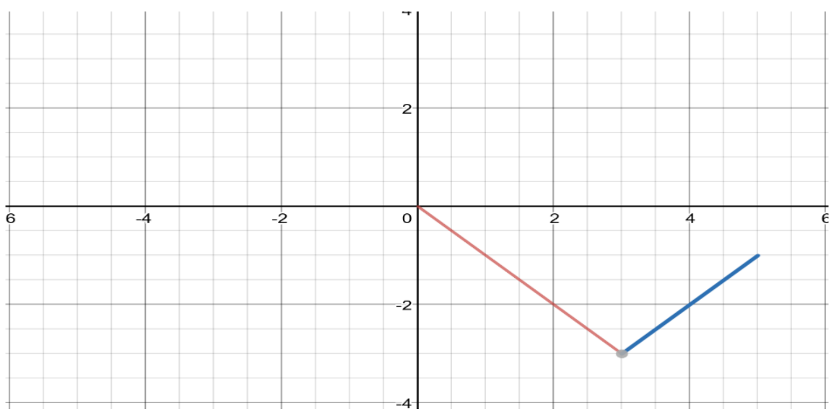


18.



19. During his major league career, Babe Ruth hit 41 less home runs than Hank Aaron did during his. Unbelievably, the two hit a total of 1,469 home runs combined. How many home runs did each player hit during his major league career?

20. An electrical engineer earns a monthly salary plus an $8,600.00 end of the year bonus. If she earns $74,000.00 at the end of the year, what is her monthly salary?

Section 3.4 Composition of Functions

Practice Problems 3.4

Let $f(x) = x^2 - 1$, $g(x) = x + 1$, and $h(x) = -5x$.

Find the compositions.

1. $f(g(3))$
2. $f(g(-2))$
3. $f(h(0))$
4. $h(f(g(4)))$
5. $g(f(h(0)))$
6. $h(g(f(6)))$
7. $f(h(x))$
8. $h(g(x))$
9. $g(h(x))$
10. $f(g(h(x)))$
11. $h(f(x))$
12. $h(g(f(x)))$

13. Find the order of the functions if the input is $3$ and the output is $-39$. Write it as a composition of functions.

14. Find the order of the functions if the input is $10$ and the output is $-600$.

15. Find the order of the function if the input is $5$ and the output is $-125$.

16. Solve for $x$.

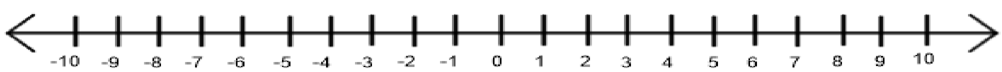
$$\frac{x}{2x-3} = \frac{x+5}{2x+1}$$

17. Solve for $x$.

$$3x - 9 = 7x + 27$$

18. Solve the inequality and sketch the graph on the number line.

$$|x - 3| < 8$$




19. What quantity of pure acid must be added to 200mL of 50% acid solution to produce a 60% acid solution?

20. Solve the quadratic equation for $c$.

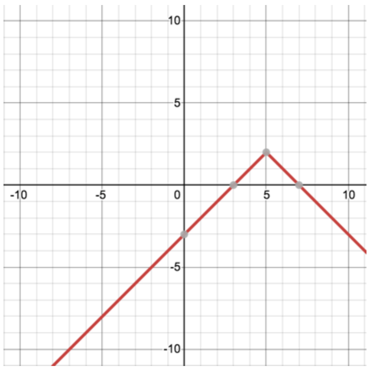
$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Section 3.5 Inverse Functions

Practice Problems 3.5

Use the Vertical Line Test to determine if each relation is a function. Write “yes” or “no.”

1.



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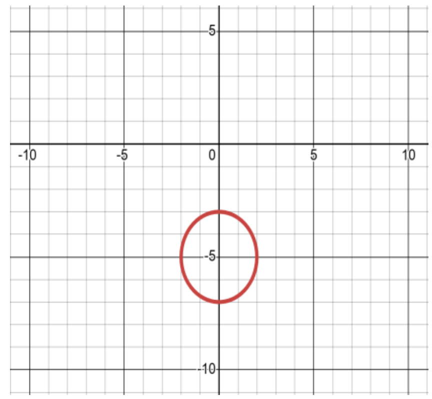

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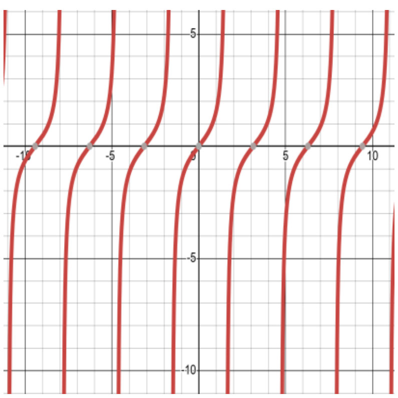

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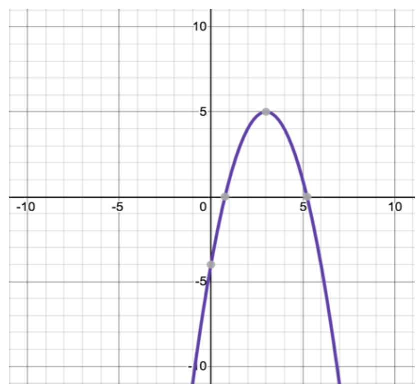

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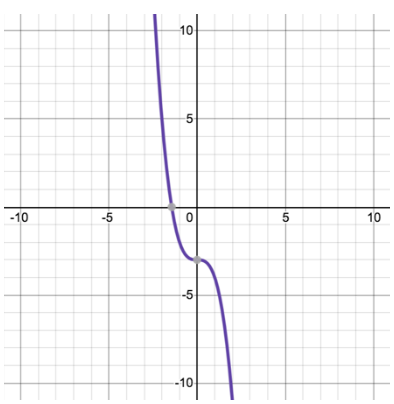

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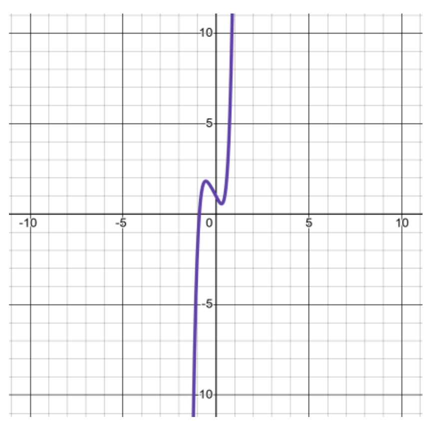


Use the Horizontal Line Test to determine if the inverse of each relation in Problem 1-6 is a function. The equations are listed next to each number. Write "yes" or "no."

7. $f(x) = -|x-5| + 2$

8. $f(x) = \pm\sqrt{4-x^2} + 5$

9. $f(x) = \tan x$

10. $f(x) = -(x-3)^2 + 5$

11. $f(x) = -x^3 - 3$

12. $f(x) = 10x^5 + 8x^4 + 3x^3 - 2x + 1$

Find the inverse of each function and write it in terms of $f^{-1}(x)$.

13. $y = 10 - x$

14. $y = \sqrt{x+5} - 2$

15. $y = \frac{x-6}{8}$

16. $y = \frac{x^3}{3} + 1$

Verify whether or not the functions are inverses. Write "yes" or "no."

17. $f(x) = 3x + 5$ $g(x) = \frac{x}{5} + 3$

18. $g(x) = 10x - 2$ $h(x) = \frac{x+2}{10}$

19. $h(x) = \sqrt[3]{\frac{x}{4} + 9}$ $k(x) = 4(x-9)^2$

20. $f(x) = \frac{9}{x-5}$ $h(x) = \frac{5}{9}x + 1$

Section 3.6 Operations with Functions

Practice Problems 3.6

Use the functions $f(x) = 3x - 5$ and $g(x) = 5x + 3$ to solve Problem 1-6.

1. $f(x) + g(x)$

2. $f(x) - g(x)$

3. $f(x) \cdot g(x)$

4. $\frac{f(x)}{g(x)}$

5. $f\big(g(x)\big)$

6. $g\big(f(x)\big)$

Use the functions $h(x) = 2x^2 - 3x$ and $k(x) = -3x^3 + 5x^2$ for Problem 7-12.

7. $k(x) + h(x)$

8. $k(x) - h(x)$

9. $k(x) \cdot h(x)$

10. $\frac{k(x)}{h(x)}$

11. $h\big(k(x)\big)$

12. Does $k(x) + h(x) = h(x) + k(x)$?

13. Does $k(x) - h(x) = h(x) - k(x)$?

14. Does $k(x) \cdot h(x) = h(x) \cdot k(x)$?

15. Does $\frac{k(x)}{h(x)} = \frac{h(x)}{k(x)}$?

16. Which function operations are closed under the Commutative Property?

17. If $f(x) = \frac{x+3}{2}$ and $g(x) = 2x - 3$, find $g(1)$.

18. Using the functions in Problem 17, find $f(g(1))$. What do you notice about your answer?

19. Find $f(-3)$ and $g(f(-3))$. What do you notice about your answer?

20. What can you conclude about the two functions and how can you demonstrate it?

## Section 3.7 Function Transformations

### Practice Problems 3.7

Given the parent function, write the transformed equation, $g(x)$, after the given transformations.

1. $f(x) = x^2$ Right 3; Down 2

2. $f(x) = \sqrt{x}$ Right 7; Down 6

3. $f(x) = x^3$ Left 3; Up 1

List the shifts of the transformed equation, $g(x)$, given the parent function.

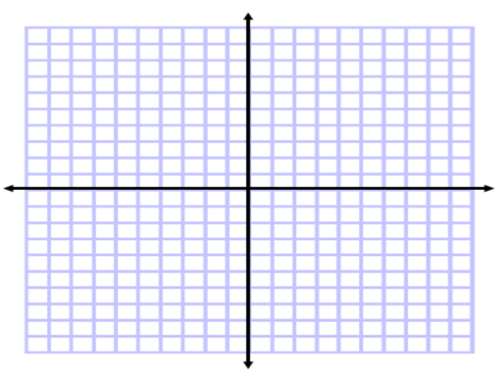
4. $f(x) = \frac{1}{x}$ $g(x) = \frac{1}{x+4} - 2$

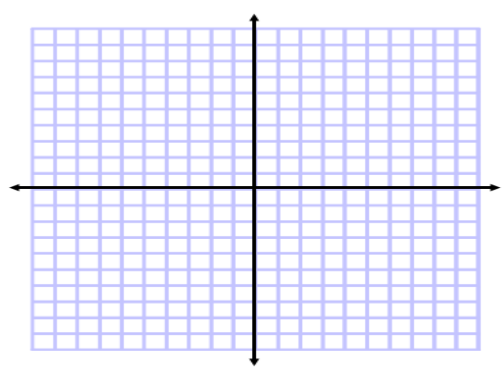
5. $f(x) = 2^x$ $g(x) = 2^{x+3} + 1$

Sketch the parent function and the transformed function on the same coordinate graph.

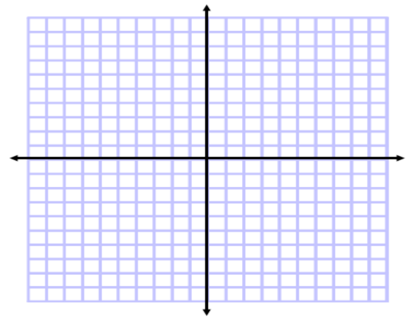
6. $f(x) = x^2$ $g(x) = x^2 - 2$

7. $f(x) = x^3$ $g(x) = (x-4)^3$





8. $f(x) = |x|$ $g(x) = |x+5| - 1$



Name the vertex or point of inflection of each equation in graphing form then name all the transformations from the parent function.

9. $f(x) = \frac{1}{2}(x-3)^2 + 8$

10. $f(x) = 5|x+2| - 4$

11. $f(x) = 0.3x^3 - 2$

12. $f(x) = \frac{3}{4}(x-7)^2$

For Problem 13-20, match each equation with its graph.

13. $y = \frac{1}{x+2}$

14. $y = -x^2 + 5$

15. $y = 2^x - 3$

16. $y = (x+2)^3 + 3$

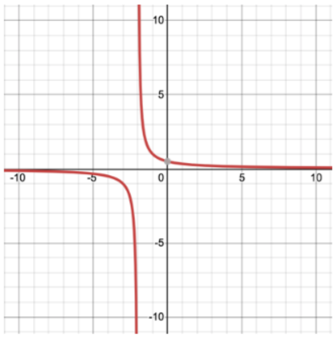
17. $y = -(x-3)^2 + 6$

18. $y = 3x - 6$

19. $y = (x-3)^3$

20. $y = (x+3)^2 - 6$

a)



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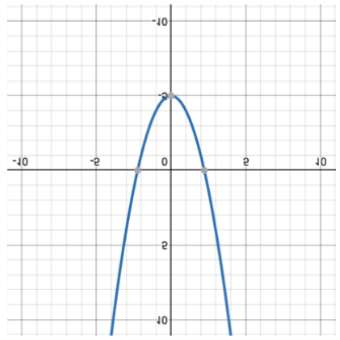

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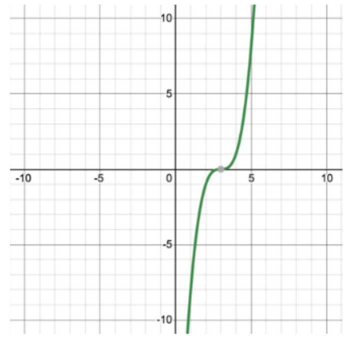
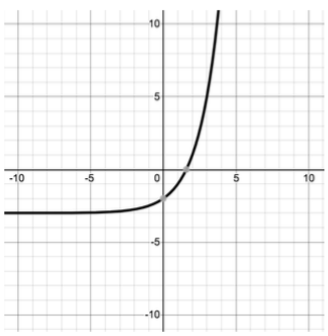
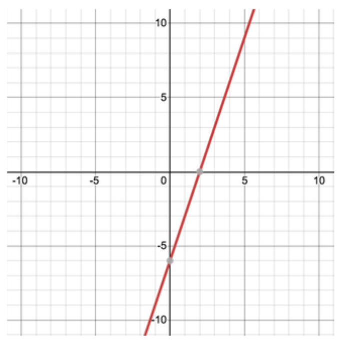


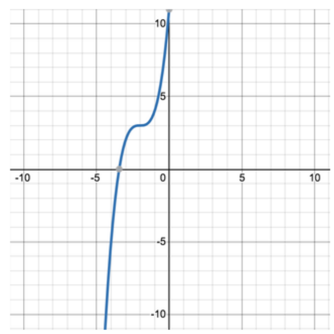
d)



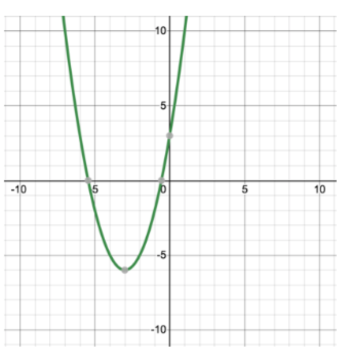
e)



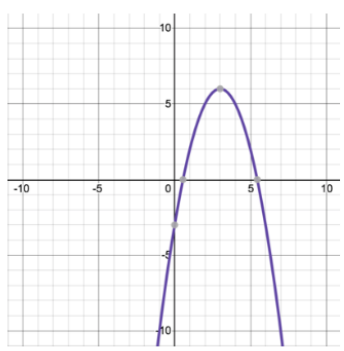
f)



g)



h)



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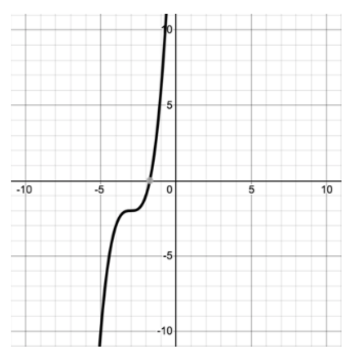


Section 3.8 Direct and Inverse Variation

Practice Problems 3.8

Use the chart from Example 1 to pick one of the names for Problem 1-5.

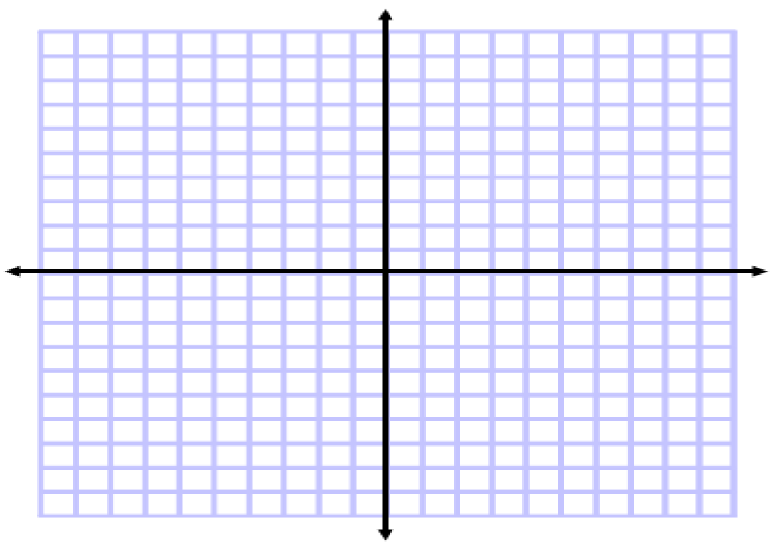
1. Complete the table below.

| $x$ (seconds) | $y$ (total feet) |
|---|---|
| 0 | |
| 1 | |
| 2 | |
| 3 | |
| 4 | |
| $x$ | |

2. What is the equation that represents the total distance $(y)$ given the number of seconds $(x)$?

3. What is the slope? What does it represent?

4. Draw the graph to represent the table. Let the $x$ axis represent the time in seconds. Let the $y$ axis represent the total distance in feet.



5. Why is the relationship between the time and distance linear?

6. Go to a football field and have someone time you as you walk 90 yards at a constant rate. Find your walking rate in feet per second and complete Problem 1-5 above using your own information.

7. If $y$ varies directly with $x$ and $y = 3$ when $x = 10$, find $y$ when $x = 60$.

8. If $m$ varies directly with $n$ and $m = 75$ when $n = 40$, find $m$ when $n = 12$.

9. If $y$ is directly proportional to $\sqrt{x}$ and $y = 25$ when $x = 9$, find $y$ when $x = 4$.

10. If $a$ varies directly with $2b - 1$ and $a = 9$ when $b = 2$, find $a$ when $b = 3$.

11. The speed of an object at rest that falls in a vacuum is directly proportional to the time it takes to fall. An object that has fallen for 2.2 seconds has a speed of 16.8 m/s. What is the speed of the object after it has fallen for 6 seconds?

12. If $y$ varies inversely with $x$ and $y = 32$ when $x = 1.5$, find $y$ when $x = 6$.

13. If $x$ varies inversely with the square root of $y$ and $x = 18$ when $y = 16$, find $x$ when $y = 36$.

14. The frequency of a radio signal varies inversely with the wavelength. The frequency of an AM radio station is 1200 KHz (Kilohertz). If the wavelength of this frequency is 200 m., what is the frequency of a wavelength of 450 m.?

Given the description, write equations for Problem 15-18. Use $k$ for the constant of variation.

15. The variable $m$ is directly proportional to $n$ and inversely proportional to $p$.

16. Area is directly proportional to the square of the radius $(r)$. Let $k = \pi$.

17. The variable $x$ is inversely proportional to the cube of $z$.

18. The volume of a sphere, $v$, is directly proportional to the cube of the diameter of the sphere.

For Problem 19-20, express the equation in written form. Like before, $k$ will be the constant of variation.

19. $L = kno$

20. $m = k\frac{s}{d^2}$

21. If $a$ varies directly with the product of $b$ and $c$, what happens to $a$ when $b$ and $c$ are doubled?

## Section 3.9 Linear Functions

## Forensic Science Lab 3.9

Anthropologists have collected data using variables such as the length of the bones in the body, gender, and race and performed calculations from this data to show that a person's height can be estimated using the length of the known bones. There is a difference for the length of the bones and the height for males and for females, and for people of different ethnicities. Forensic Science use this data to analyze bones and determine heights of persons. Age is the main factor that affects height, but gender and race can also affect height among other factors.

Before a person reaches age 18-23, their bones have not competed their growth and it is difficult to analyze from this age group for this reason. The data from the table below was collected from adults that are over the age of 23 whose growth is assumed to be complete. The formulas for the first table are from the femur bone which is the large bone extending from the hip to the knee. The humeral bone in the second table is the large bone extending from the shoulder to the elbow.

**Formula for Calculating Height Using the Femur**

| Race | Male Equation | Female Equation |
|---|---|---|
| Caucasian | 2.32 · length + 65.53 cm | 2.47 · length + 54.10 cm |
| African American | 2.10 · length + 72.22 cm | 2.28 · length + 59.76 cm |

**Formula for Calculating Height Using the Humeral Bone**

| Race | Male Equation | Female Equation |
|---|---|---|
| Caucasian | 2.89 · length + 78.10 cm | 3.36 · length + 57.97 cm |
| African American | 2.88· length + 75.48 cm | 3.08 · length + 64.67 cm |

The forensic team determined one of the bones found at a crash scene was a femur 43.5 cm. in length and came from a Caucasian male.

There were two humeral bones found, one was 30.7 cm. and the other 31.1 cm. and came from African American females.

1. Using the length of the bones found and the factors of gender and race and the tables given, find the heights of the persons.

2. Is it possible that the two humeral bones were from the same female. Explain your thinking.

Measure the height of each member of your family and the length of each person's femur, which is the large bone that ranges from the hip joint to the knee cap. Put the data in the table below. (If you measure inches you will need to convert to cm. knowing that 1 in. = 2.54 cm.)

You will need the following:

- A flexible tape-measure
- Members of your family
- Calculator

Complete the table below for names, height and femur length. (Leave the calculated height blank for now.)

| **Names of the Family Members** | | | | |
|---|---|---|---|---|
| **Height in cm.** | | | | |
| **Femur Length in cm.** | | | | |
| **Calculated Height in cm.** | | | | |

2. Based on each member's sex and race, use the equations in the tables to determine the calculated height in cm. If your ethnicity is not found on the table, use the search bar for more extensive tables and complete formulas.

3. Does the information you obtained from the equation reflect each members' measured height? Is it close or reasonable?

4. If it is not close, what factors might cause this difference?

## Section 3.10 Point-Slope Form

### Practice Problems 3.10

Given a point on each line and the slope of each line, find the equation of the line.

1. Point: (3, 2) $m = \frac{1}{4}$

2. Point: (-5, -5) $m = 3$

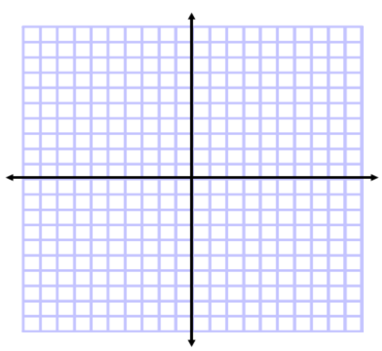
3. Point: (-2, 1) $m = \frac{2}{3}$

4. Point: (1, -4) $m = -2$

5. Given the point (1, 9) and the slope $m = 3$, find the equation of this line and call it $f(x)$.

6. Find the inverse of $f(x)$ from Problem 5. Let $f^{-1}(x)$ be $g(x)$.

7. Using a graph, show that $f(x)$ and $g(x)$ are inverses.



8. Use what you know about the composition of functions to show that $f(x)$ and $g(x)$ are inverses.

A store owner makes grandfather clocks. The linear function for the length $(L)$ of the pendulum (in cm.) related to its mass ($m$) (in grams) in metal is $L(m) = \frac{m}{10} - 20$.

The period of the pendulum $(t)$ for one swing back and forth is $t(L) = 2(\pi)\sqrt{\frac{L}{980}}$. (Time is in seconds.)

9. If the pendulum is made of 900 grams of metal, what is the length of the pendulum?

10. What is the period of the pendulum with 900 grams of metal?

11. What is $t(L(900))$?

12. What relationship is expressed by $t(L(m))$?

13. What does the composition of a functions allow for in the pendulum problem?

Given two points on a line, find the slope, then use one of the points to write the equation in point-slope form and convert to slope-intercept form.

14. (7, 6) and (10, 15)

15. (4, 11) and (5, 9)

16. (-9, 9) and (0, 1)

17. Convert the answer from Problem 16 to standard form ($ax + by = c$).

In 2018, one US dollar was equivalent to 101.1 Kenyan Shillings.

18. Let $U(x)$ be the amount of dollars for an item priced at $x$ Kenyan shillings and let $k(x)$ be the number of shillings for an item priced at $x$ US dollars. Write expressions for $U(x)$ and $k(x)$.

19. How many US dollars is the price of a traveling wardrobe at 25,000 Kenyan shillings?

20. Are $U(x)$ and $k(x)$ inverses of one another? Why or why not?

## Section 3.11 Absolute Value Functions

### Practice Problems 3.11

What is the vertex of each absolute value equation?

1. $y = \frac{1}{4}|x - 3|$

2. $y = -4|x + 3|$

3. $y = |x - 1| + 8$

4. $y = -2|x - 6| + 5$

5. $y = |x + 7| - 4$

6. $y = \frac{3}{4}|x| - 7$

7. $y = 11|x|$

8. If the vertex of an absolute value equation is (5, -1), which of the following might be the equation?

a) $f(x) = |x + 5| + 1$

b) $f(x) = |x - 5| + 1$

c) $f(x) = |x + 5| - 1$

d) $f(x) = |x - 5| - 1$

9. Given $y = |x|$ and $T(x, y) \rightarrow (x - 5,\ y + 6)$, find the image of $(-4, 4)$.

10. Given $y = |x|$ and $T(x, y) \rightarrow (x, y - 4)$, find the image of $(3, 3)$.

11. Under some translation of $y = |x|$, $T(1, 1)$ is mapped to $(0, 7)$. What is the formula for $T(x, y)$?

12. Use the formula $T(x, y)$ from Problem 11 to find $T(-2, 2)$.

13. Given the rule $\mathrm{T}(x, y) \rightarrow (x - 1,\ y + 4)$ for $y = |x|$, what is the equation for the translations?

14. What is the vertex of the equation in Problem 13?

15. Given $f(x) = |x|$ and $g(x) = |x - 8|$, state the rule for a translation that maps the graph of $f$ onto $g$.

16. Complete the table for $y = |x| - 5$ for input {-3, -2, -1, 0, 1, 2, 3}

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

17. Sketch the graph of the equation $y = |x| - 5$.

18. What is the vertex of $y = |x| - 5$? How does that relate to the table?

19. How does $y = \frac{1}{3}|x|$ affect the parent function when $a = \frac{1}{3}$?

20. What happens to the absolute value graph when $a < 0$, $0 < a < 1$, and $a > 1$?

## Section 3.12 Step Functions

### Practice Problems 3.12

1. What is the greatest integer less than or equal to 4?

2. What is the greatest integer less than or equal to 4.5?

Use the rounding down technique to evaluate each greatest integer.

3. $[-3.6]$

4. $[9.3]$

5. $[-6]$

6. $[0.47]$

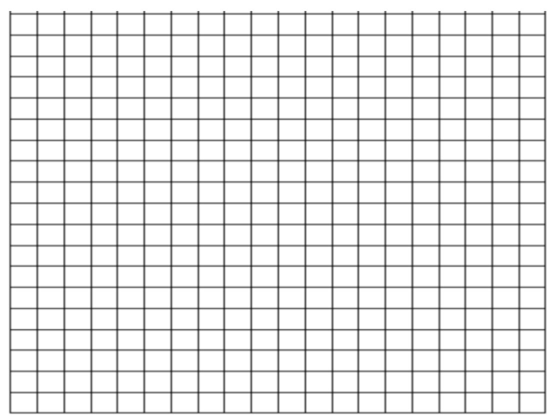
While serving overseas, Eduardo is charged $0.20 per minute for a phone call. Every fraction of a minute is rounded down to the nearest minute. (So, for a 1 minute and 30 second phone call, the charge is only for 1 minute.)

Use the above information to do Problem 7-10.

7. Complete the table for the charges to his cell phone for minutes of use.

8. Draw the graph of the greatest integer step function for Problem 7.

| **Minutes** | **Dollars** |
|---|---|
| 0.5 | |
| 1 | |
| 1.5 | |
| 2 | |
| 2.3 | |
| 3 | |
| 4 | |
| 5 | |
| 5.25 | |
| 5.75 | |



9. Fill in the blank to complete the equation for dollars $(d)$ that is charged for $m$ minutes of calls.

$$d = (0.20)[\_\_]$$

10. Use the greatest integer equation to find the amount of money that is charged for a call that is 20 minutes and 30 seconds long.

11. What is the smallest integer greater than or equal to 4?

12. What is the smallest integer greater than or equal to 4.5?

For Problem 13-16, use the rounding up technique to evaluate each smallest integer.

13. $]-3.6[$

14. $]9.3[$

15. $]4.5[$

16. $]-6[$

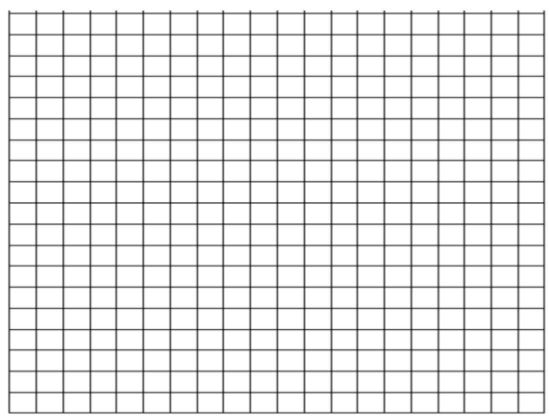
While overseas, an investment company is charged \$0.20 per minute and every fraction of a minute for phone calls made by employees. (So, for a 1 minute and 30 second call, the charge is for 2 minutes.)

For Problem 17-20, use the above information to solve.

17. Complete the table for the cell phone charges to the company for minutes of use.

18. Draw a graph of the least integer step function.

| **Minutes** | **Dollars** |
|---|---|
| 0.5 | |
| 1 | |
| 1.5 | |
| 2 | |
| 2.3 | |
| 3 | |
| 4 | |
| 5 | |
| 5.25 | |
| 5.75 | |



19. Fill in the blank to complete the equation for dollars $(d)$ that is charged for $m$ minutes of calls.

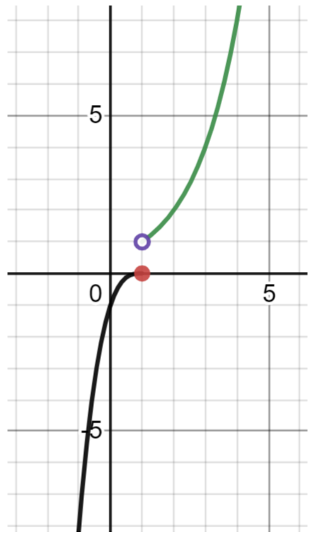
$$d = (\_\_)]m[$$

20. Use the least integer equation to find the amount of money that is charged for a call that is 20 minutes and 30 seconds long.

Section 3.13 Piecewise Functions

Practice Problems 3.13

Use the function below to answer Problem 1-7.




1. Is this a continuous or discontinuous function? Why or why not?

2. Is this a step function or a piecewise function? Explain why.

3. Is there a gap or a jump in the function?

4. Given the function below, write the intervals using inequality notation.

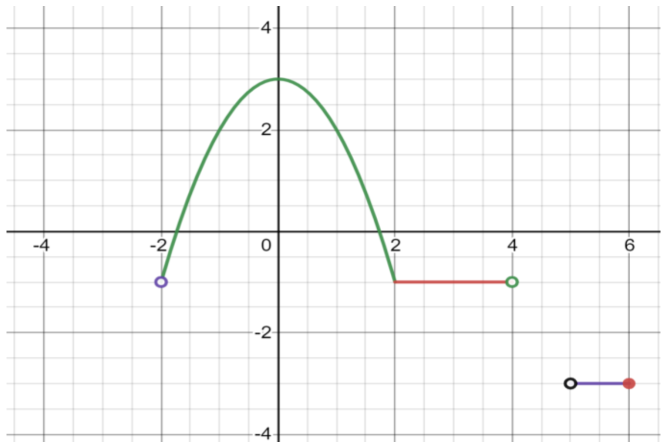
$$f(x) = \begin{cases} 2^{x-1} \\ (x-1)^3 \end{cases}$$

5. Is the point (-2, 1) a solution of the piecewise function? Why or why not?

6. What is the domain of the function?

7. What is the range of the function?

Given the function below, answer Problem 8-14.




8. Is this a continuous or discontinuous function? Why or why not?

9. Is this a step function or a piecewise function? Explain why.

10. Is there a gap or a jump in the function?

11. Given the function below, write the intervals using inequality notation.

$$f(x) = \begin{cases} -x^2 + 3 \\ -1 \\ -3 \end{cases}$$

12. Is the point (3, 0) a solution?

13. What is the domain of the function?

14. What is the range of the function?

Kalika, Clayton, Caleb and Dawson took a trip out to the west coast. The table below represents the time and distance it took for the friends to make the trip.

| **Time (Hours)** | **Distance (Miles)** |
|---|---|
| 1 | 80 |
| 4 | 300 |
| 6 | 300 |
| 7 | 370 |
| 10 | 600 |

15. What is the rate (in mph) from 1 to 4 hours?

16. Why is the distance constant from 4 to 6 hours?

17. Draw the graph below with time on the *x*-axis and distance on the *y*-axis.

18. Is this a continuous or discontinuous function? Why or why not?

19. Is this a step function or a piecewise function? Explain your reasoning.

20. Draw a step function that would represent speed while traveling west.

Section 3.14 Module Review

1. Is the data in the table a function? Explain why or why not.

| $x$ | -3 | 4 | 2 | 1 | 2 | 0 |
|---|---|---|---|---|---|---|
| $f(x)$ | -2 | 8 | -4 | 6 | 3 | 2 |

2. Does the data in the table below represent a function? Explain why or why not.

| $x$ | $f(x)$ |
|---|---|
| -8 | 1 |
| 4 | 1 |
| 2 | 4 |
| 0 | 3 |
| -3 | 8 |
| 6 | 2 |

3. List the domain and range using the data from the table in Problem 1.

4. List the domain and range of the function below.

$$\{(-4,6)\ \ (-2,1)\ \ (5,8)\ \ (0,6)\ \ (2,1)\}$$

5. Is $f(x) = x^2 - 7x$ an even function, odd function, or neither? Demonstrate how you know.

6. Is $f(x) = 3x^2 - 4$ an even function, odd function, or neither? Demonstrate how you know.

7. Given $f(x) = x^2 - 7x$ and $g(x) = 3x - 4$, find $f(g(x))$.

8. Given $h(x) = \frac{x}{2} + 3$ and $k(x) = 2x$, find $k(h(x))$.

9. Given $h(x) = \sqrt{2x - 3}$, find the value of the function.

a) $h(6)$ b) $h(2)$

10. Given $k(x) = 3x^2 + 1$, find the value of the function.

a) $k(-2)$ b) $k(0)$

11. Find the inverse of $g(x) = (x - 3)^2 + 5$ and write it in terms of $g^{-1}(x)$.

12. Find $g(4)$ using the function $g(x)$ in Problem 11. Use the answer to that in the function $g^{-1}(x)$ to show that they are inverses (Hint: you should get what you started with).

13. Find the inverse of $h(x) = \frac{\sqrt{x}+4}{2}$ and write it in terms $h^{-1}(x)$. What operations change from $h(x)$ to $h^{-1}(x)$?

14. Find $f(x) + g(x)$ when $f(x) = 2x + 1$ and $g(x) = x - 3$.

15. Find $f(x) - g(x)$ when $f(x) = x^2 + 3x$ and $g(x) = 2x - 4$.

16. Find $h(x) \cdot k(x)$ when $h(x) = x + 5$ and $k(x) = x - 6$.

17. Find $\frac{h(x)}{k(x)}$ when $h(x) = 3x - 6$ and $k(x) = x^2 - 4$.

18. A dam built in the year 2000 is gradually creating a reservoir (lake). The depth of the water is modeled by the function $w(t) = 10t + 6$ where $t$ is the number of years since the dam was built and $w(t)$ represents the depth of the water in feet. What does the 10 represent in the equation? What does the 6 represent in the equation?

19. When will the reservoir have a depth of 26 meters? How deep is the reservoir in 2017?

20. The circumference of a circle is the outside of the circle. The diameter of the circle is the line that extends from one side of the circumference to the opposite side and passes through the center. Trace a cup or can on a paper to make a circle. Find objects with increasingly larger diameters and trace the circles one inside the other. Or use a compass and open it out ¼ of an inch each time you draw a circle until eight nested circles are drawn. Number the circles increasing in circumference1-8. Measure the circumference and diameter of each circle in skittles® and record it in the chart. Graph the results and answer the questions.

| $\boldsymbol{d}$ (in skittles®) | $\boldsymbol{c}$ (in skittles®) |
|---|---|
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |

a) As the diameter increases, what happens to the circumference?

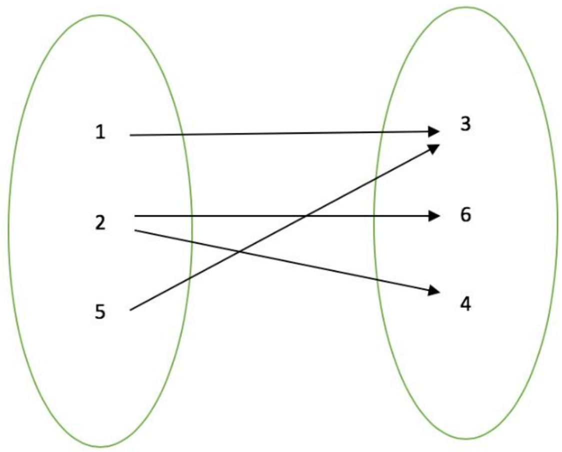
b) Is this a direct variation or an inverse variation?

c) What type of equation models the relation between diameter and circumference?

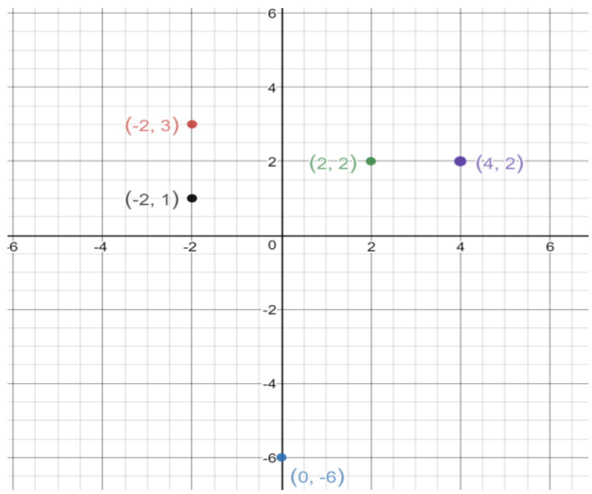
d) Use two points on the graph and check the equation $c = \pi d$. How close are the results?

Section 3.15 Module Test

1. Is the mapping below a function? Explain why or why not.




2. Is the graph below a function? Explain why or why not.




3. List the domain and range of the mapping in Problem 1.

4. List the domain and range of the ordered pairs in Problem 2.

5. Is $f(x) = x^5 + 5x^3$ an even function, odd function, or neither? Demonstrate why.

6. Is $f(x) = \frac{x^2+2}{x^3-x}$ an even function, odd function, or neither? Demonstrate why.

7. Given $f(x) = 7x$ and $g(x) = 2x^2 + 3x$, find $f(g(x))$.

8. Given $h(x) = \sqrt{x+4}$ and $k(x) = 2x - 2$, find $k(h(x))$.

9. Given $h(x) = (x+3)^2 - 1$, find the value of the function.

a) $h(7)$ b) $h(-3)$

10. Given $k(x) = -2x^3 - 4$, find the value of the function.

a) $k(-1)$ b) $k\left(\frac{1}{2}\right)$

11. Find the inverse of $g(x) = \frac{\sqrt{x}}{4} - 4$ and write it in terms of $g^{-1}(x)$.

12. Find $g(16)$ using the function $g(x)$ in Problem 11. Use the answer to that in the function $g^{-1}(x)$ to show that they are inverses (Hint: you should get what you started with).

13. Find the inverse of $h(x) = (x+2)^2 - 3$ and write it in terms of $h^{-1}(x)$?. What operations change from $h(x)$ to $h^{-1}(x)$?

14. Find $f(x) + g(x)$ when $f(x) = \sqrt{x} + 5$ and $g(x) = \sqrt{4x} - 8$.

15. Find $f(x) - g(x)$ when $f(x) = x^2 + 2$ and $g(x) = -3x^2 - 4x$

16. Find $h(x) \cdot k(x)$ when $h(x) = 3x^2$ and $k(x) = -3x^3 + 5$.

17. Find $\frac{h(x)}{k(x)}$ when $h(x) = 3x + 4$ and $k(x) = 2x^2 - 1$.

18. Trey planted a memory tree in his yard in honor of his father who passed away. The tree was 2.5 feet tall when he purchased it and has grown 1.5 feet each year since then. What is the rate of growth of the tree (slope)? What is the initial height of the tree ($y$ −intercept)?

19. Write an equation for the height of the memory tree from Problem 18. Let $h(t)$ represent height in feet and $t$ represent time in years since 2010. How tall will the tree be in 2030?

20. Using the same circle pattern for the circles numbered 1-8, find the radius of each circle using skittles® (radius is the length from the center of the circle to the circumference and is half the diameter). Then find the area of the circle in skittles®. The area is to be covered with skittles so instead of being square units it will be skittle® units. Cover each circle completely and estimate if some extend over the circumference. Complete the table and graph below and answer the questions.

| ***r*** (in skittles®) | ***A*** (in skittles®) |
|---|---|
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |

a) As the radius decreases, what happens to the area?

b) What equation models this graph: a quadratic ($y = x^2$) or a square root ($y = \sqrt{x}$)?

c) Use two points to check the equation $A = \pi r^2$. How close are the solutions?