Name: **Features of Functions** | **5.1H**

Ready, Set, Go!

Ready

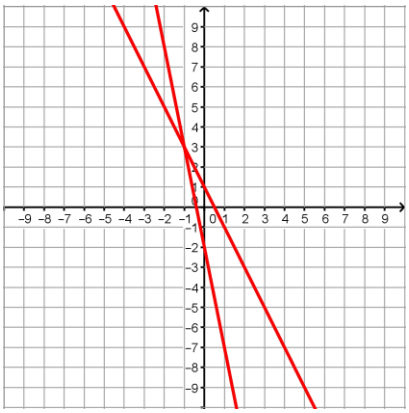
Topic: Solve systems by graphing

For each system of linear equations:

a. **Graph the system**
b. **Find the *x*- and *y*-intercepts for each equation**
c. **Find where $f(x) = g(x)$.**

1. $f(x) = -5x - 2$
   $g(x) = -2x + 1$

a.



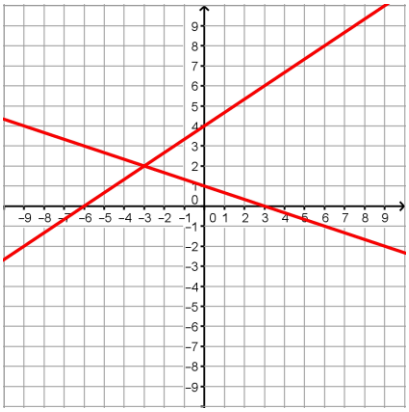
b.

	x-intercept	*y*-intercept
$f(x)$	$\left(-\frac{2}{5}, 0\right)$	$(0, -2)$
$g(x)$	$\left(\frac{1}{2}, 0\right)$	$(0, 1)$

c. $(-1, 3)$

2. $f(x) = \frac{2}{3}x + 4$
   $g(x) = -\frac{1}{3}x + 1$

a.



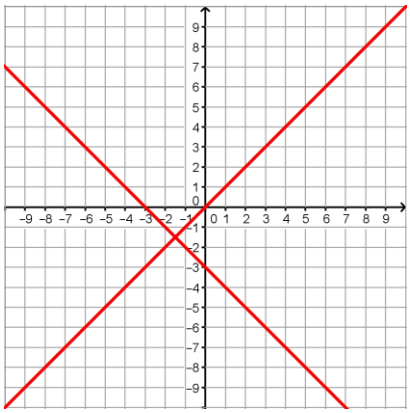
b.

	x-intercept	*y*-intercept
$f(x)$	$(-6, 0)$	$(0, 4)$
$g(x)$	$(3, 0)$	$(0, 1)$

c. $(-3, 2)$

3. $f(x) = x$
   $g(x) = -x - 3$

a.



b.

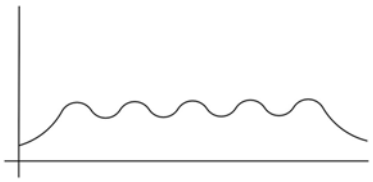
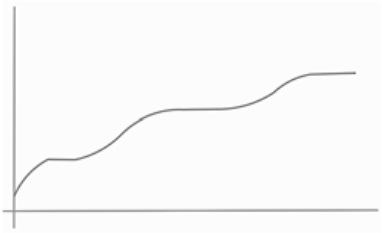
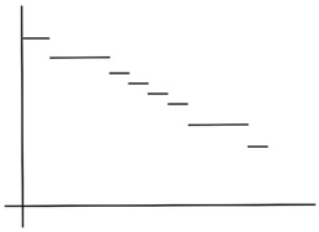
	x-intercept	*y*-intercept
$f(x)$	$(0, 0)$	$(0, 0)$
$g(x)$	$(-3, 0)$	$(0, -3)$

c. $\left(-\frac{3}{2}, -\frac{3}{2}\right)$

Set

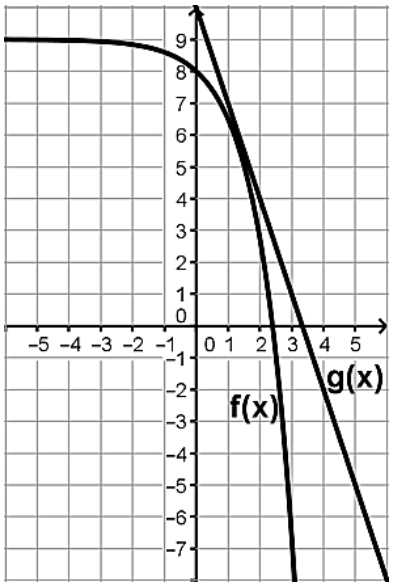
Topic: Describing attributes of a function based on the graphical representation.

For each graph given match it to the contextual description that fits best. Then label the independent and dependent axes on each graph with the proper variables.

Graphs	Contextual Descriptions
4. **B** 	a. The amount of money in a savings account where regular deposits and some withdrawals are made.
5. **E** 	b. The temperature of the oven on a day that mom bakes several batches of cookies.
6. **D** 	c. The amount of gasoline on hand at the gas station before a tanker truck delivers more.
7. **A** 	d. The number of watermelons available for sale at the farmer's market on Thursday.
8. **C** 	e. The amount of mileage recorded on the odometer of a delivery truck over a time period.

Given the pair of graphs on each coordinate grid, create a list of similarities the two graphs share and a list of differences. Consider attributes like, continuous, discrete, increasing, decreasing, linear, exponential, restrictions on domain or range, etc.

9.



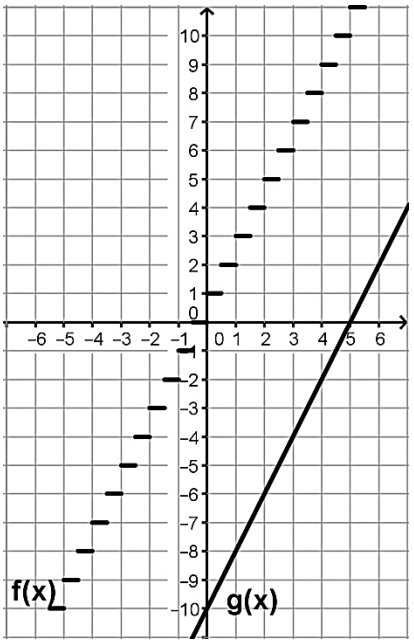
Similarities:

Answers may include: continuous, decreasing, domain

Differences:

Answers may include: linear v exponential, range, intercepts

10.



Similarities:

Answers may include: increasing, linear, rate

Differences:

Answers may include: continuous v discrete, intercepts, range

Go

Topic: Solving equations

Find the value of *x* in each equation.

11. $10^x = 100{,}000$

$\boldsymbol{x = 5}$

12. $3x + 7 = 5x - 21$

$\boldsymbol{x = 14}$

13. $-6x - 15 = 4x + 35$

$\boldsymbol{x = -5}$

14. $5x - 8 = 37$

$\boldsymbol{x = 9}$

15. $3^x = 81$

$\boldsymbol{x = 4}$

16. $3x - 12 = -4x + 23$

$\boldsymbol{x = 5}$

17. $10 = 2^x - 22$

$\boldsymbol{x = 5}$

18. $243 = 8x + 3$

$\boldsymbol{x = 30}$

19. $5^x - 7 = 118$

$\boldsymbol{x = 3}$

Name: **Features of Functions** **5.2H**

Ready, Set, Go!

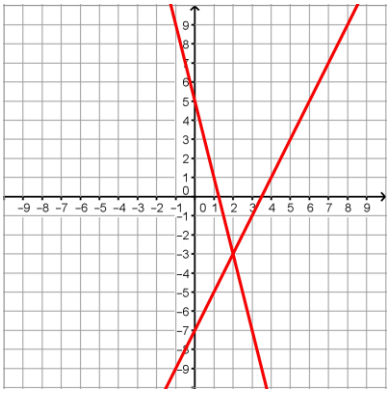
Ready

Topic: Solve systems by graphing

Graph each system of linear equations and find where $f(x) = g(x)$.

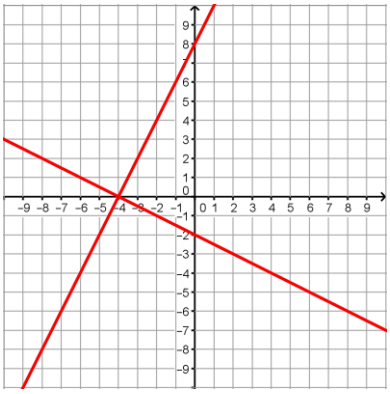
1. $f(x) = 2x - 7$
   $g(x) = -4x + 5$

   $(2, -3)$



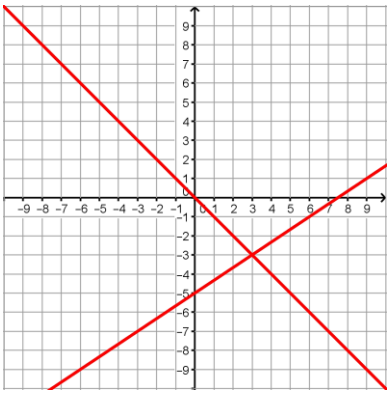
2. $f(x) = -\frac{1}{2}x - 2$
   $g(x) = 2x + 8$

   $(-4, 0)$



3. $f(x) = \frac{2}{3}x - 5$
   $g(x) = -x$

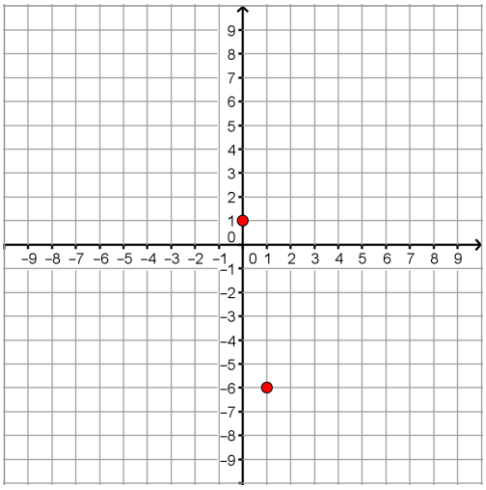
   $(3, -3)$



Topic: Creating graphical representations and naming the domain.

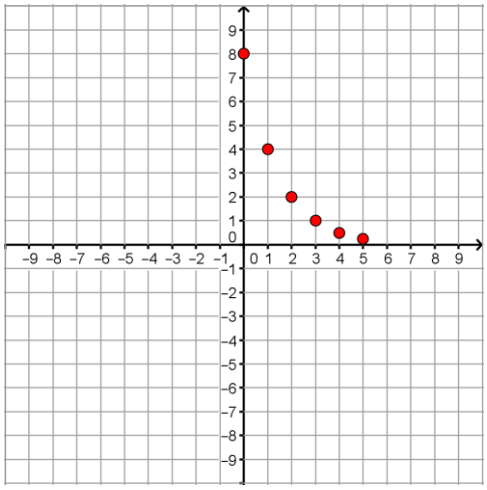
Sketch a graph to represent each function, and then state the domain of the function.

4 A sequence of terms such that
$f(0) = 1, f(n) = f(n-1) - 7$



Domain: {non-negative integers}

5. A sequence of terms such that
$f(0) = 8, f(n) = \frac{1}{2}f(n-1)$



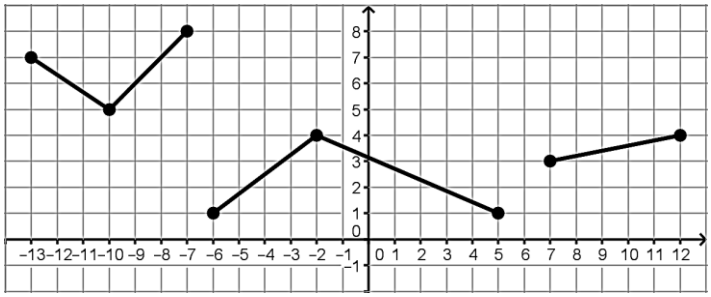
Domain: {non-negative integers}

Set

Topic: Describe features of a function from its graphical representation.

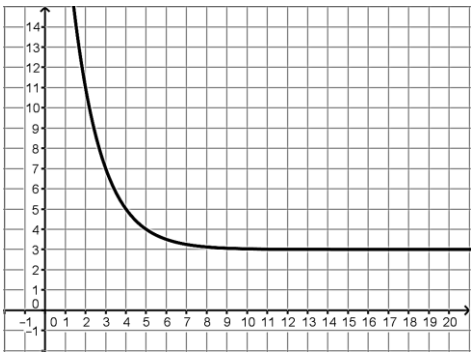
For each graph given provide a description of the function which includes the type of function (if known), intervals where the graph is decreasing & increasing, domain/range, and minimum and maximum values (if they exist).

6.



Description of function:
Type of function: ***Piecewise***
Decreasing: $(-13, -10), (-2, 5)$
Increasing: $(-10, -7), (-6, -2), (7, 12)$
Domain: $[-13, -7], [-6, 5], [7, 12]$
Range: $[1, 4], [5, 8]$
Max: ***8***,
Min: ***1***

7.



Description of function:
Type of function: ***Exponential***
Decreasing: $(-\infty, \infty)$
Increasing: **NA**
Domain: $(-\infty, \infty)$
Range: $(3, \infty)$
Max: **NA**
Min: **NA**

Topic: Attributes of linear and exponential functions.

Determine if the statement is true or false, then justify why.

8. All linear functions are increasing.

   True/~~False~~ Why? ***They can increase or decrease.***

9. Arithmetic sequences are an example of linear functions.

   True/False Why? ***They have a constant rate of change.***

10. Exponential functions have a domain that includes all real numbers.

    True/False Why? ***All real numbers can be exponents.***

11. Geometric sequences have a domain that includes all integers.

    True/~~False~~ Why? ***Only non-negative integers.***

12. The range for an exponential function includes all real numbers.

    True/~~False~~ Why? ***Exponential functions have a horizontal asymptote.***

13. All linear relationships are functions with a domain and range containing all real numbers.

    True/~~False~~ Why? ***Arithmetic sequences are an example.***

Go

Topic: Create equations using both explicit and recursive notation.

Write equations for the given tables in both recursive and explicit form.

14.

n	$f(n)$
1	6
2	12
3	24

Explicit:
$\boldsymbol{f(n) = 6(2)^{n-1}}$

Recursive:
$\boldsymbol{f(1) = 6,}$
$\boldsymbol{f(n) = f(n-1) \cdot 2}$

15.

n	$f(n)$
0	-13
2	-5
3	-1

Explicit:
$\boldsymbol{f(n) = 4n - 13}$

Recursive:
$\boldsymbol{f(0) = -13,}$
$\boldsymbol{f(n) = f(n-1) + 4}$

16.

n	$f(n)$
1	5
4	11
5	13

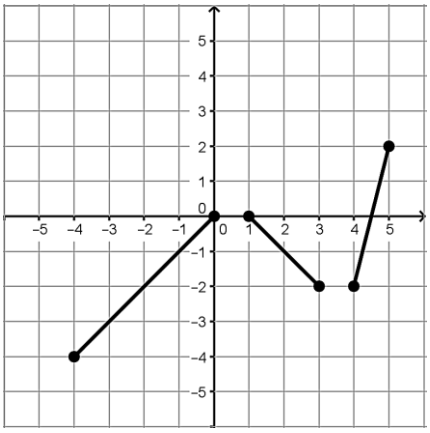
Explicit:
$\boldsymbol{f(n) = 2n + 3}$

Recursive:
$\boldsymbol{f(1) = 5,}$
$\boldsymbol{f(n) = f(n-1) + 2}$

Topic: Determine the domain and range of a function from the graphical representation.

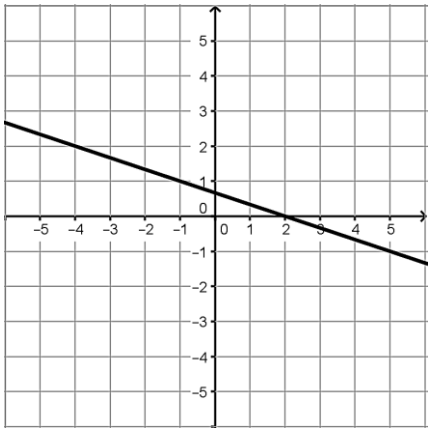
For each graph determine the domain of the function.

17.



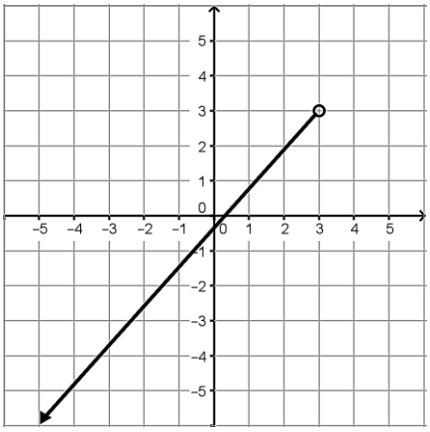
Domain: $\boldsymbol{[-4, 0], [1, 3], [4, 5]}$
Range: $\boldsymbol{[-4, 2]}$

18.



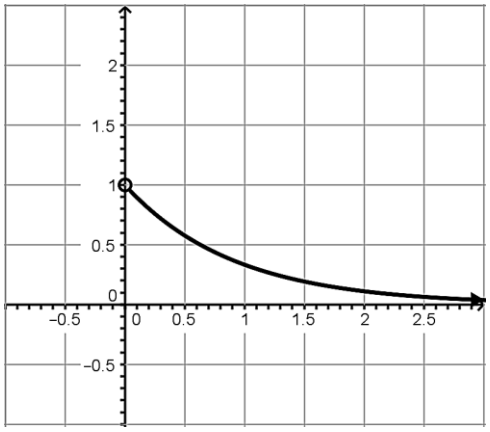
Domain: $\boldsymbol{(-\infty, \infty)}$
Range: $\boldsymbol{(-\infty, \infty)}$

19.



Domain: $\boldsymbol{(-\infty, 3)}$
Range: $\boldsymbol{(-\infty, 3)}$

20.



Domain: $\boldsymbol{(0, \infty)}$
Range: $\boldsymbol{(0, 1)}$

Name: **Features of Functions** | **5.3H**

Ready, Set, Go!

Ready

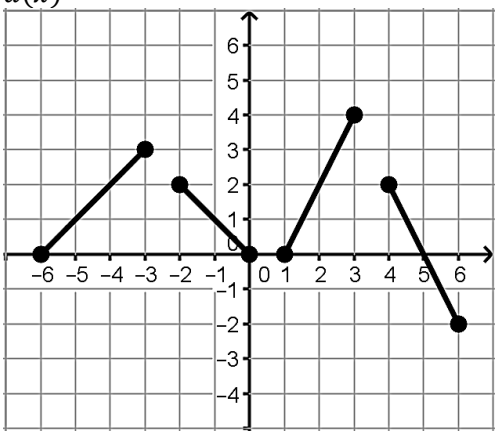
Topic: Attributes of linear and exponential functions.

1. Write a well-developed paragraph comparing and contrasting linear and exponential functions. Be sure to include as many characteristics of each function as possible and be clear about the similarities and differences these functions have.
   Answers will vary

Topic: Using graphical representations of functions to find solutions

Use the graph of each function provided to find the values indicated.

2. $d(x)$



a. $d(-5) =$ ***1***

b. $d(4) =$ ***2***

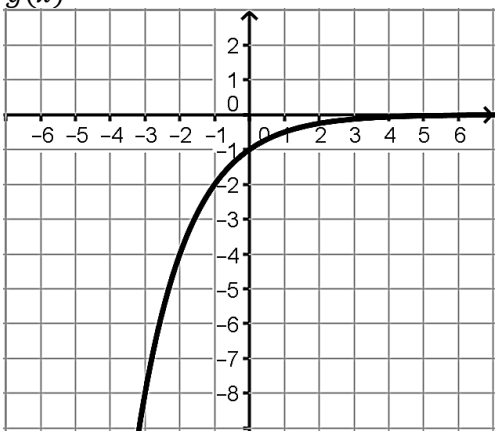
c. $d(x) = 4, x =$ ***3***

d. $d(x) = 0, x =$ **$-6, 0, 1, 5$**

e. Intervals of increasing: **$(-6, -3), (1, 3)$**

f. Intervals of decreasing: **$(-2, 0), (4, 6)$**

3. $g(x)$



a. $g(-1) =$ **-2**

b. $g(-3) =$ **-8**

c. $g(x) = -4, x =$ **-2**

d. $g(x) = -1, x =$ ***0***

e. Intervals of increasing: $(-\infty, \infty)$

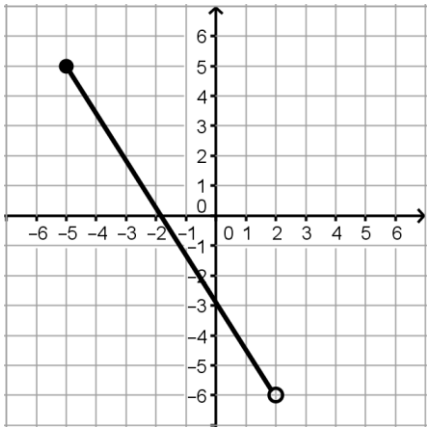
f. Intervals of decreasing: ***NA***

Set

Topic: Identifying attributes of a function from its graphical representation.

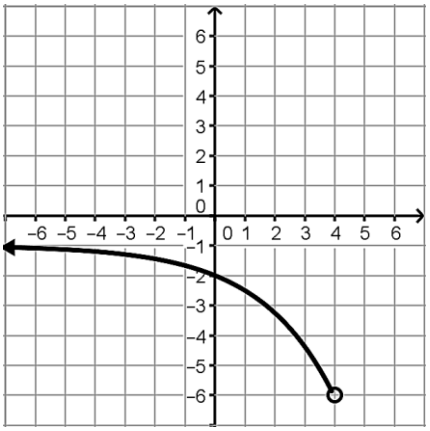
Based on the graph given in each problem below, identify the domain, range, intervals of increase and decrease.

4.



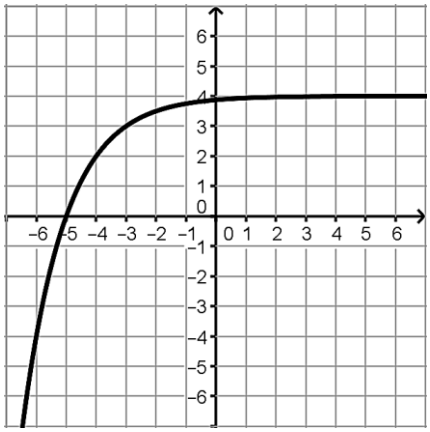
Domain: $[-5, 2)$
Range: $(-6, 5]$
Increasing: **NA**
Decreasing: $(-5, 2)$
Minimum value: **NA**
Maximum value: **5**

5.



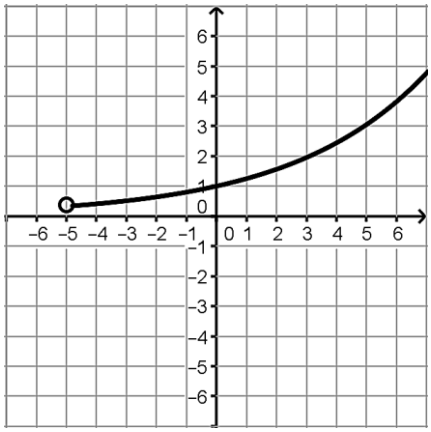
Domain: $(-\infty, 4)$
Range: $(-6, -1)$
Increasing: **NA**
Decreasing: $(-\infty, 4)$
Minimum value: **NA**
Maximum value: **NA**

6.



Domain: $(-\infty, \infty)$
Range: $(-\infty, 4)$
Increasing: $(-\infty, \infty)$
Decreasing: **NA**
Minimum value: **NA**
Maximum value: **NA**

7.



Domain: $(-5, \infty)$
Range: $\left(\frac{1}{2}, \infty\right)$
Increasing: $(-5, \infty)$
Decreasing: **NA**
Minimum value: **NA**
Maximum value: **NA**

Topic: Given context of a function find solutions.

For each situation either create a function or use the given function to find and interpret solutions.

8. Fran collected data on the number of feet she could walk each second and wrote the following rule to model her walking rate $d(t) = 4t$.

   a. What is Fran looking for if she writes "$d(12) =$" ?

      The number of feet she walked after 12 seconds

   b. In this situation what does $d(t) = 100$ tell you?

      The number of seconds it took to walk 100 feet.

   c. How can the function rule be used to indicate a time of 16 seconds was walked?

      Substitute 16 for t; $d(16)$

   d. How can the function rule be used to indicate that a distance of 200 feet was walked?

      Set $d(t)$ equal to 200; $d(t) = 200$

9. Ms. Callahan works hard to budget and predict her costs for each month. She is currently attempting to determine how much her cell phone company will likely charge her for the month. She is paying a flat fee of $80 a month for a plan that allows for unlimited calling but costs her an additional twenty cents per text message.

   a. Write a function, $c(t)$, for Ms. Callahan's current cell plan that will calculate the cost for the month based on the number of text messages she makes.
      $\boldsymbol{c(t) = 0.2t + 80}$

   b. Find $c(20)$
      $\boldsymbol{c(20) = 84}$

   c. Find $c(t) = 100$
      $\boldsymbol{t = 100}$

   d. Find $c(45)$
      $\boldsymbol{c(45) = 89}$

   e. Find $c(t) = 90$
      $\boldsymbol{t = 50}$

   f. For $20 she can add unlimited texting to her current plan. At what number of texts would this option be less expensive than her current plan?
      $\boldsymbol{t > 100}$

10. Mr. Multbank has developed a population growth model for the rodents in the field by his house. He believes that starting each spring the population can be modeled based on the number of weeks with the function $p(t) = 8(2)^t$

a. Find $p(t) = 128$

t = 4

b. Find $p(4)$

128

c. Find $p(10)$

8192

d. Find the number of weeks it will take for the population to be over 20,000.

11 weeks

e. In a year with 16 weeks of summer, how many rodents would he expect by the end of the summer using Mr. Multbank's model?

524,288 rodents

f. What are some factors that could change the actual result from your estimate?

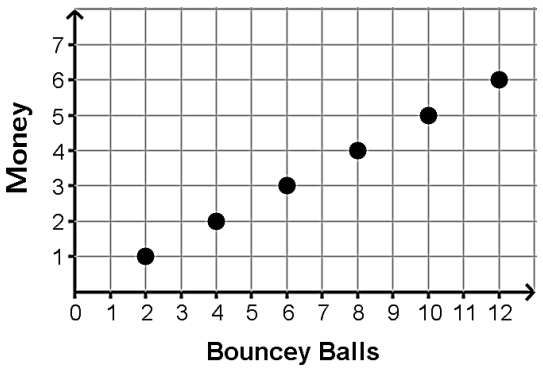
Environmental factors such as food supply, water, disease, etc.

Go

Topic: Discrete and continuous

For each context or representation determine whether it is discrete or continuous or could be modeled best in a discrete or continuous way and state why.

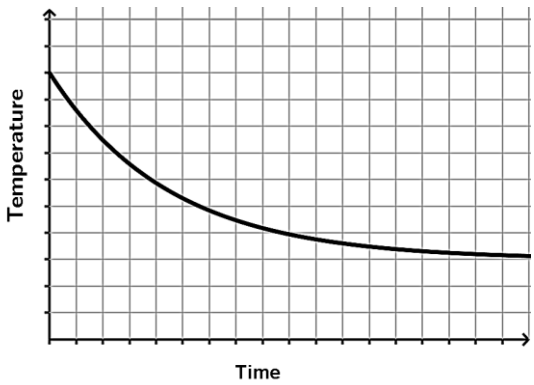
11.



Discrete/Continuous

Why?
You can't buy a partial number of balls.

12.



Discrete/Continuous

Why?
Time and temperature change are continuous

13. Marshal tracks the number of hits he gets each baseball game and is recording his total number of hits for the season in a table.

Discrete/Continuous

Why?
Number of hits must be a whole number

14. The distance you have traveled since the day began.

Discrete/Continuous

Why?
Time and distance are continuous

15.

Number of Gum Balls	Cost
5	1
10	2
15	3
20	4

Discrete/Continuous

Why?
Gum balls must be a whole number

Topic: Finding equations and rules for functions

Find both the explicit and the recursive equations for each table of values below.

16.

n	$f(n)$
2	4
3	8
4	16
5	32

Explicit:

$\boldsymbol{f(n) = 2^n}$

Recursive:

$\boldsymbol{f(2) = 4, f(n) = f(n-1) \cdot 2}$

17.

n	$f(n)$
2	16
3	4
4	1

Explicit:

$\boldsymbol{f(n) = 16\left(\frac{1}{4}\right)^{n-2}}$

Recursive:

$\boldsymbol{f(2) = 16, f(n) = f(n-1) \cdot \frac{1}{4}}$

18.

n	$f(n)$
2	40
4	32
8	16

Explicit:

$\boldsymbol{f(n) = -4n + 48}$

Recursive:

$\boldsymbol{f(2) = 40, f(n) = f(n-1) - 4}$

19.

n	$f(n)$
17	5
20	10
26	20

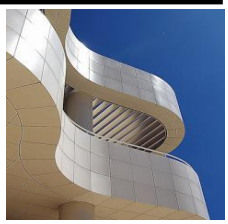
Explicit:

$\boldsymbol{f(n) = \frac{5}{3}n - \frac{70}{3}}$

Recursive:

$\boldsymbol{f(17) = 5, f(n) = f(n-1) + \frac{5}{3}}$

Name: **Features of Functions** | **5.4H**



Ready, Set, Go!

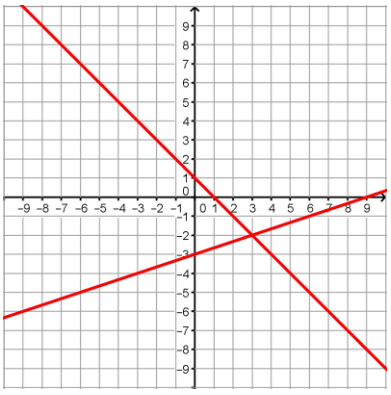
Ready

Topic: Solve systems of equations

Solve each system of equations either by substitution, elimination, and matrix row reduction. ***Use each method once. Graph each to show the solution.***

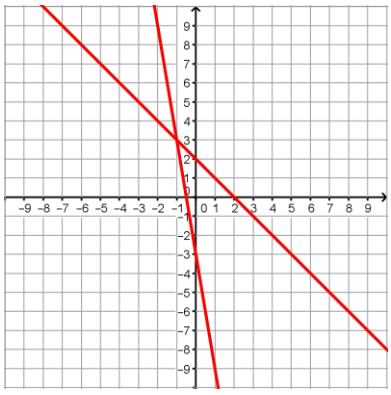
1. $x - 3y = 9$
   $x + y = 1$

   $(\mathbf{3}, \mathbf{-2})$



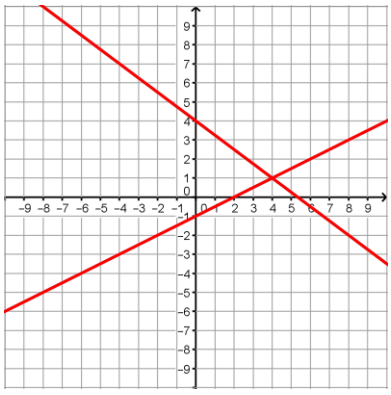
2. $6x + y = -3$
   $x + y = 2$

   $(\mathbf{-1}, \mathbf{3})$



3. $3x + 4y = 16$
   $x - 2y = 2$

   $(\mathbf{4}, \mathbf{1})$

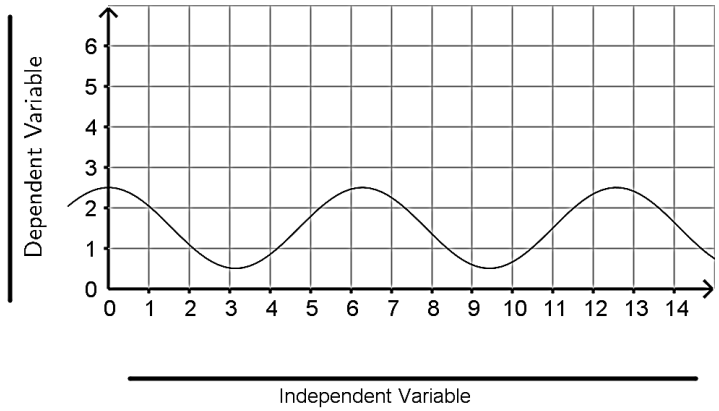


Set

Topic: Connecting context to graphical representations

For each graph create a context, provide independent and dependent variables that will fit the context you choose (label the axes with your choices). Then create a story that describes what is happening on the graph.

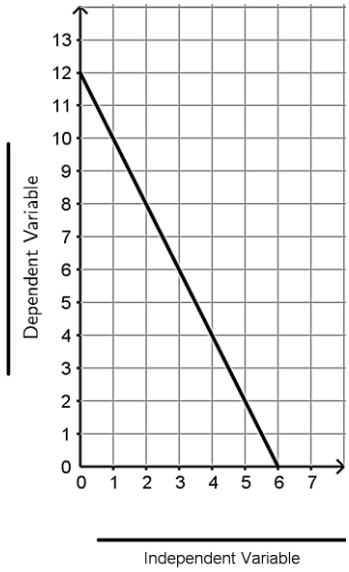
4.



Description of context and a story for the graph:

Answers will vary

5.



Description of context and a story for the graph:

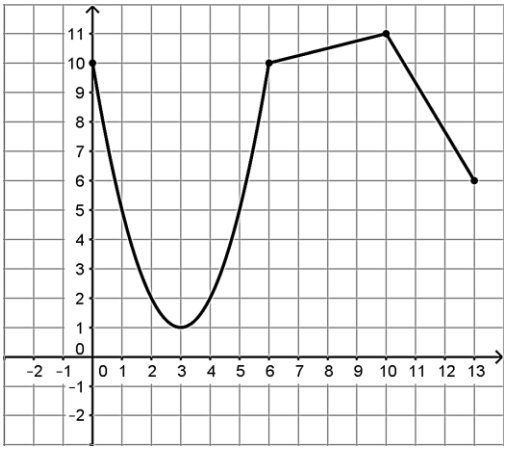
Answers will vary

Go

Topic: Describe features of a function from its graphical representation.

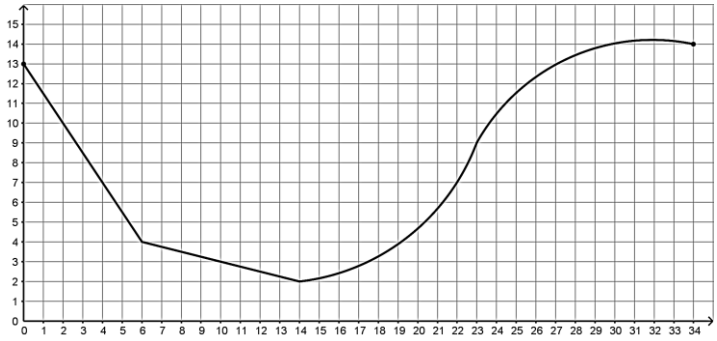
For each graph given provide a description of the function. Be sure to consider the following: decreasing/increasing, min/max, domain/range, etc.

6.



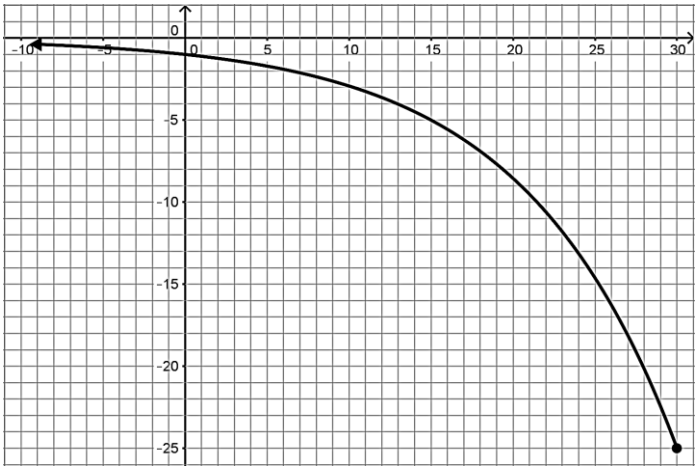
Decreasing: $(0, 3), (10, 13)$
Increasing: $(3, 10)$
Min: 1
Max: 11
Domain: $[0, 13]$
Range: $[1, 11]$

7.



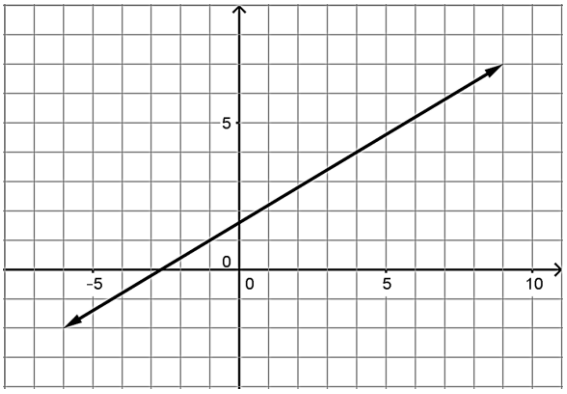
Decreasing: $(0, 14), (31, 34)$
Increasing: $(14, 31)$
Min: 2
Max: 14.5
Domain: $[0, 34]$
Range: $[2, 14.5]$

8.



Decreasing: $(-\infty, 30)$
Increasing: NA
Min: -24
Max: NA
Domain: $(-\infty, 30]$
Range: $[-24, 0)$

9.



Decreasing: **NA**
Increasing: $(-\infty, \infty)$
Min: **NA**
Max: **NA**
Domain: $(-\infty, \infty)$
Range: $(-\infty, \infty)$

Topic: Solving literal equations for a specified variable.

Rewrite each equation in slope-intercept form ($y = mx + b$).

10. $12x + 3y = 6$

$y = -4x + 2$

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

$y = -3x - 1$

12. $y - 9x = 4(x - 2)$

$y = 13x - 8$

Write an explicit function for the linear function that goes through the given point with the given slope.

13. $m = 3 \quad (-1, 2)$

$y = 3(x + 1) + 2$

14. $m = \frac{3}{4} \quad (-4, 2)$

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

Name: **Features of Functions** | **5.5H**

Ready, Set, Go!

Ready

Topic: Determine domain and range, and whether a relation is a function or not a function.

Determine if each set of ordered pairs is a function or not then state the domain and range.

1. $\{(-7,2),(3,5),(8,4),(-6,5),(-2,3)\}$

   Function: (Yes) / No

   Domain: $\{-7,-6,-2,3,8\}$

   Range: $\{2,3,4,5\}$

2. $\{(9,2),(0,4),(4,0),(5,3),(2,7),(0,-3),(3,-1)\}$

   Function: Yes / (No)

   Domain: $\{0,2,3,4,5,9\}$

   Range: $\{-3,-1,0,2,3,4,7\}$

3. $\{(1,2),(2,3),(3,4),(4,5),(5,6),(6,7),(7,8),(8,9)\}$

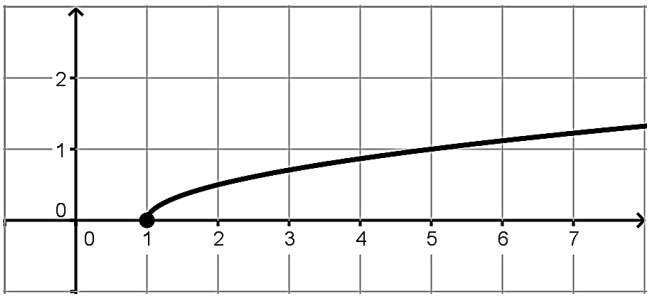
   Function: (Yes) / No

   Domain: $\{1,2,3,4,5,6,7,8\}$

   Range: $\{2,3,4,5,6,7,8,9\}$

For the representation of the function given determine the domain and range.

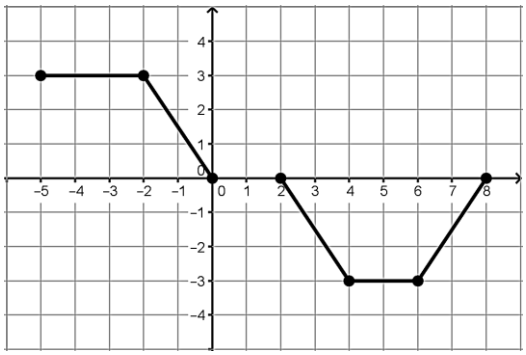
4.



Domain: $[1,\infty)$

Range: $[0,\infty)$

5.



Domain: $[-5,0],[2,8]$

Range: $[-3,3]$

6. $f(x) = -2x + 7$

Domain: $(-\infty, \infty)$

Range: $(-\infty, \infty)$

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

Domain: $(-\infty, \infty)$

Range: $(\mathbf{0}, \infty)$

8. The elements in the table define the entirety of the function.

x	$h(x)$
	9
2	98
3	987
4	9876

Domain: $\{\mathbf{1, 2, 3, 4}\}$

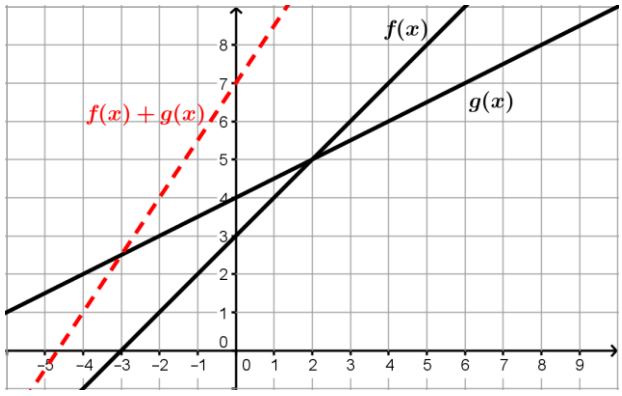
Range: $\{\mathbf{9, 98, 987, 9876}\}$

Set

Topic: Comparing functions from different representations

Use the given representation of the functions to answer the questions.

9.



a. Where does $f(x) = g(x)$?
$\boldsymbol{x = 2}$

b. What is $f(4) + g(4)$?
13

c. What is $g(-2) - f(-2)$?
$\mathbf{-2}$

d. On what interval is $g(x) > f(x)$?
$(-\infty, \mathbf{2})$

e. Sketch $f(x) + g(x)$ on the graph provided.
dashed line at left

10. The functions $a(x)$ and $b(x)$ are defined in the table below. Each function is a set of exactly five ordered pairs.

$\boldsymbol{x}$	$\boldsymbol{a(x)}$	$\boldsymbol{b(x)}$	$\boldsymbol{a(x) + b(x)}$	$\boldsymbol{a(x) - b(x)}$
-3	1	-1	**0**	**2**
-1	7	-5	**2**	**12**
0	3	-10	**-7**	**13**
2	8	2	**10**	**6**
7	3	3	**6**	**0**

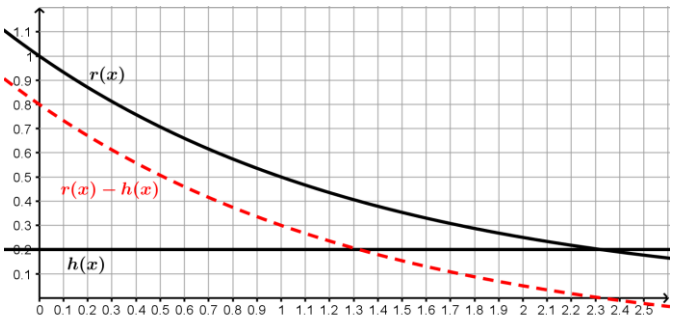
a. What is $a(-3) + b(-3)$?
0

b. What is $a(-1) - b(-1)$?
12

c. What is $a(0) + b(0)$?
-7

d. Complete the additional columns in the table with $a(x) + b(x)$ in one column and $a(x) - b(x)$ in the other column.
See above

11.



a. Where is $r(x) > h(x)$?
$(-\infty, \mathbf{2.3})$

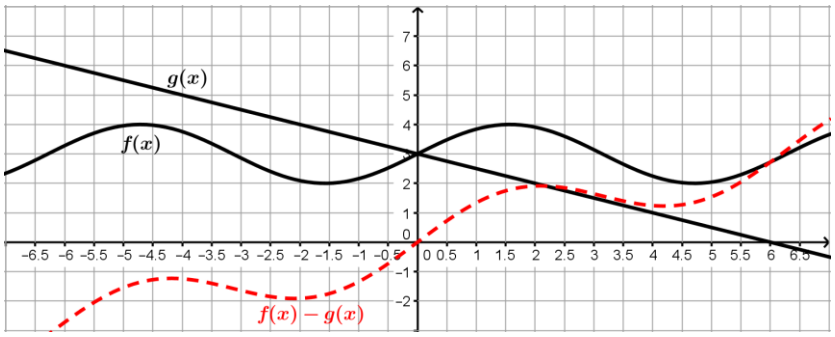
b. What is $r(1) - h(1)$?
0.3

c. What is $r(0) + h(0)$?
1.2

d. Create an explicit rule for $r(x)$ and for $h(x)$.
$\boldsymbol{r(x) = (0.5)^x}$ $\boldsymbol{h(x) = 0.2}$

e. Sketch $r(x) - h(x)$ on the graph
dashed curve at left

12.



a. Where does $f(x) = g(x)$?
$\boldsymbol{x = 0}$

b. What is $f(4) + g(4)$?
***approximately* 3.25**

c. What is $g(-2) - f(-2)$?
***approximately* 1.8**

d. On what interval is $g(x) > f(x)$?
$(-\infty, \mathbf{0})$

e. Sketch $f(x) - g(x)$ on the graph provided.
dashed curve at right

Topic: Determine whether or not the relationship is a function.

Determine if the relationship presented is a function or not and provide a justification.

13. The distance a person is from the ground related to time as they ride a Ferris Wheel.

Yes, time does not repeat

14. The amount of daylight during a day throughout the calendar year.

Yes, days do not repeat

15. The value of a Volkswagen Bug convertible from time of first purchase in 1978 to now.

Yes, years do not repeat

16. A person's name and their phone number.

No, two people with the same name could have different phone numbers

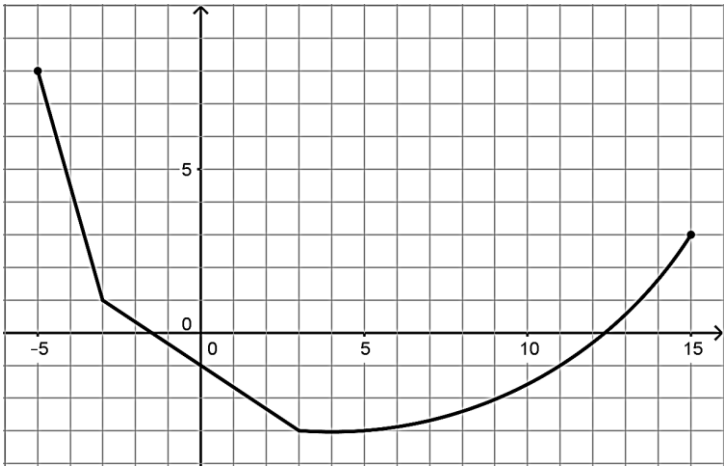
17. The stadium in which a football player is playing related to the outcome of the game.

No, the player could win or lose in the same stadium

Go

Topic: Determining features of functions and finding solutions using functions.

18. For the graph given below, describe the intervals of decrease/increase, min/max, and domain/range.



Decreasing: $(-5, 3)$ Increasing: $(3, 15)$ Min: -3 Max: 8
Domain: $[-5, 15]$ Range: $[-3, 8]$

19. For the given situation use the function to find and interpret solutions.

Hope has been tracking the progress of her family as they travel across the country during their vacation and she has created a function, $d(t) = 78t$ to model the progress they are making, where t represents the number of days and $d(t)$ represents the miles traveled.

a. What would Hope be attempting to find if she writes: $d(4) = 78(4)$?

The distance traveled after 4 days

b. What would $d(t) = 450$ mean in this situation?

They have traveled 450 miles

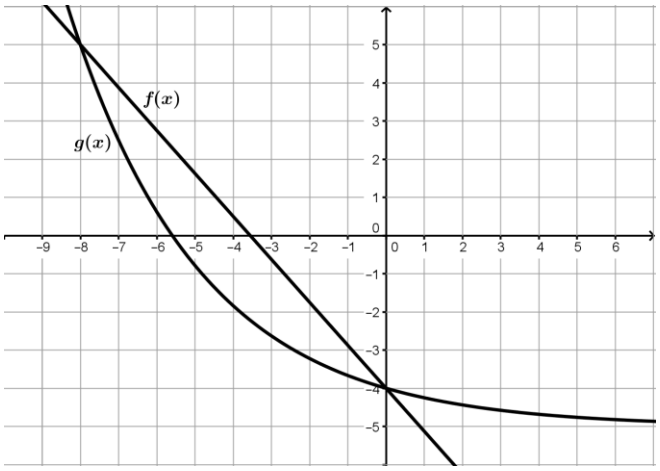
c. What would $d(3.5)$ mean in this situation?

The amount of miles traveled after 3.5 days

d. How could Hope use the function to find the time it would take to travel 800 miles?
$78t = 800$ ***solve for t***

Use the given representation of the functions to answer the questions.

20.



a. Where does $f(x) = g(x)$?

$x = -8$ and $x = 0$

b. What is $g(0) + f(0)$?

-8

c. On what interval(s) is $g(x) > f(x)$?

$(-\infty, \mathbf{-8}), (\mathbf{0}, \infty)$

d. What is $g(-8) + f(-8)$?

10

Name: **Features of Functions** | **5.6H**

Ready, Set, Go

Ready

Topic: Find the output or input based on what is given.

For each function find the desired solutions.

1. $h(t) = 2t - 5$

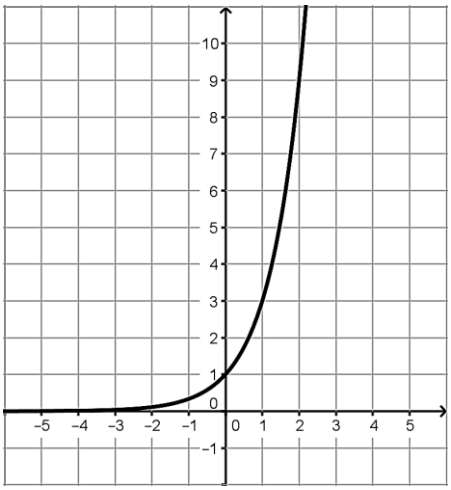
   a. $h(-4) =$ **-13**

   b. $h(t) = 23, t =$ **14**

   c. $h(13) =$ **21**

   d. $h(t) = -33, t =$ **-14**

2. $g\,(x)$



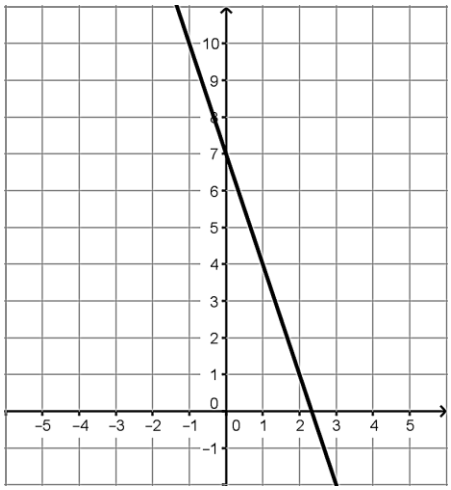
   a. $g(2) =$ **9**

   b. $g(x) = 3, x =$ **1**

   c. $g(0) =$ **1**

   d. What is the explicit rule for $g(x)$
   $g(x) = 3^x$

3. $r\,(x)$



   a. $r(-1) =$ **10**

   b. $r(x) = 4, x =$ **1**

   c. $r(2) =$ **1**

   d. What is the explicit rule for $r(x)$
   $r(x) = -3x + 7$

Set

Topic: Describing the key features of functions and creating a representation of a function given the key features.

Use the given description of several of the key features of the function to sketch a possible graph of the function.

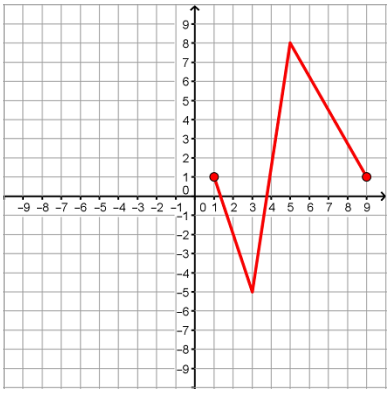
4. The function has a minimum at -5.

   The function has a maximum at 8.

   The function has two intervals on which it is decreasing and one interval on which it is increasing.

   The domain of the functions contains all Real numbers from 1 to 9.

   Possible answer shown at right



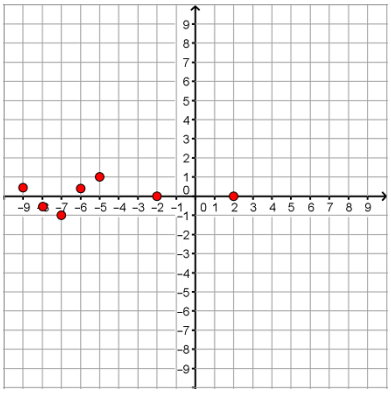
5. This function is not continuous anywhere.

   The function contains only seven elements in its domain.

   The values of the domain are between -9 and 2.

   The values of the range are from -1 and 1.

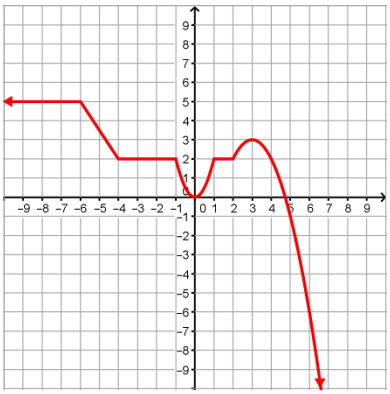
   Possible answer shown at right



6. The function has three intervals on which its slope is zero.

   The function has a maximum and a minimum.

   Possible answer shown at right

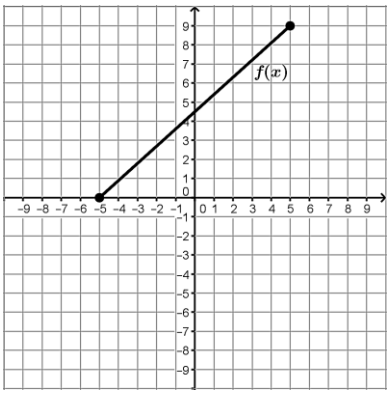


Go

Topic: Features of functions

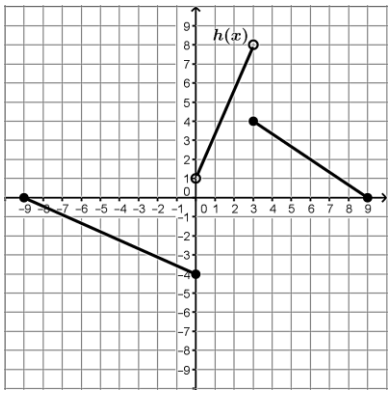
Describe the following features of the function: Domain, range, whether or not the function is continuous, intervals where the function is increasing and decreasing, minimum and maximum values.

7.



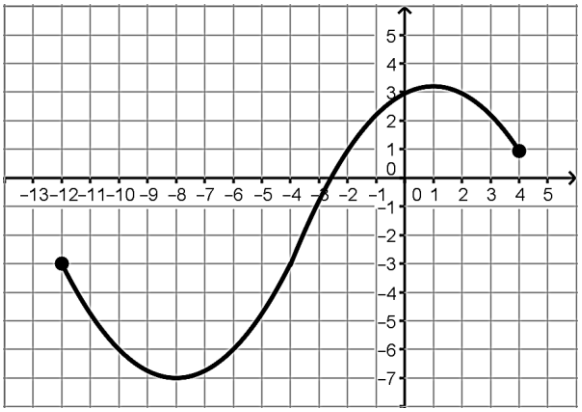
Domain: $[-5, 5]$
Range: $[0, 9]$
Continuous: (Yes)/No
Increasing: $(-5, 5)$
Decreasing: **NA**
Minimum: **0**
Maximum: **9**

8.



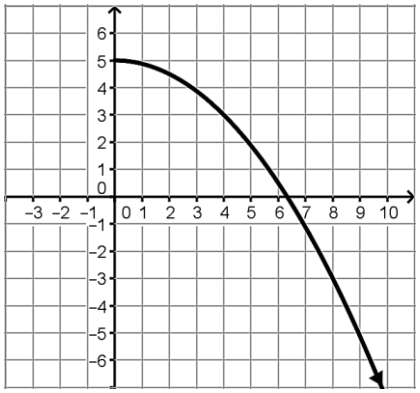
Domain: $[-9, 9]$
Range: $[-4, 8)$
Continuous: Yes/(No)
Increasing: $(0, 3)$
Decreasing: $(-9, 0), (3, 9)$
Minimum: -4
Maximum: **NA**

9.



Domain: $[-12, 4]$
Range: $[-7, 3.1]$ **(approximate max)**
Continuous: (Yes)/No
Increasing: $(-8, 1)$
Decreasing: $(-12, -8), (1, 4)$
Minimum: -7
Maximum: **approximately 3.1**

10.



Domain: $[0, \infty)$
Range: $(-\infty, 5]$
Continuous: (Yes)/No
Increasing: **NA**
Decreasing: $(0, \infty)$
Minimum: **NA**
Maximum: **5**

11. $f(0) = 2, f(n) = f(n-1) \cdot 3$

Domain: ***whole numbers***
Range: $\{2, 6, 18, 54, \ldots\}$
Continuous: Yes/No
Increasing: **on its domain**
Decreasing: **NA**
Minimum: **2**
Maximum: **NA**

12. $g(x) = -9 + 4x$

Domain: $(-\infty, \infty)$
Range: $(-\infty, \infty)$
Continuous: Yes/No
Increasing: $(-\infty, \infty)$
Decreasing: **NA**
Minimum: **NA**
Maximum: **NA**

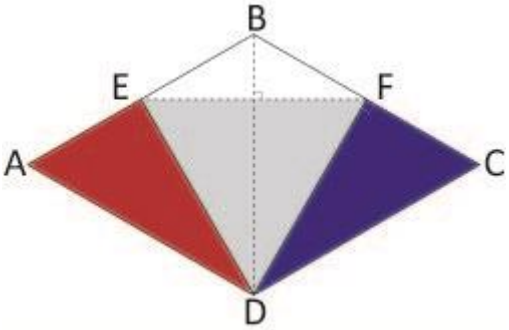
13. $f(x) = |x|$

Domain: $(-\infty, \infty)$
Range: $[0, \infty)$
Continuous: Yes/No
Increasing: $(0, \infty)$
Decreasing: $(-\infty, 0)$
Minimum: **0**
Maximum: **NA**

End of Module 5 Challenge Problems *SOLUTIONS*

The following problems are intended for students to work on after Module 5H Test. The problems focus on the following ideas from the next module: working with triangles and the Pythagorean Theorem. The following page is blank for the teacher to copy and give to each student after the test. Below are the solutions.

Tricia has designed a new kite. The kite consists of a combination of triangular regions, as shown. She has some of the necessary materials, but she still needs six wooden dowels for the frame, one piece of transparent polymer for ΔDEF and colored nylon fabric for ΔADE, ΔCDF and ΔBEF. She was excited to realize she was working with several equilateral triangles. She remembered learning that the height of an equilateral triangle will bisect the base.



1. The frame of the kite will consist of six wooden dowels. Four of the dowels will be placed along the perimeter of kite, shown in the figure as rhombus *ABCD*. The remaining two dowels will be perpendicular to one another, shown in the figure as dashed line segments *BD* and *EF*. If equilateral triangle *DEF* has sides of length 3 ft, what is the total length, in feet, of the wooden dowels needed for the kite's frame? Express your answer as a decimal to the nearest hundredth.

   We are told that $DE = EF = DF = 3\ ft$. We can conclude that ΔABD and ΔBCD are equilateral. Since quadrilateral ABCD is a rhombus composed of two equilateral triangles, it follows that $AB = BC = CD = DA = BD = 2\sqrt{3}\ ft$. Since EF = 3 ft, the total length of the wooden dowels needed is $5 \times (2\sqrt{3}) + 3 = 3 + 10\sqrt{3}\ ft \approx 20.321\ ft$

2. The center region of Tricia's kite will be created using transparent polymer material. If the polymer material exactly covers this region of the kite shown in the figure as ΔDEF, what fraction of the kite's area consists of the transparent polymer material? Express your answer as a common fraction.

   In the previous problem we determined that equilateral triangle BCD has height 3 ft and side length $2\sqrt{3}\ ft$. Therefore, the area of ΔBCD is $\frac{1}{2}(2\sqrt{3})(3) = 3\sqrt{3}\ ft^2$. Since quadrilateral ABCD is a rhombus and ΔBCD is congruent to ΔABD, the area of the entire kite is $2 \times (3\sqrt{3}) = 6\sqrt{3}\ ft^2$. Triangle DEF has height $\frac{a\sqrt{3}}{2} = \frac{3\sqrt{3}}{2}\ ft$. Therefore, the area of ΔDEF is $\frac{1}{2}(3)\left[\frac{3\sqrt{3}}{2}\right] = \frac{9\sqrt{3}}{4}\ ft^2$. The fraction of the kite's area consisting of the transparent polymer is $[\frac{9\sqrt{3}}{4} \div 6\sqrt{3} = \frac{3}{8}$.

3. Triangle *BEF* is the only portion of the kite that will be made of white nylon fabric. What is the area, in square feet, of the white region of the kite, shown in the figure as ΔBEF? Express your answer as a decimal to the nearest hundredth.

   From the previous problems we know the height of ΔDEF is $\frac{3\sqrt{3}}{2}\ ft$, and BD = $2\sqrt{3}$ ft. Therefore, the height of ΔBEF is $\frac{\sqrt{3}}{2}$ ft. The area of ΔBEF is $\frac{1}{2}(3)\left(\frac{\sqrt{3}}{2}\right)$. Therefore, the area of ΔBEF is $\frac{3\sqrt{3}}{4} \approx 1.299\ ft^2$.