

Secondary One Mathematics: An Integrated Approach

Module 5

Features of Functions

By

The Mathematics Vision Project:

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Module 5 – Features of Functions

Classroom Task: 5.1 Getting Ready for a Pool Party- A Develop Understanding Task
Using a story context to graph and describe key features of functions t (F.IF. 4)

Ready, Set, Go Homework: Features of Functions 5.1

Classroom Task: 5.2 Floating Down the River – A Solidify Understanding Task *Using tables and graphs to interpret key features of functions (F.IF. 4, F.IF. 5)*

Ready, Set, Go Homework: Features of Functions 5.2

Classroom Task: 5.3 Features of Functions – A Practice Understanding Task
Features of functions using various representations (F.IF. 4, F.IF. 5)

Ready, Set, Go Homework: Features of Functions 5.3

Classroom Task: 5.4 The Water Park – A Solidify Understanding Task
Interpreting functions using notation (F.IF.2, F.IF.4, F.IF. 5, F.IF.7, A.REI.11, A.CED.3)

Ready, Set, Go Homework: Features of Functions 5.4

Classroom Task: 5.5 Pooling it Together – A Solidify Understanding Task
Combining functions and analyzing contexts using functions (F.BF.1b, F.IF.2, F.IF.4, F.IF. 5, F.IF.7, A.REI.11, A.CED.3)

Ready, Set, Go Homework: Features of Functions 5.5

Classroom Task: 5.6 Interpreting Functions – A Practice Understanding Task
Using graphs to solve problems given in function notation (F.BF.1b, F.IF.2, F.IF.4, F.IF. 5, F.IF.7, A.REI.11, A.CED.3)

Ready, Set, Go Homework: Features of Functions 5.6

Classroom Task: 5.7 A Water Function – A Solidify Understanding Task
Defining Function (F.IF.1)

Ready, Set, Go Homework: Features of Functions 5.7

Classroom Task: 5.8 To Function or Not to Function – A Practice Understanding Task
Identifying whether or not a relation is a function given various representations (F.IF.1, F.IF.3)

Ready, Set, Go Homework: Features of Functions 5.8

Classroom Task: 5.9 Match that Function – A Practice Understanding Task
Matching features and representations of a specific function (F.IF.2, F.IF.4, F.IF. 5, F.IF.7, A.REI.11, A.CED.3)

Ready, Set, Go Homework: Features of Functions 5.9

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5.1 Getting Ready for a Pool Party

A Develop Understanding Task



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Sylvia has a small pool full of water that needs to be emptied and cleaned, then refilled for a pool party. During the process of getting the pool ready, Sylvia did all of the following activities, each during a different time interval.

| | |
|---|--|
| Removed water with a single bucket | Filled the pool with a hose (same rate as emptying pool) |
| Drained water with a hose (same rate as filling pool) | Cleaned the empty pool |
| Sylvia and her two friends removed water with three buckets | Took a break |

1. Sketch a possible graph showing the height of the water level in the pool over time. Be sure to include all of activities Sylvia did to prepare the pool for the party. Remember that only one activity happened at a time. Think carefully about how each section of your graph will look, labeling where each activity occurs.

2. Create a story connecting Sylvia's process for emptying, cleaning, and then filling the pool to the graph you have created. Do your best to use appropriate math vocabulary.

3. Does your graph represent a function? Why or why not? Would all graphs created for this situation represent a function?

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Ready, Set, Go!



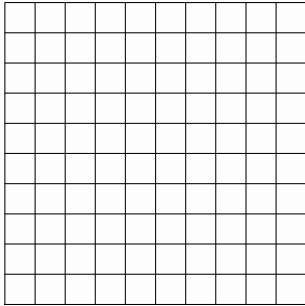
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Ready

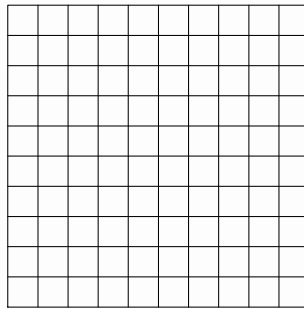
Topic: Graphing linear and exponential functions

Graph each of the functions.

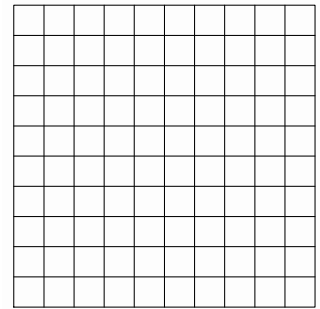
1. $f(x) = -2x + 5$



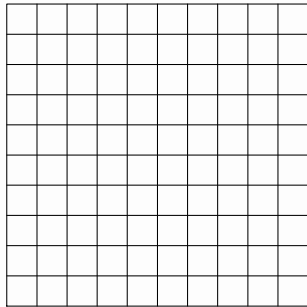
2. $g(x) = 4 - 3x$



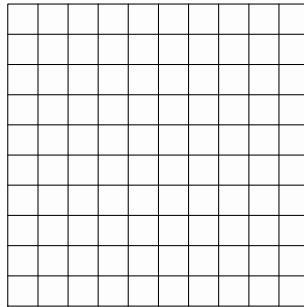
3. $h(x) = 5(3)^x$



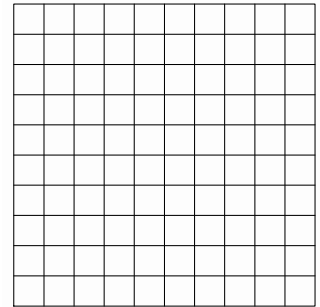
4. $k(x) = 4(2)^x$



5. $v(t) = 2.5t - 4$



6. $f(x) = 8(3)^x$



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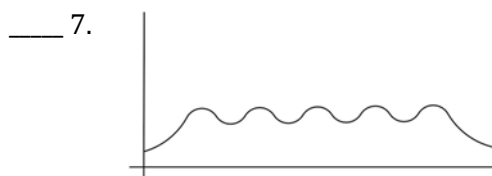
Set

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

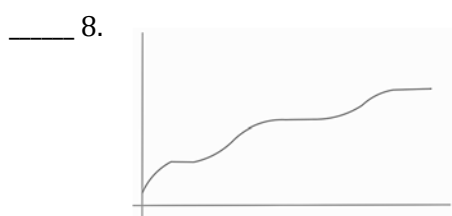
For each graph given match it to the contextual description that fits best. Then label the independent and dependent axis with the proper variables.

Graphs

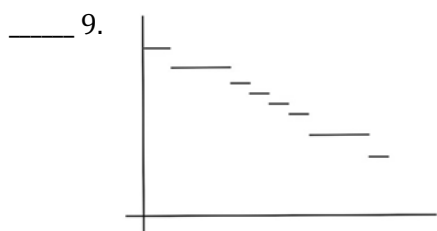
Contextual Descriptions



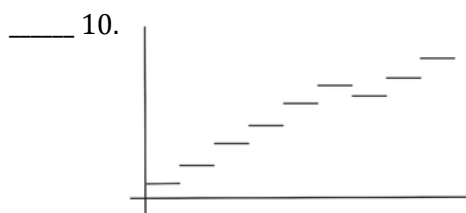
a. The amount of money in a savings account where regular deposits and some withdrawals are made.



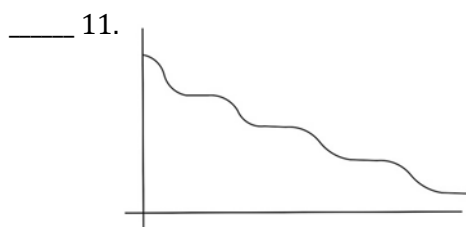
b. The temperature of the oven on a day that mom bakes several batches of cookies.



c. The amount of gasoline on hand at the gas station before a tanker truck delivers more.



d. The number of watermelons available for sale at the farmer's market on Thursday.



e. The amount of mileage recorded on the odometer of a delivery truck over a time period.

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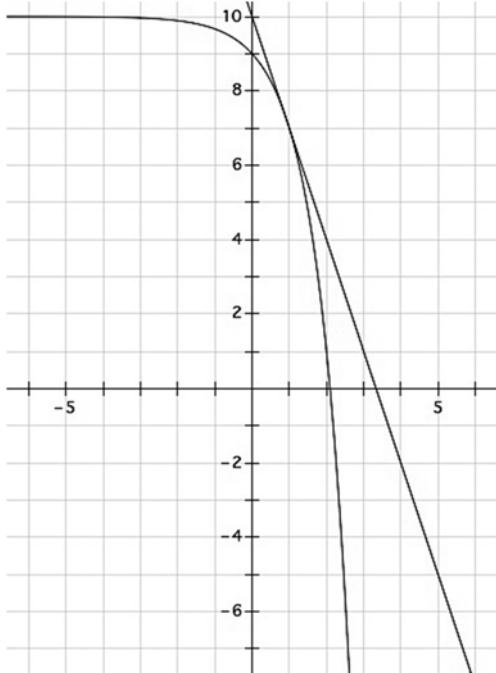
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Features of Functions | 5.1

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.)

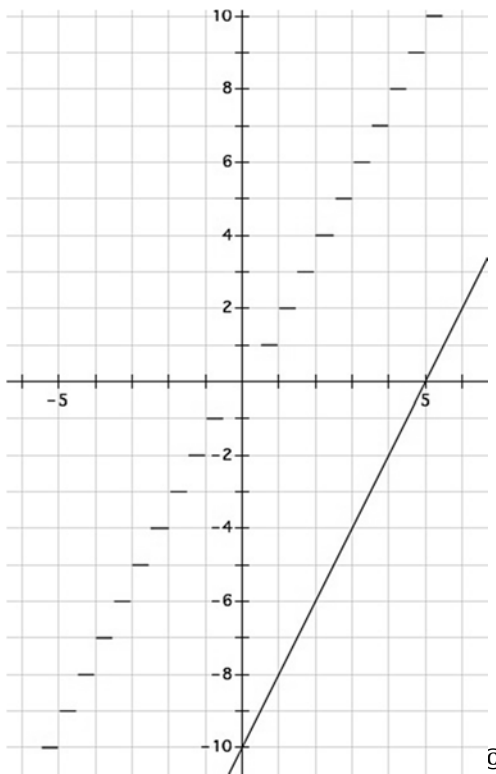
12.



Similarities:

Differences:

13.



Similarities:

Differences:

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Go

Topic: Solving Equations

Find the value of x in each equation.

14. $10^x = 100,000$

15. $3x + 7 = 5x - 21$

16. $-6x - 15 = 4x + 35$

17. $5x - 8 = 37$

18. $3^x = 81$

19. $3x - 12 = -4x + 23$

20. $10 = 2^x - 22$

21. $243 = 8x + 3$

22. $5^x - 7 = 118$



5.2 Floating Down the River

A Solidify Understanding Task

Alonzo, Maria, and Sierra were floating in inner tubes down a river, enjoying their day. Alonzo noticed that sometimes the water level was higher in some places than in others. Maria noticed there were times they seemed to be moving faster than at other times. Sierra laughed and said “Math is everywhere!” To learn more about the river, Alonzo and Maria collected data throughout the trip.

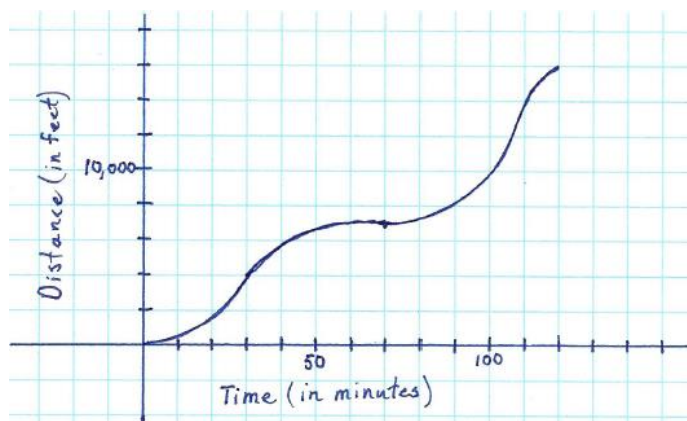


Alonzo created a table of values by measuring the depth of the water every ten minutes.

| | | | | | | | | | | | | | |
|----------------------|---|----|----|----|----|----|----|----|----|----|-----|-----|-----|
| Time (in minutes) | 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 110 | 120 |
| Depth (in feet) | 4 | 6 | 8 | 10 | 6 | 5 | 4 | 5 | 7 | 12 | 9 | 6.5 | 5 |

1. Use the data collected by Alonzo to interpret the key features of this relationship.

Maria created a graph by collecting data on a GPS unit that told her the distance she had traveled over a period of time.



2. Using the graph created by Maria, describe the key features of this relationship.

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3. Sierra looked at the data collected by her two friends and made several of her own observations. Explain why you either agree or disagree with each observation made.

- The depth of the water increases and decreases throughout the 120 minutes of floating down the river.
- The distance traveled is always increasing.
- The distance traveled is a function of time.
- The distance traveled is greatest during the last ten minutes of the trip than during any other ten minute interval of time.
- The domain of the distance/time graph is all real numbers.
- The y-intercept of the depth of water over time function is $(0,0)$.
- The distance traveled increases and decreases over time.
- The water level is a function of time.
- The range of the distance/time graph is from $[0, 15000]$.
- The domain of the depth of water with respect to time is from $[0,120]$
- The range of the depth of water over time is from $[4,5]$.
- The distance/ time graph has no maximum value.
- The depth of water reached a maximum at 30 minutes.



Ready, Set, Go!



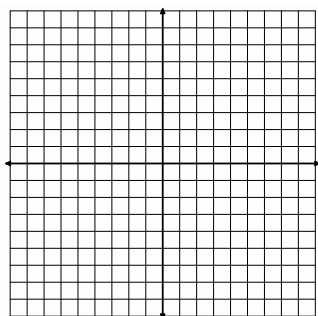
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Ready

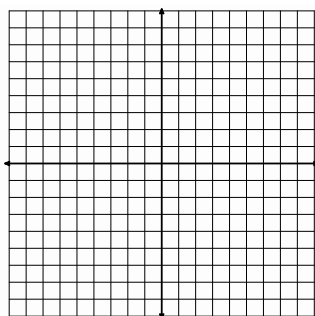
Topic: Solve systems by graphing

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

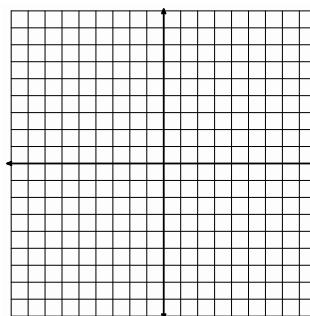
1.
$$\begin{cases} f(x) = 2x - 7 \\ g(x) = -4x + 5 \end{cases}$$



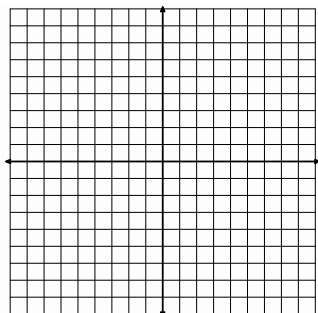
2.
$$\begin{cases} f(x) = -5x - 2 \\ g(x) = -2x + 1 \end{cases}$$



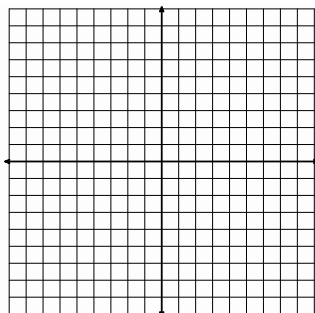
3.
$$\begin{cases} f(x) = -\frac{1}{2}x - 2 \\ g(x) = 2x + 8 \end{cases}$$



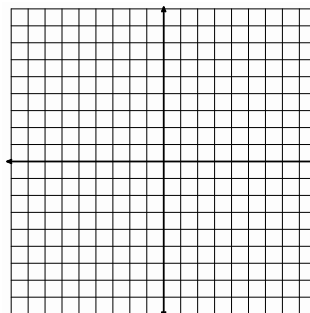
4.
$$\begin{cases} f(x) = \frac{2}{3}x - 5 \\ g(x) = -x \end{cases}$$



5.
$$\begin{cases} f(x) = \frac{2}{3}x + 4 \\ g(x) = -\frac{1}{3}x + 1 \end{cases}$$



6.
$$\begin{cases} f(x) = x \\ g(x) = -x - 3 \end{cases}$$



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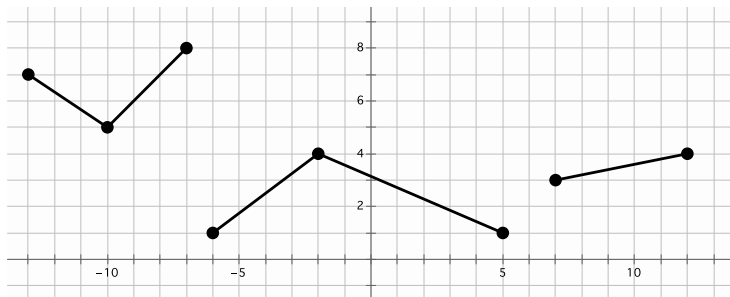


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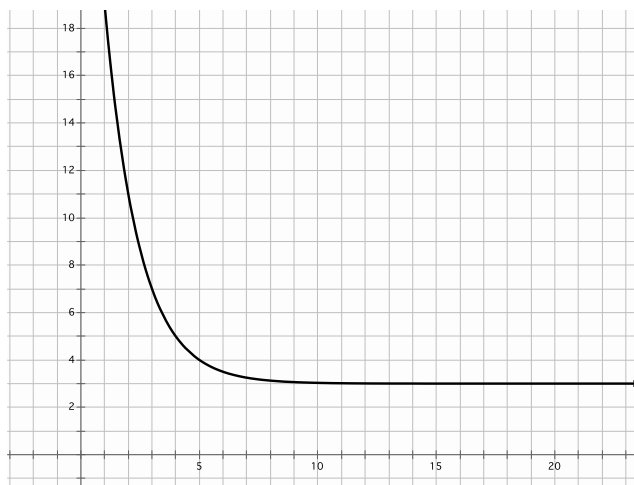
Topic: Describe features of a function from its graphical representation.

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

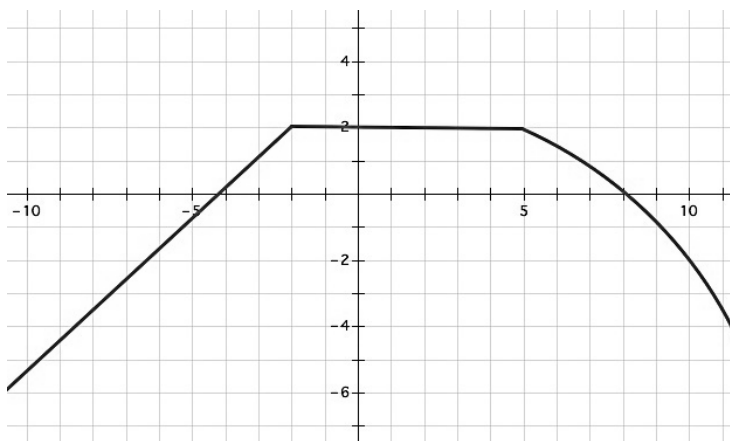
7. Description of function



8. Description of function



9. Description of function



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Go

Topic: Create equations using both explicit and recursive notation.

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

10.

| n | $f(n)$ |
|-----|--------|
| 1 | 5 |
| 2 | 2 |
| 3 | -1 |

Explicit:

Recursive:

11.

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

Explicit:

Recursive:

12.

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

Explicit:

Recursive:

13.

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

Explicit:

Recursive:

14.

| n | $f(n)$ |
|-----|---------|
| 2 | 5 |
| 7 | 15,625 |
| 9 | 390,625 |

Explicit:

Recursive:

15.

| n | $f(n)$ |
|-----|--------|
| 0 | -4 |
| 1 | -16 |
| 2 | -64 |

Explicit:

Recursive:

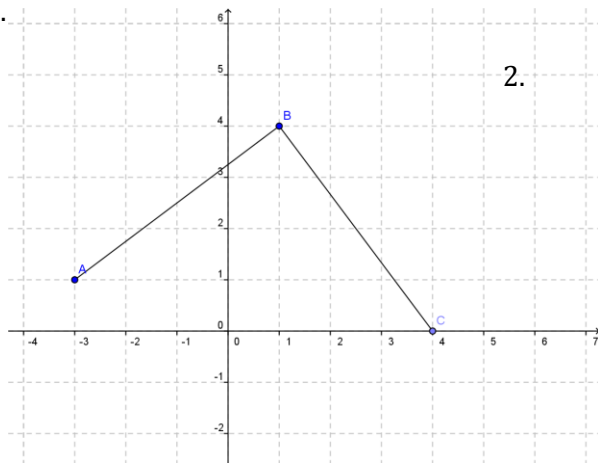


5.3 Features of Functions

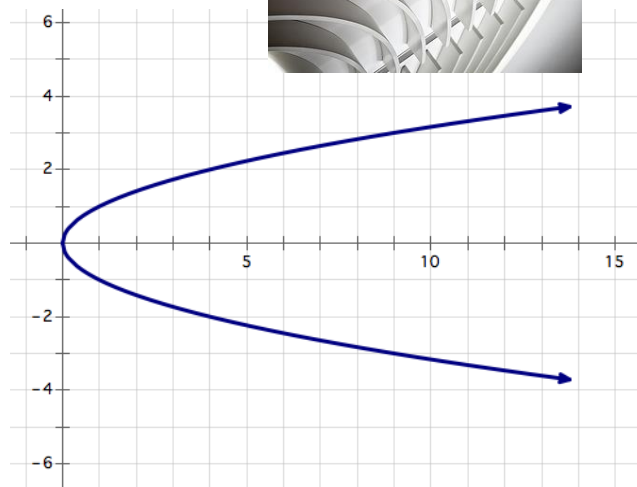
A Practice Understanding Task

For each graph, determine if the relationship represents a function, and if so, state the key features of the function (intervals where the function is increasing or decreasing, the maximum or minimum value of the function, domain and range, x and y intercepts, etc.)

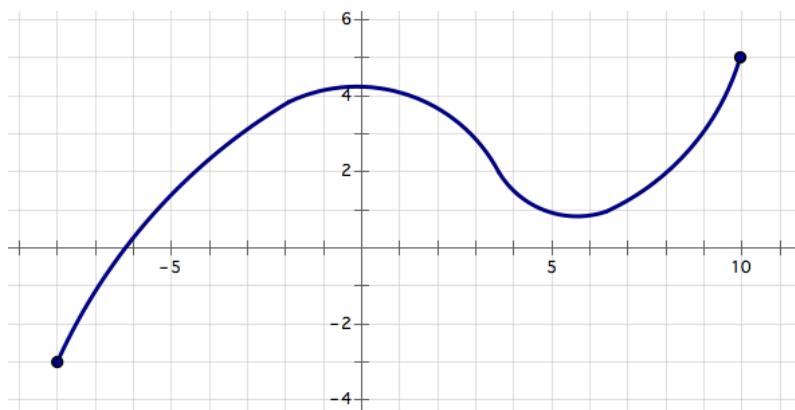
1.



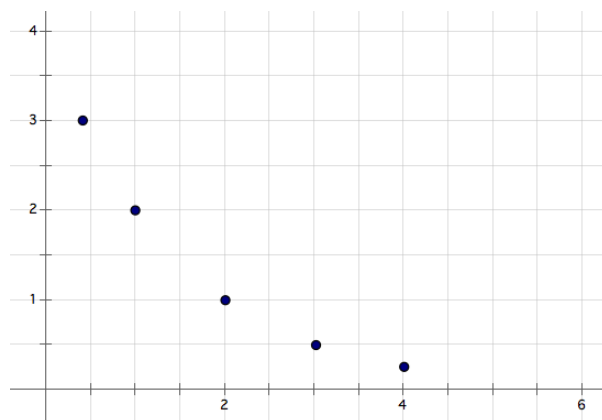
2.



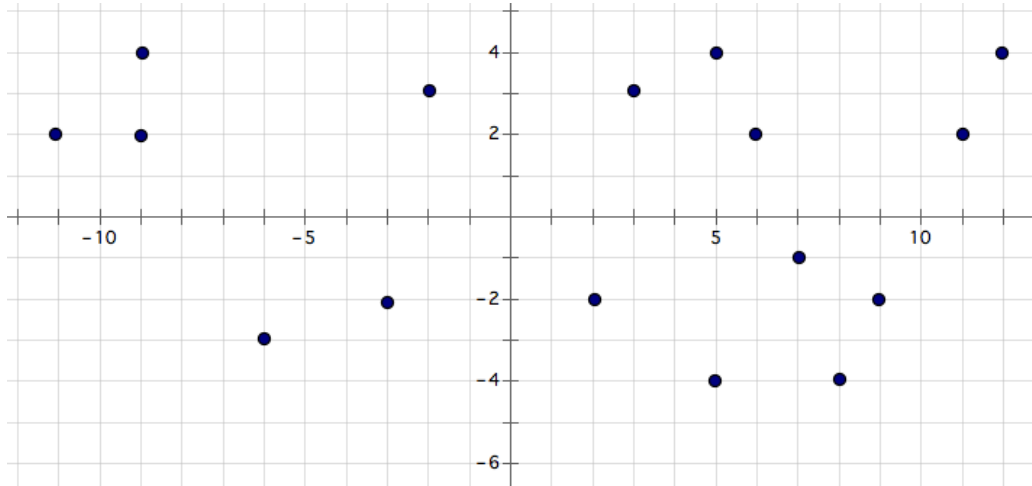
3.



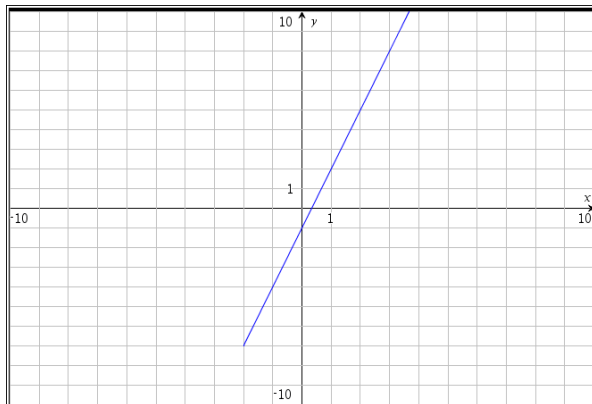
4.



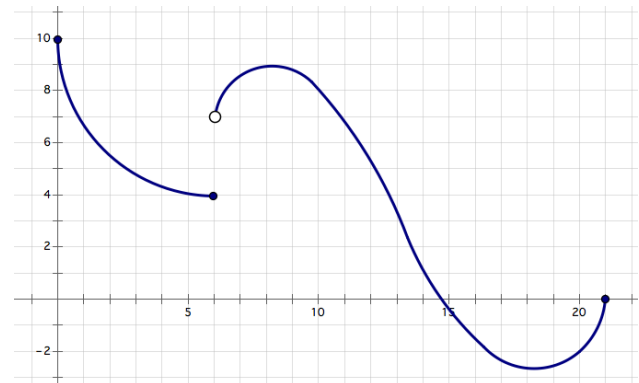
5.



6.



7.



The following represents a continuous function defined on the interval from $[0, 6]$.

| x | $f(x)$ |
|-----|--------|
| 0 | 2 |
| 1 | -3 |
| 2 | 0 |
| 3 | 2 |
| 4 | 6 |
| 5 | 12 |
| 6 | 20 |

8. Determine the domain, range, x and y intercepts.
 9. Based on the table, identify the minimum value and where it is located

The following represents a discrete function defined on the interval from $[1, 5]$.

| x | $f(x)$ |
|-----|--------|
| 1 | 4 |
| 2 | 10 |
| 3 | 5 |
| 4 | 8 |
| 5 | 3 |

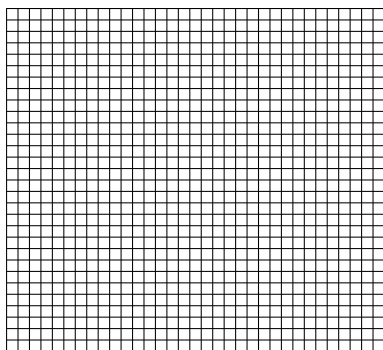
10. Determine the domain, range, x and y intercepts.
 11. Based on the table, identify the minimum value and where it is located.

Describe the key features for each situation.

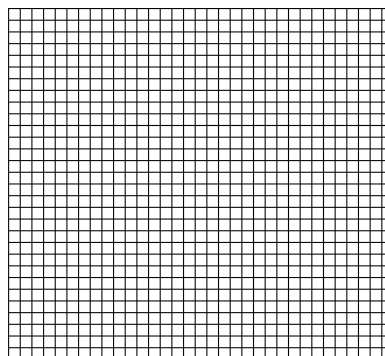
12. The amount of daylight dependent on the time of year.
 13. The first term in a sequence is 36. Each consecutive term is exactly $1/2$ of the previous term.
 14. Marcus bought a \$900 couch on a six months, interest free payment plan. He makes \$50 payments to the loan each week.
 15. The first term in a sequence is 36. Each consecutive term is $1/2$ less than the previous term.
 16. An empty 15 gallon tank is being filled with gasoline at a rate of 2 gallons per minute.

For each equation, sketch a graph and show key features of the graph.

17. $f(x) = -2x + 4$, when $x \geq 0$



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



Ready, Set, Go!



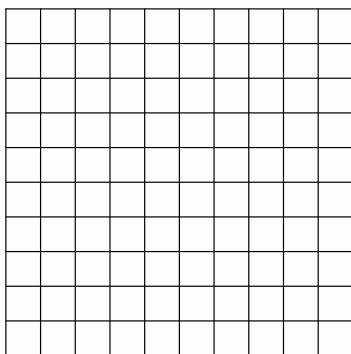
Ready

Topic: Creating graphical representations and naming the domain.

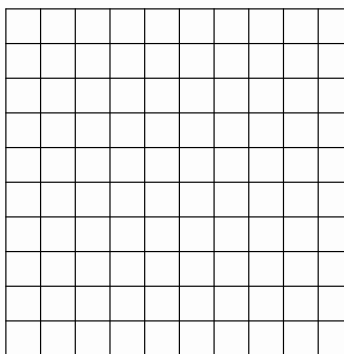
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Sketch a graph to represent each function, then state the domain of the function.

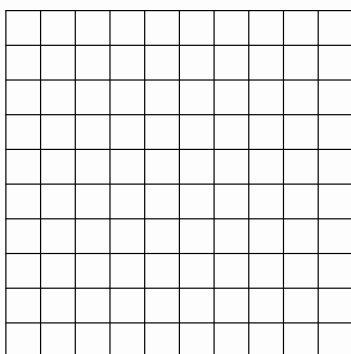
1. $y = 3x - 5$



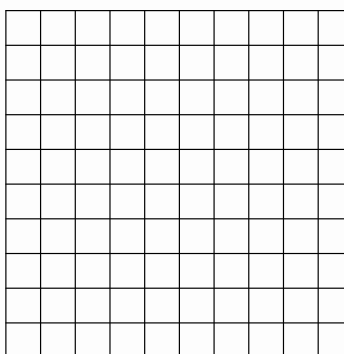
2. $f(x) = 3(4)^x$



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



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



Set

Topic: Attributes of linear and exponential functions.



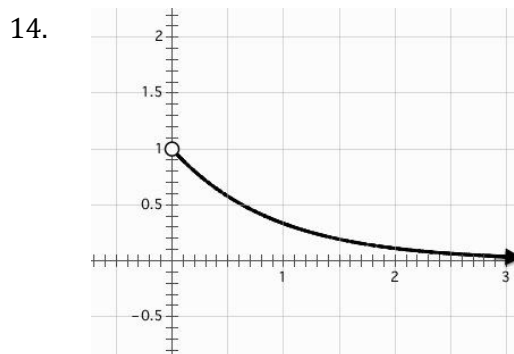
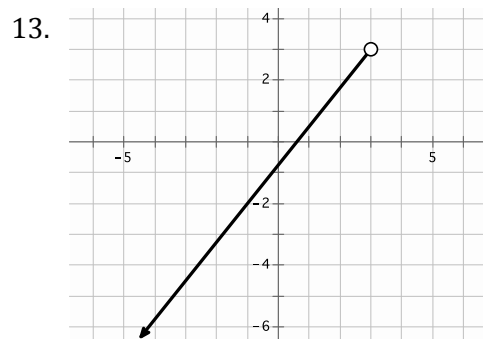
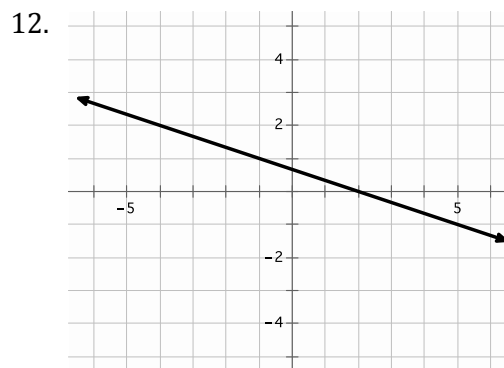
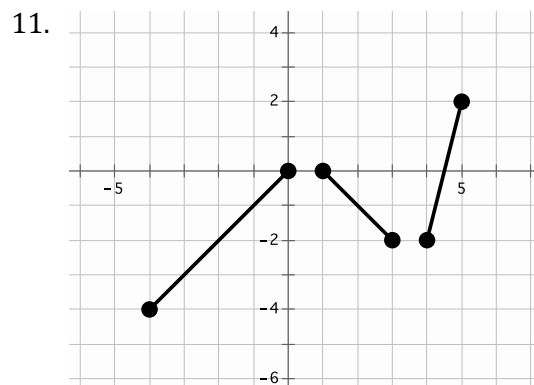
Determine if the statement is true or false, then justify why.

5. All linear functions are increasing.
6. Arithmetic sequences are an example of linear functions.
7. Exponential functions have a domain that includes all real numbers.
8. Geometric sequences have a domain that includes all integers.
9. The range for an exponential function includes all real numbers.
10. All linear relationships are functions with a domain and range containing all real numbers.

Go

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

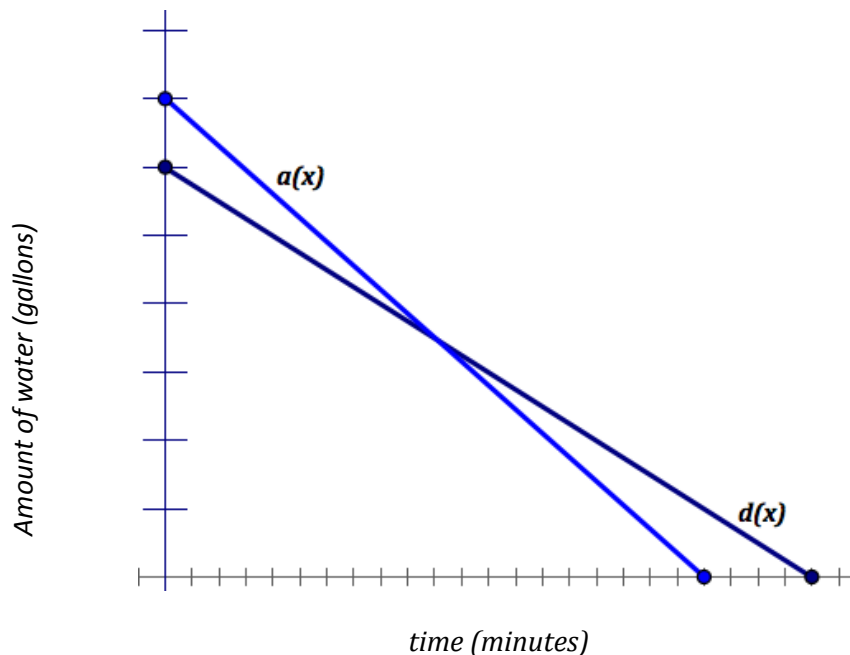
For each graph determine the domain of the function.



5.4 The Water Park

A Solidify Understanding Task

Aly and Dayne work at a water park and have to drain the water at the end of each month for the ride they supervise. Each uses a pump to remove the water from the small pool at the bottom of their ride. The graph below represents the amount of water in Aly's pool, $a(x)$, and Dayne's pool, $d(x)$, over time.



Part I

1. Make as many observations as possible with the information given in the graph above.

Part II

Dayne figured out that the pump he uses drains water at a rate of 1000 gallons per minute and takes 24 minutes to drain.

2. Write the equation to represent the draining of Dayne's pool, $d(x)$. What does each part of the equation mean?

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3. Based on this new information, correctly label the graph above.
4. For what values of x make sense in this situation? Use interval notation to write the domain of the situation.
5. Determine the range, or output values, that make sense in this situation.
6. Write the equation used to represent the draining of Aly's pool, $a(x)$. Using interval notation, state the domain and range for the function, $a(x)$ as well as the domain and range of the situation. Compare the two domains by describing the constraints made by the situation.

Part III

Based on the graph and corresponding equations for each pool, answer the following questions.

7. When is $a(x) = d(x)$? What does this mean?
8. Find $a(10)$. What does this mean?
9. If $d(x)=2000$, then $x= \underline{\hspace{1cm}}$. What does this mean?
10. When is $a(x) > d(x)$? What does this mean?



Ready, Set, Go!



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Ready

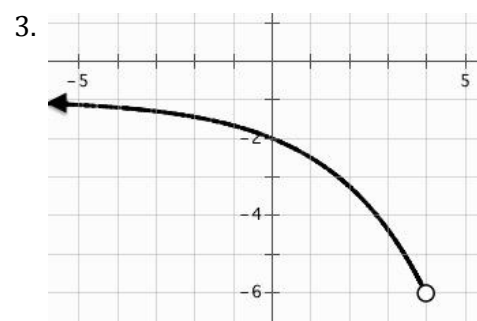
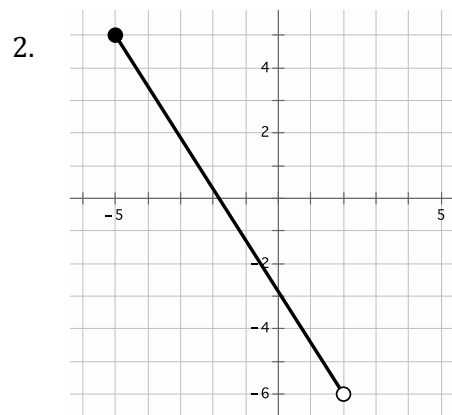
Topic: Attributes of linear and exponential functions.

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.

Set

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

Based on the graph given in each problem below, identify attributes of the function such as the domain, range and whether or not the function is increasing or decreasing, etc.



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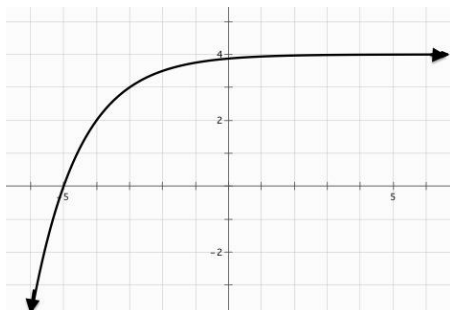
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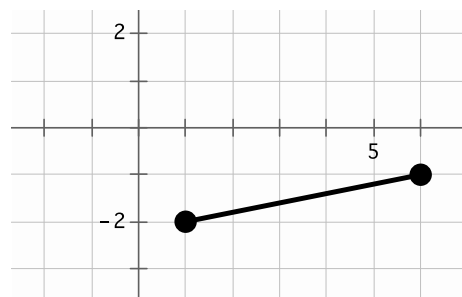


Features of Functions | 5.4

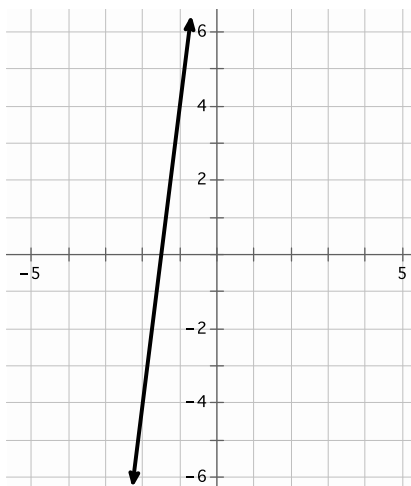
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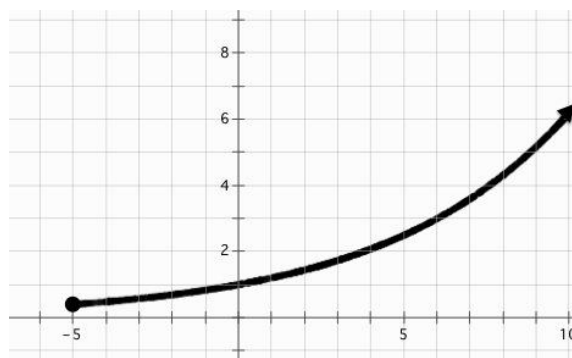
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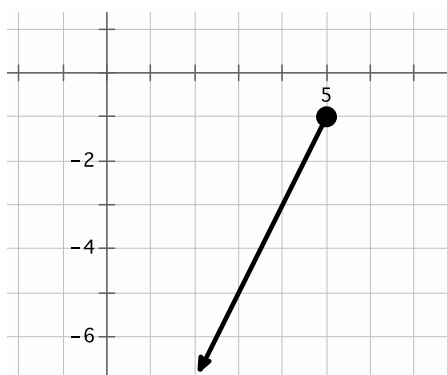
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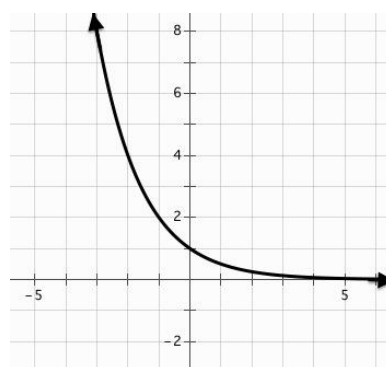
7.



8.



9.



Go

Topic: Finding equations and rules for functions

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

10.

| n | $f(n)$ |
|-----|--------|
| 1 | 3 |
| 2 | 5 |
| 3 | 7 |
| 4 | 9 |

Explicit:

Recursive:

11.

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

Explicit:

Recursive:

12.

| n | $f(n)$ |
|-----|--------|
| 6 | 23 |
| 7 | 19 |
| 8 | 15 |
| 9 | 11 |

Explicit:

Recursive:

13.

| n | $f(n)$ |
|-----|--------|
| 1 | 1 |
| 2 | 3 |
| 3 | 9 |

Explicit:

Recursive:

14.

| n | $f(n)$ |
|-----|--------|
| 3 | 8 |
| 4 | 4 |
| 5 | 2 |

Explicit:

Recursive:

15.

| n | $f(n)$ |
|-----|--------|
| 6 | 7 |
| 9 | 13 |
| 12 | 19 |

Explicit:

Recursive:

16.

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

Explicit:

Recursive:

17.

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

Explicit:

Recursive:

18.

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

Explicit:

Recursive:



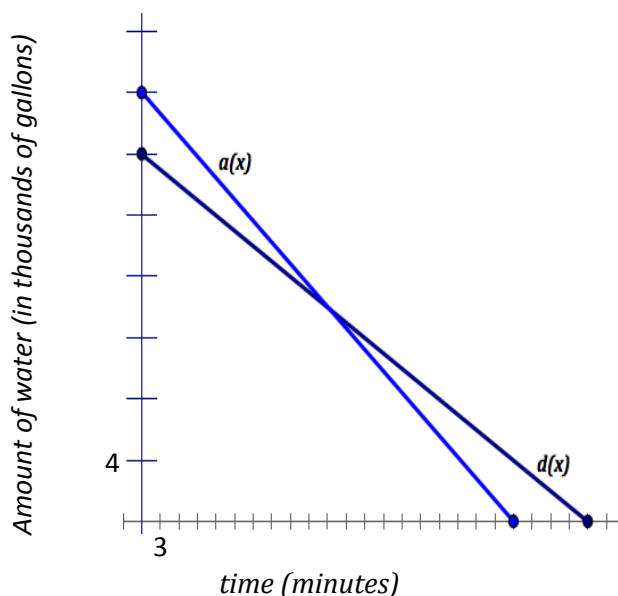
5.5 Pooling It Together

A Solidify Understanding Task

Aly and Dayne work at a water park and have to drain the water at the end of each month for the ride they supervise. Each uses a pump to remove the water from the small pool at the bottom of their ride. The graph below represents the amount of water in Aly's pool, $a(x)$, and Dayne's pool, $d(x)$, over time. In this scenario, they decided to work together to drain their pools and created the equation $g(x) = a(x) + d(x)$. Using the graph below showing $a(x)$ and $d(x)$, create a new set of axes and graph $g(x)$. Identify $g(x)$ and label (scale, axes).



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Answer the following questions about $g(x)$.

1. What does $g(x)$ represent?
2. Name the features of $g(x)$ and explain what each means (each intercept, domain and range for this situation and for the equation, maxima and minima, whether or not $g(x)$ is a function, etc.)
3. Write the equation for $g(x)$ using the intercepts from the graph. Compare this equation to the sum of the equations created for $a(x)$ and $d(x)$ from "The Water Park" task. Should be they be equivalent? Why or why not?

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When combining functions, a lot of connections can be made. Make at least three connections showing how the equations $a(x)$, $d(x)$, and $g(x)$ relate to the graphs of $a(x)$, $d(x)$, and $g(x)$. (hint: think about the key features of these functions).

For A Twist:

If Aly and Dayne's boss started to drain the water before they arrived and when they got there, there was already 5,000 less gallons of water to be drained, how would this impact the equation?

Write the new equation representing how long it will take them to drain the two pools.



Ready, Set, Go!

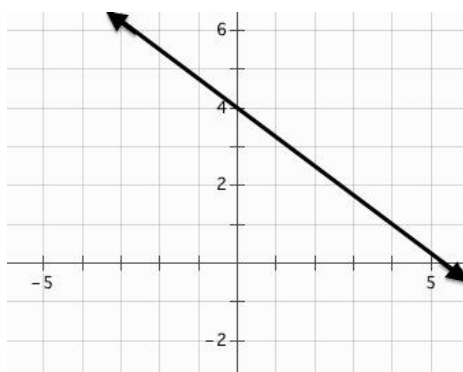


Ready

Topic: Use a graphical representation to find solutions.

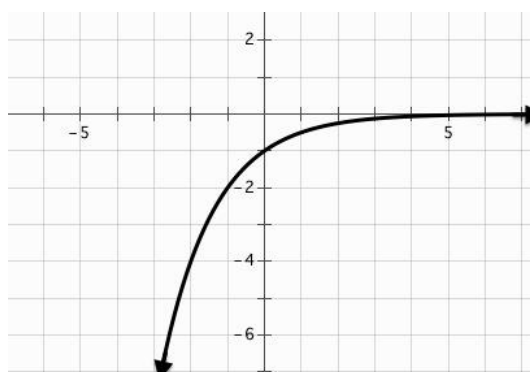
Use the graph of each function provided to find the values indicated.

1. $f(x)$



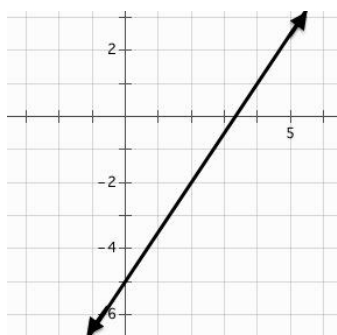
- a. $f(4) = \underline{\hspace{2cm}}$ b. $f(-4) = \underline{\hspace{2cm}}$
 c. $f(x) = 4, x = \underline{\hspace{2cm}}$ d. $f(x) = 7, x = \underline{\hspace{2cm}}$

2. $g(x)$



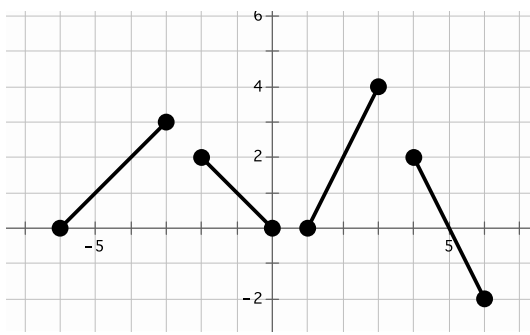
- a. $g(-1) = \underline{\hspace{2cm}}$ b. $g(-3) = \underline{\hspace{2cm}}$
 c. $g(x) = -4, x = \underline{\hspace{2cm}}$ d. $g(x) = -1, x = \underline{\hspace{2cm}}$

3. $h(x)$



- a. $h(0) = \underline{\hspace{2cm}}$ b. $h(3) = \underline{\hspace{2cm}}$
 c. $h(x) = 1, x = \underline{\hspace{2cm}}$ d. $h(x) = -2, x = \underline{\hspace{2cm}}$

4. $d(x)$



- a. $d(-5) = \underline{\hspace{2cm}}$ b. $d(4) = \underline{\hspace{2cm}}$
 c. $d(x) = 4, x = \underline{\hspace{2cm}}$ d. $d(x) = 0, x = \underline{\hspace{2cm}}$

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Set

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.

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

- What is Fran looking for if she writes " $d(12) =$ " ?
- In this situation what does $d(t) = 100$ tell you?
- How can the function rule be used to indicate a time of 16 seconds was walked?
- How can the function rule be used to indicated that a distance of 200 feet was walked?

6. 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.

- 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.
- Find $c(20)$
- Find $c(45)$
- Find $c(t) = 100$
- Find $c(t) = 90$
- At what number of texts would \$20 unlimited texting be less expensive then her current plan?



Features of Functions | 5.5

7. 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 $p(t) = 128$

b. Find $p(4)$

c. Find $p(10)$

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

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

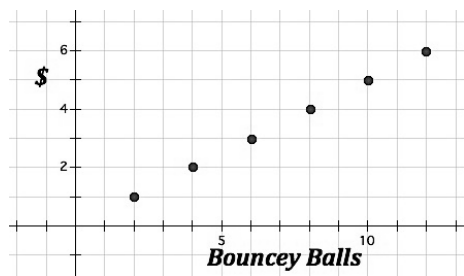
Go

Topic: Discrete and continuous

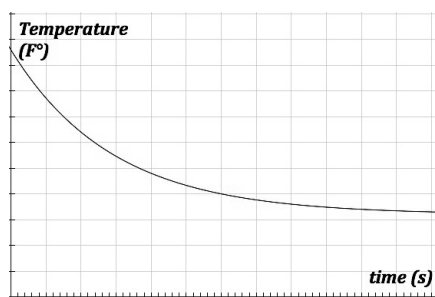
For each context or representation determine whether it is discrete or continuous or could be modeled best in a discrete or continuous way and state why.

8. Susan has a savings plan where she places \$5 a week in her piggy bank.

9.



10.



11. 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.

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

13.

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

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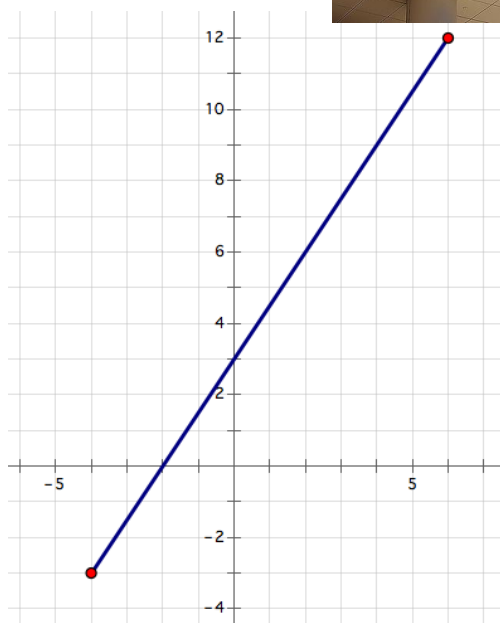
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5.6 Interpreting Functions

A Practice Understanding Task

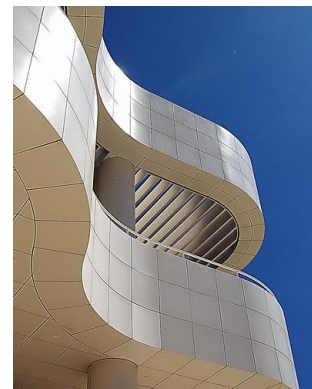
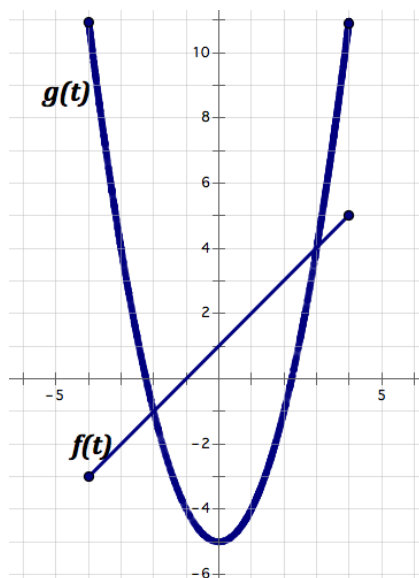
Given the graph of $f(x)$, answer the following questions. Unless otherwise specified, restrict the domain of the function to what you see in the graph below. Approximations are appropriate answers.

1. What is $f(2)$?
2. For what values, if any, does $f(x) = 3$?
3. What is the x-intercept?
4. What is the domain of $f(x)$?
5. On what intervals is $f(x) > 0$?
6. On what intervals is $f(x)$ increasing?
7. On what intervals is $f(x)$ decreasing?
8. For what values, if any, is $f(x) > 3$?



Consider the linear graph of $f(t)$ and the nonlinear graph of $g(t)$ to answer questions 9-14. Approximations are appropriate answers.

9. Where is $f(t) = g(t)$?
10. Where is $f(t) > g(t)$?
11. What is $f(0) + g(0)$?
12. What is $f(-1) + g(-1)$?
13. Which is greater: $f(0)$ or $g(-3)$?
14. Graph: $f(t) + g(t)$ from $[-1, 3]$



The following table of values represents two continuous functions, $f(x)$ and $g(x)$. Use the table to answer the following questions:

| x | $f(x)$ | $g(x)$ |
|-----|--------|--------|
| -5 | 42 | -13 |
| -4 | 30 | -9 |
| -3 | 20 | -5 |
| -2 | 12 | -1 |
| -1 | 6 | 3 |
| 0 | 2 | 7 |
| 1 | 0 | 11 |
| 2 | 0 | 15 |
| 3 | 2 | 19 |
| 4 | 6 | 23 |
| 5 | 12 | 27 |
| 6 | 20 | 31 |

15. What is $g(-3)$?
16. For what value(s) is $f(x) = 0$?
17. For what values is $f(x)$ increasing?
18. On what interval is $g(x) > f(x)$?
19. Which function is changing faster in the interval $[-5, 0]$? Why?

Use the following relationships to answer the questions below.

$$h(x) = 2^x$$

$$f(x) = 3x - 2$$

$$g(x) = 5$$

$$x = 4$$

$$y = 5x + 1$$

20. Which of the above relations are functions? Explain.
21. Find $f(2)$, $g(2)$, and $h(2)$.
22. Write the equation for $g(x) + h(x)$.
23. Where is $g(x) < h(x)$?
24. Where is $f(x)$ increasing?
25. Which of the above functions has the fastest growth rate?

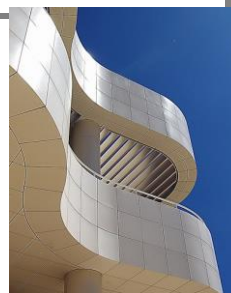
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Ready, Set, Go!



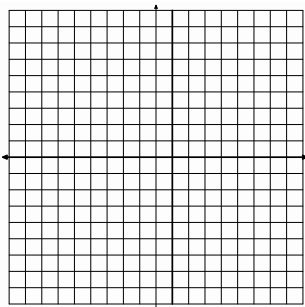
Ready

Topic: Solve systems of equations

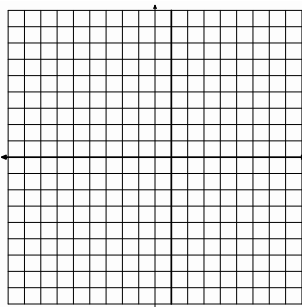
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Solve each system of equations either by graphing, substitution, elimination, or matrix row reduction. Use each method at least once.

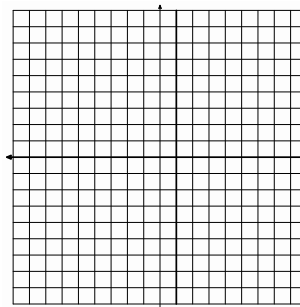
$$1. \begin{cases} 3x + 4 \\ 4x + 1 \end{cases}$$



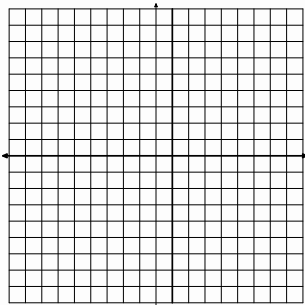
$$2. \begin{cases} -5x + 12 \\ -2x - 3 \end{cases}$$



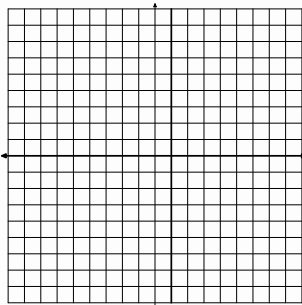
$$3. \begin{cases} \frac{1}{2}x + 2 \\ 2x - 7 \end{cases}$$



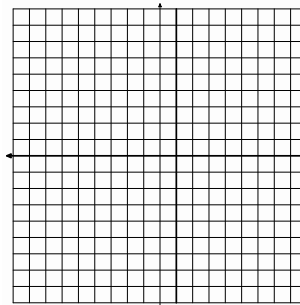
$$4. \begin{cases} -\frac{2}{3}x + 5 \\ -x + 7 \end{cases}$$



$$5. \begin{cases} x + 5 \\ -x - 3 \end{cases}$$



$$6. \begin{cases} x - 6 \\ -x - 6 \end{cases}$$



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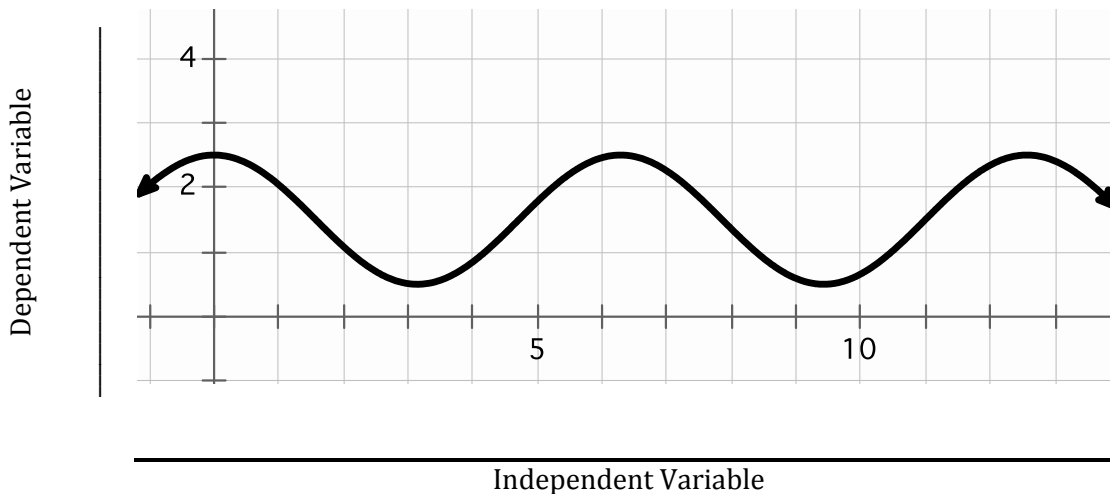


Set

Topic: Connecting context to graphical representations

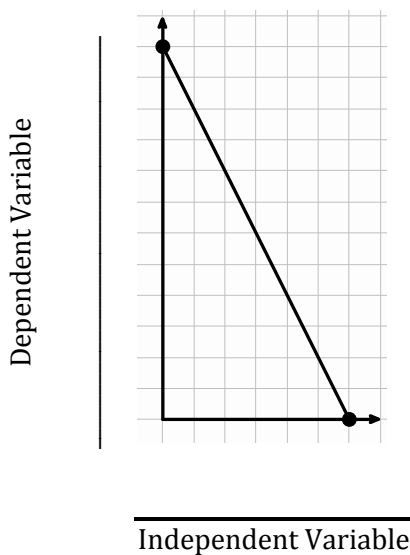
For each graph create a context, provide independent and dependent variables that will fit the context you choose. Then create a story that describes what is happening on the graph.

7.



Description of context and a story for the graph:

8.



Description of context and a story for the graph:

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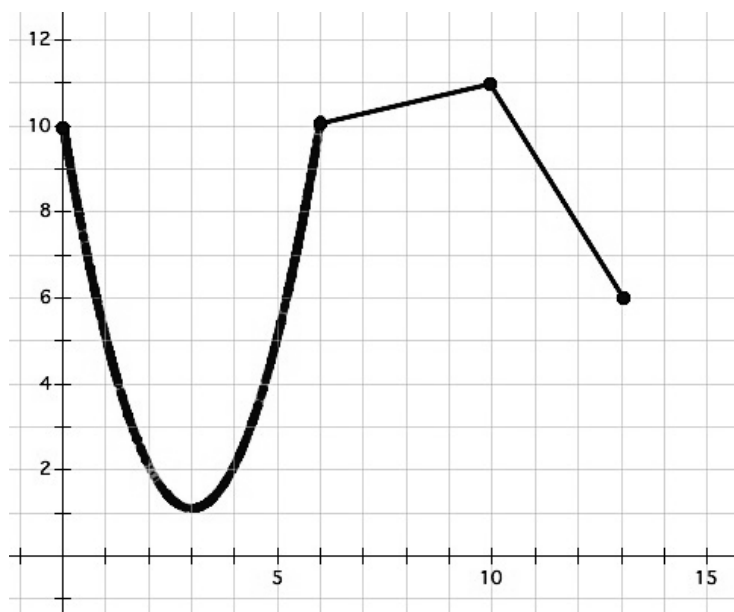
Go

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.

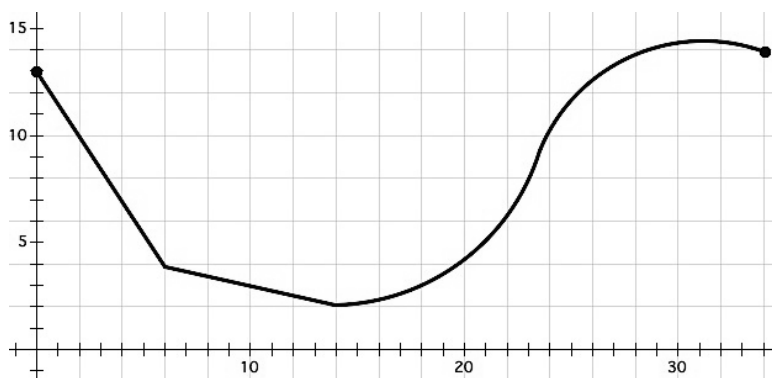
9.

Description of function:



10.

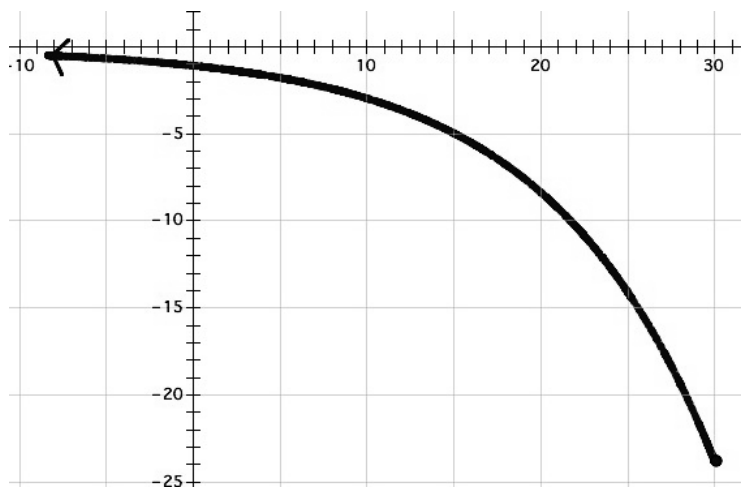
Description of function:



Features of Functions | 5.6

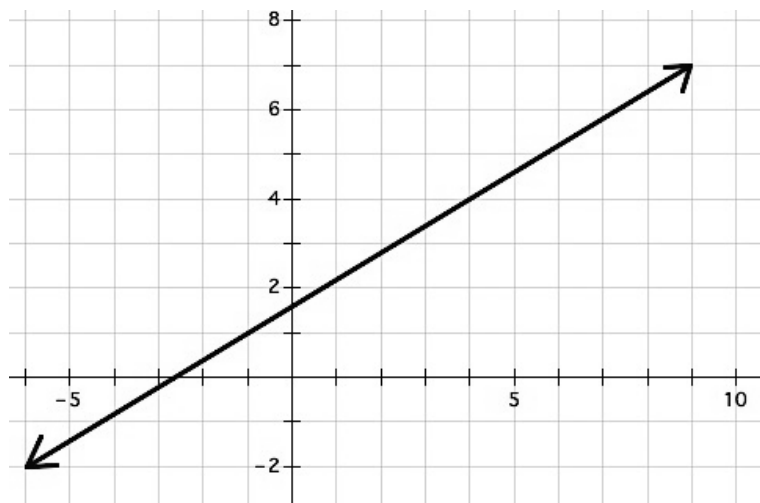
11.

Description of function:



12.

Description of function:



5.7 A Water Function

A Develop Understanding Task

Andrew walked around the water park taking photos of his family with his phone. Later, he discovered his phone was missing. So that others could help him look for his lost phone, he drew a picture that 'retraced his steps' showing where he had walked.



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If we wanted to determine Andrew's location in the park with respect to time, would his location be a function of time?

Why or why not? Explain.

1. Situation A: Sketch a graph of the total distance Andrew walked if he walked at a constant rate the entire time.
2. Situation B: Sketch a graph of Andrew's distance from the entrance (his starting point) as a function of time.
3. How would the graph of each situation change if Andrew stopped at the slide for a period of time? Would this change whether or not this situation is a function?

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Ready, Set, Go!



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Ready

Topic: Mathematical comparisons

Use the given comparison statements to answer the questions.

- 3 out of 5 students prefer playing football to playing basketball.
 - What percent of students prefer playing football?
 - What percent of students prefer playing basketball?

- The ratio of student wearing yellow to students not wearing yellow is 3 to 7.
 - What fraction of students have on yellow?
 - What percent of students don't have on yellow?

- Of the students at school, 40% attended the basketball game.
 - What fraction of the students attended the basketball game?
 - How many times more students did not attend the basketball game?

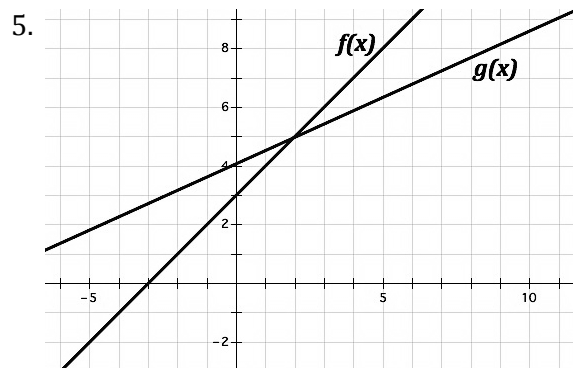
- 1000 students ride buses to school while 600 walk or carpool.
 - What fraction of students ride the bus?
 - How many more students ride the bus than walk or carpool?
 - What percent of students walk or carpool?



Set

Topic: Comparing functions from different representations

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

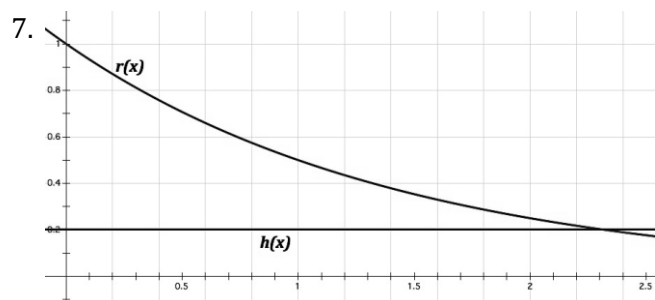


- Where does $f(x) = g(x)$?
- What is $f(4) + g(4)$?
- What is $g(-2) - f(-2)$?
- On what interval is $g(x) > f(x)$?
- Sketch $f(x) + g(x)$ on the graph provided.

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

| x | $a(x)$ | $b(x)$ |
|-----|--------|--------|
| -3 | 1 | -1 |
| -1 | 7 | -5 |
| 0 | 3 | -10 |
| 2 | 8 | 2 |
| 7 | 3 | 3 |

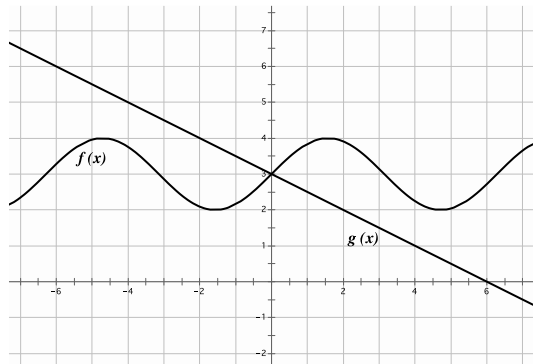
- What is $a(-3) + b(-3)$?
- What is $a(-1) - b(-1)$?
- What is $a(0) + b(0)$?
- Add two columns to the table and provided $a(x) + b(x)$ in one and $a(x) - b(x)$ in the other.



- Where is $r(x) > h(x)$?
- What is $r(1) - h(1)$?
- What is $r(0) + h(0)$?
- Create an explicit rule for $r(x)$ and for $h(x)$.
- Sketch $r(x) - h(x)$ on the graph.



8.



- Where does $f(x) = g(x)$?
- What is $f(4) + g(4)$?
- What is $g(-2) - f(-2)$?
- On what interval is $g(x) > f(x)$?
- Sketch $f(x) - g(x)$ on the graph provided.

Go

Topic: Solving equations for a specified variable. Literal equations.

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

9. $12x + 3y = 6$

10. $8x + y = 5$

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

12. $9x - y = 7$

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

14. $16x = 20 + 8y$

Write an explicit function for the linear function that goes through the given point with the given slope simplified into slope-intercept form.

15. $m = 3, (-1, 2)$

16. $m = -5, (3, 4)$

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

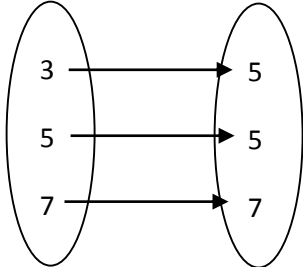


5.8 To Function or Not To Function

A Practice Understanding Task



Determine if the following relationships are functions and then justify your reasoning.

| 1. A person's name versus their social security number. | 2. A person's social security number versus their name. | 3. The cost of gas versus the amount of gas pumped. | | | | | | | | | | |
|--|--|--|----------|------|---|---|----|---|---|---|---|---|
| 4. { (3,6), (4, 10), (8,12), (4, 10) } | 5. The temperature in degrees Fahrenheit with respect to the time of day. | 6. <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>distance</th> <th>days</th> </tr> </thead> <tbody> <tr> <td>6</td> <td>2</td> </tr> <tr> <td>10</td> <td>4</td> </tr> <tr> <td>6</td> <td>5</td> </tr> <tr> <td>9</td> <td>8</td> </tr> </tbody> </table> | distance | days | 6 | 2 | 10 | 4 | 6 | 5 | 9 | 8 |
| distance | days | | | | | | | | | | | |
| 6 | 2 | | | | | | | | | | | |
| 10 | 4 | | | | | | | | | | | |
| 6 | 5 | | | | | | | | | | | |
| 9 | 8 | | | | | | | | | | | |
| 7. The area of a circle as it relates to the radius. | 8.  | 9. The radius of a cylinder is dependent on the volume. | | | | | | | | | | |
| 10. The size of the radius of a circle dependent on the area. | 11. Students letter grade dependent on the percent earned. | 12. The length of fence needed with respect to the amount of area to be enclosed. | | | | | | | | | | |
| 13. The explicit formula for the recursive situation below: $f(1) = 3$ and $f(n + 1) = f(n) + 4$ | 14. If x is a rational number, then $f(x) = 1$ If x is an irrational number, then $f(x) = 0$ | 15. The national debt with respect to time. | | | | | | | | | | |



Ready, Set, Go!



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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:

Range:

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

Function: Yes / No

Domain:

Range:

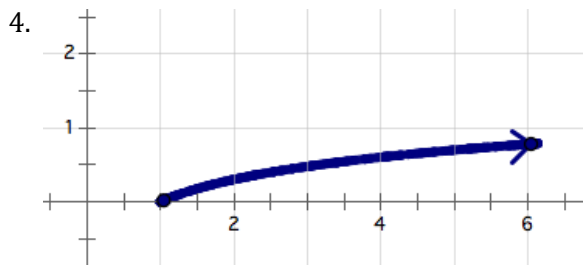
3. $\{(1, 2), (2, 3), (3, 4), (4, 5), (5, 6), (6, 7), (7, 8), (8, 9)\}$

Function: Yes / No

Domain:

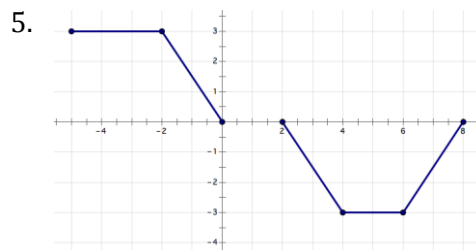
Range:

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



Domain:

Range:



Domain:

Range:

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Features of Functions | 5.8

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

Domain:

Range:

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

Domain:

Range:

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

| x | h(x) |
|---|------|
| 1 | 9 |
| 2 | 98 |
| 3 | 987 |
| 4 | 9876 |

Domain:

Range:

Set

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

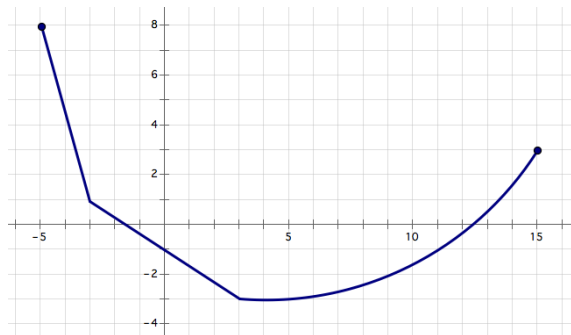
Determine if the relationship presented is a function or not and provide a justification.

- The distance a person is from the ground related to time as they ride a Ferris Wheel.
- The amount of daylight during a day throughout the calendar year.
- The value of a Volkswagen Bug convertible from time of first purchase in 1978 to now.
- A person's name and their phone number.
- The stadium in which a football player is playing related to the outcome of the game.

Go

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

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



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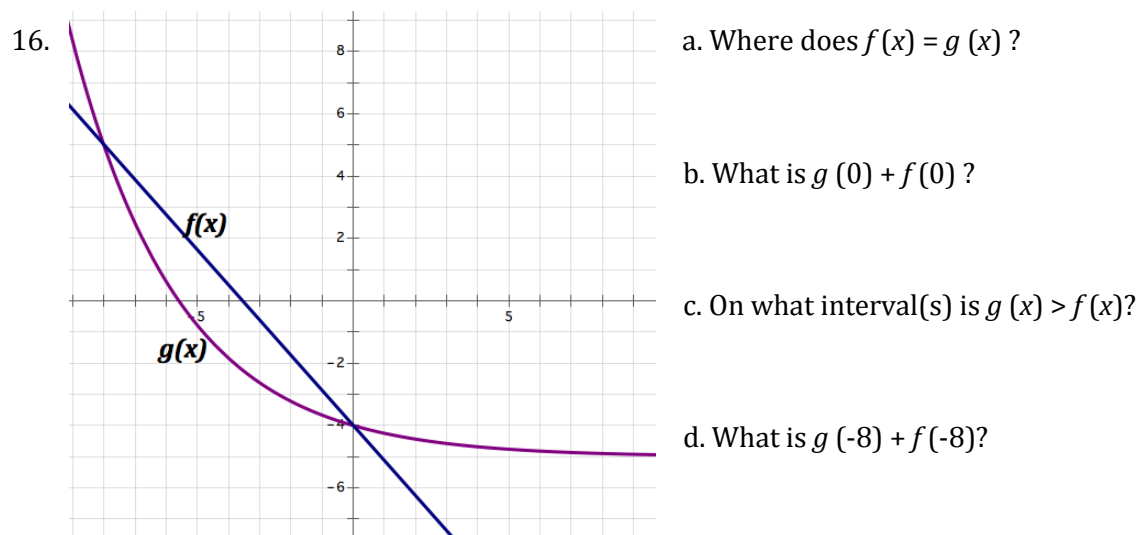
Features of Functions | 5.8

15. For the given situation use the given 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.

- What would Hope be attempting to find if she writes " $d(4) = 78(4)$ " ?
- What would $d(t) = 450$ mean in this situation?
- What would $d(3.5)$ mean in this situation?
- How could Hope use the function to find the time it would take to travel 800 miles?

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



5.9 Match That Function

A Practice Understanding Task

Welcome to Match That Function! To play, sort the deck of cards into sets by grouping cards together that describe a specific relationship. Each set is supposed to have four cards; however, one card is missing from every set. After you have sorted the cards into ten sets, create a fourth card for each set that would complete the set. Be sure to use a different representation than what is provided.



Ready, Set, Go!

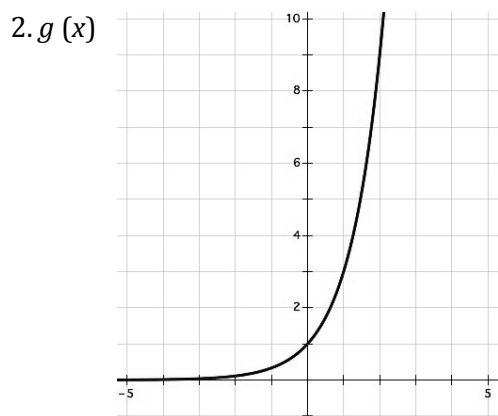
Ready

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

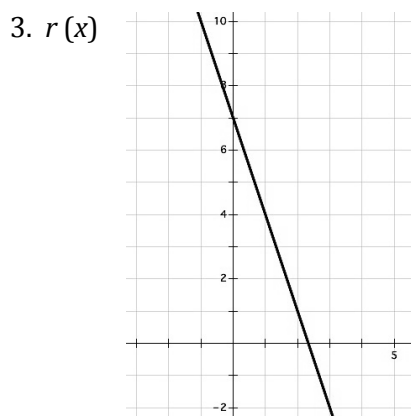
For each function find the desired solutions.

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

a. $h(-4) = \underline{\hspace{2cm}}$ b. $h(t) = 23, t = \underline{\hspace{2cm}}$ c. $h(13) = \underline{\hspace{2cm}}$ d. $h(t) = -33, t = \underline{\hspace{2cm}}$



- $g(2) = \underline{\hspace{2cm}}$
- $g(x) = 3, x = \underline{\hspace{2cm}}$
- $g(0) = \underline{\hspace{2cm}}$
- What is the explicit rule for $g(x)$



- $r(-1) = \underline{\hspace{2cm}}$
- $r(x) = 4, x = \underline{\hspace{2cm}}$
- $r(2) = \underline{\hspace{2cm}}$
- What is the explicit rule for $r(x)$



Set

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

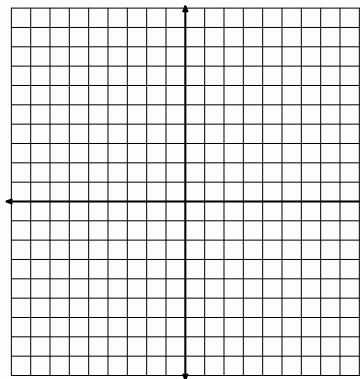
Use the given description of several of the key features of the function to sketch a possible graph of the function.

4. Domain contains all Real numbers between -2 and 3.

Range contains all Real numbers between 3 and 7.

The function is increasing from -2 to 0 and decreasing after 0.

The function is not continuous at every point.

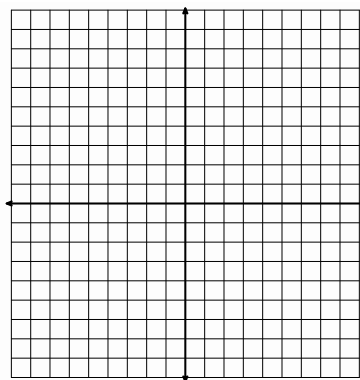


5. The function has a minimum at -5.

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.

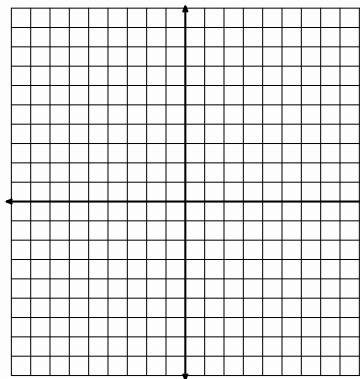


6. This function is not continuous anywhere.

The function contains only seven elements in its domain.

The values of the domain are between -10 and 2.

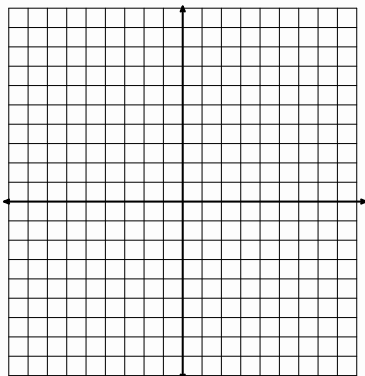
The values of the range are between -1 and 1.



Features of Functions | 5.9

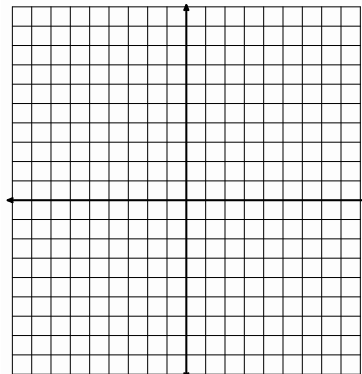
7. The function has three intervals on which its slope is zero.

The function has a maximum and a minimum.



8. The domain of the function is $[-5, \infty)$

The range of the function is $[0, \infty)$

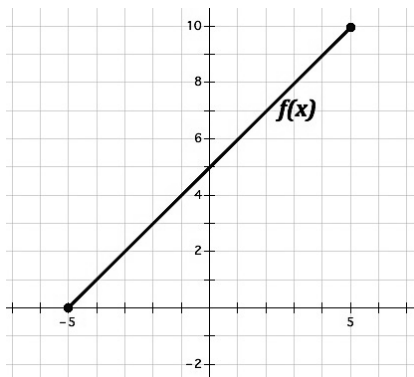


Go

Topic: Determine the following for each function: domain, range, discrete, continuous, increasing, decreasing, etc.

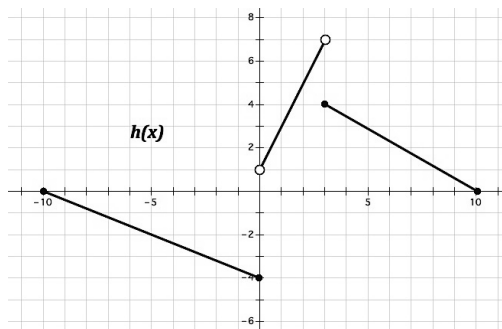
Given the representation of the function(s) provided determine the domain, range, and whether the function is discrete, continuous, increasing, decreasing, etc.

9.



Description of Function:

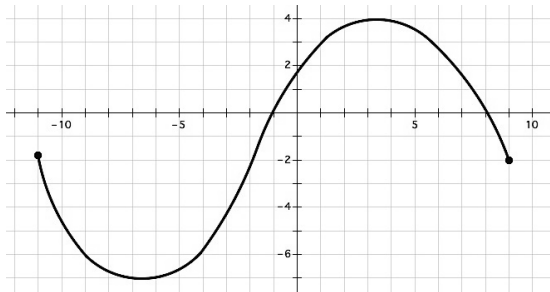
10.



Description of Function:

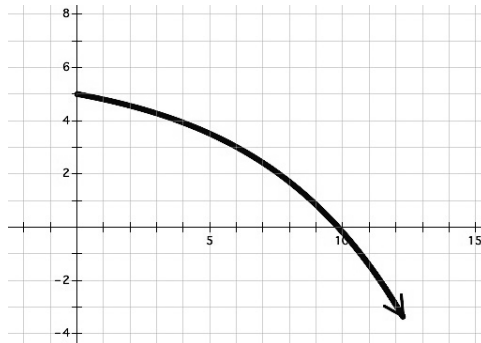


11.



Description of Function:

12.



Description of Function:

13. $f(0) = 2, f(n + 1) = 3(f(n))$

Description of Function:

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

Description of Function:

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

Description of Function:

