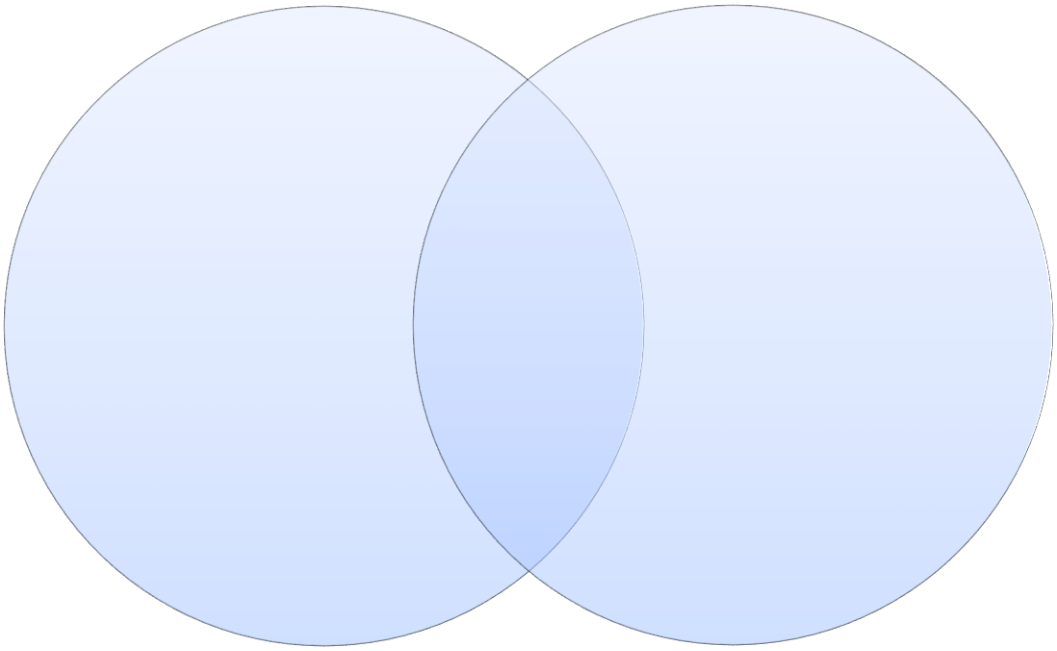
Name: _____ Hour: _____

Algebra

Unit 1

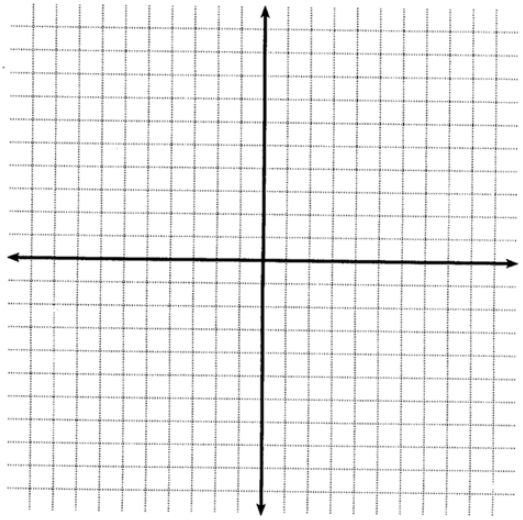
Relating Graphs to Events

Independent vs. Dependent Variables



Mapping Diagrams & Vertical Line Test

What is a function?

Mapping Diagram	Vertical Line Test (VLT)
Purpose/Explanation:	**Purpose/Explanation:**
Example:	**Example:** 

Domain and Range

What is function notation?

Domain	Range

Domain & Range in a table	**Domain & Range in coordinates**
Domain & Range in a graph	

Writing Function Rules

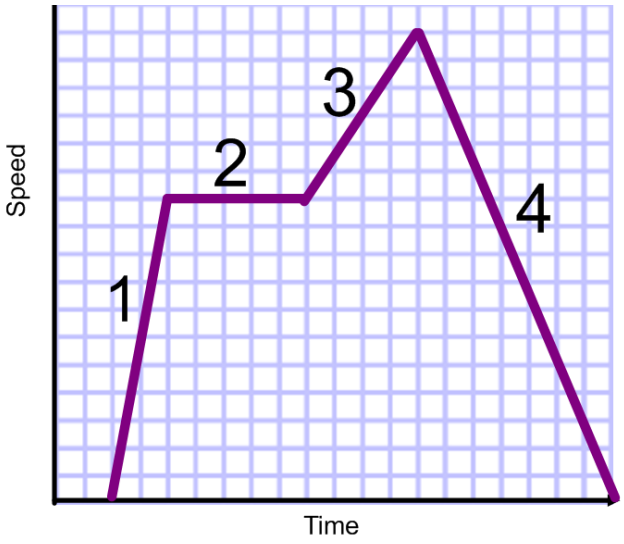
Function rules in tables	**Function rules in graphs**	**Function rules in coordinates**

Step Functions

What is a step function?	
Greater than	Less than
Example:	

Relating Graphs to Events

1. Use the graph to determine which situation is happening at the given time. Match the letter of the situation with the numbered portion on the graph.



A. increased speed over a period of time

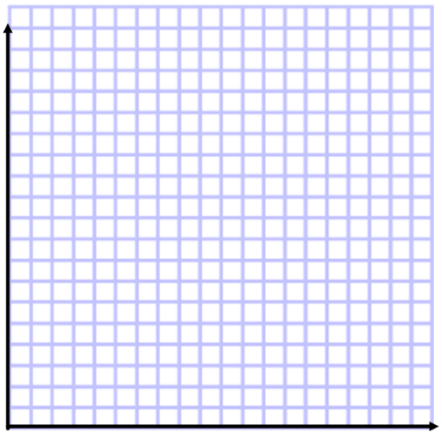
B. decreased speed

C. ran at a steady pace

D. increased speed rapidly

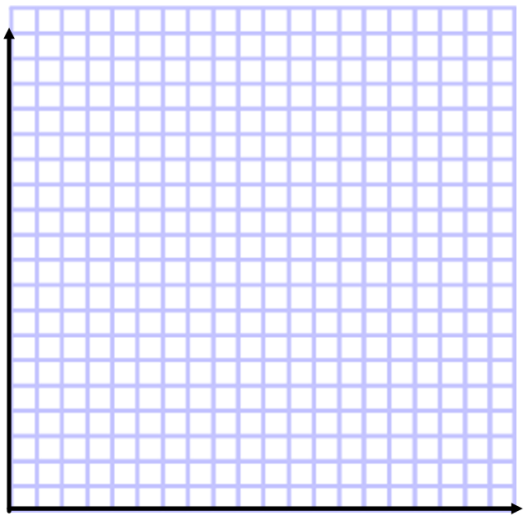
2. Use the situation described below to construct a graph that would satisfy that situation.

Distance from the ground on a ferris wheel

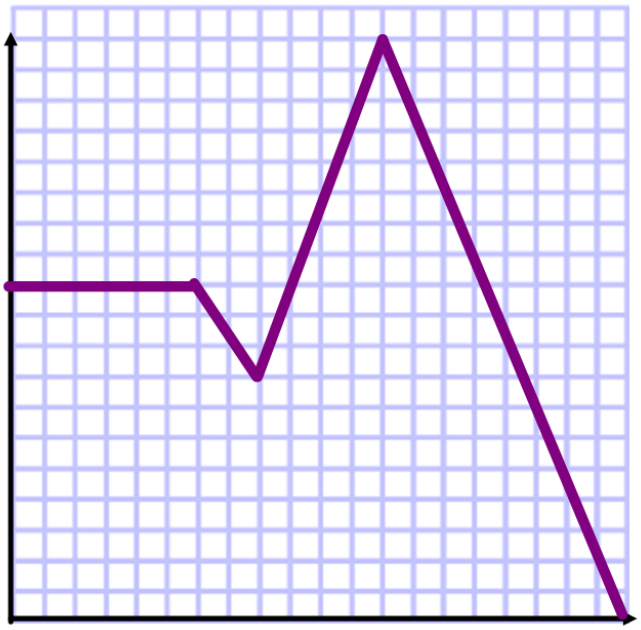


3. Use the situation described below to construct a graph that would satisfy that situation.

Pulse rate as you watch a scary movie



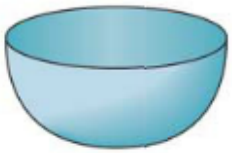
4. Use the graph provided to come up with a situation that would describe the graph. (you may not use speed/time)
Make sure to label the x-axis, y-axis, and describe each increment change



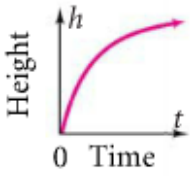
5. Choose the letter of the best answer. Then describe why you believe that answer is correct.

3 EXAMPLE **Relating Graphs to Situations**

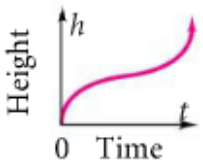
Multiple Choice Suppose you pour water into the container at a steady rate. Which graph shows the change in the height of the liquid in the container over time?



A



B



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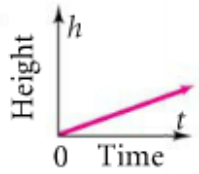

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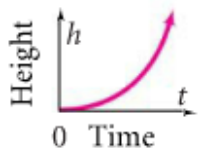


Independent and Dependent Variables

Name _____ **Date** _____

Identify the independent and dependent variables for each situation described below.

	Independent Variable	Dependent Variable
John measures the length and width of each side of a rectangle. He uses those values to calculate the area.		
$y = 4x + 1$		
David measures how many inches his tomato plant grows every week.		
Marks works full time as a busboy at a local café. He earns \$6 per hour and then an additional \$3 per hour for each hour over 40 hours that he works per week.		
The number of gum balls, g, that can be packaged in a box with a volume of V cubic units is given by $g = 40V + 15$.		
Jake works as a sales representative. He earns \$1,275 per month plus an 8% commission on his total sales.		

Mapping Diagrams and Vertical Line Test

In order for a group of relations to be considered a function, each _____ must have only one _____.

Activity #1: Identifying Relations and Functions

Determine if the relations form a function by setting up a table/mapping diagram. Then explain.

1.) {(-5, -4), (0, -4), (5, -4)}

2.) {(3, -1), (3, 0), (-3, 4), (3, 8)}

3.) {(-3, -2), (-1, 0), (1, 0), (5, -2)}

Activity #2: Vertical-Line Test

Apply the Vertical-Line Test to the graphs on the next page, and then determine if the relations form a function. If it is not, explain why.

1._____ 2._____ 3._____

4._____ 5._____ 6._____

Activity #3: Word Problems

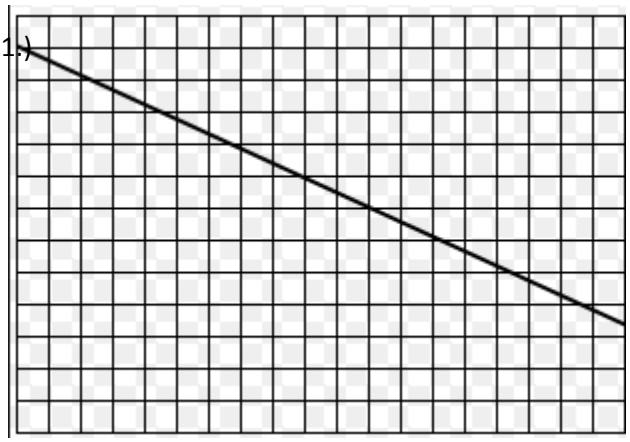
1.) Is the time you take to go to the library a function of the distance to the library? Explain.

2.) Is the price of a one-year subscription to your favorite magazine a function of the age of the subscriber? Explain.

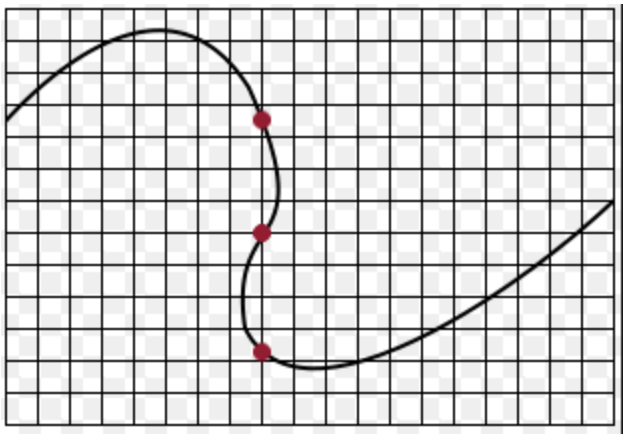
3.) Is the number of students on a field trip a function of the number of buses used? Explain.

Activity #2: Vertical-Line Test

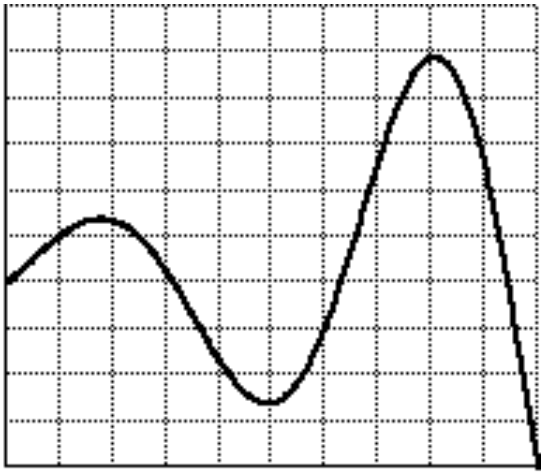
1.)



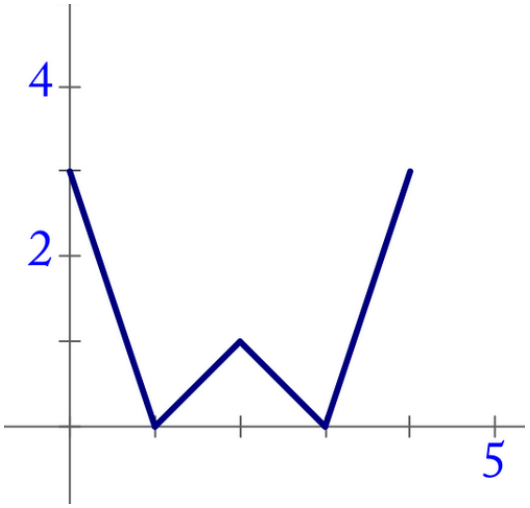
2.)



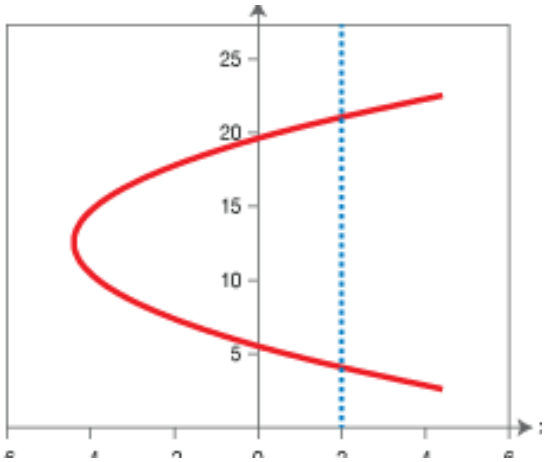
3.)



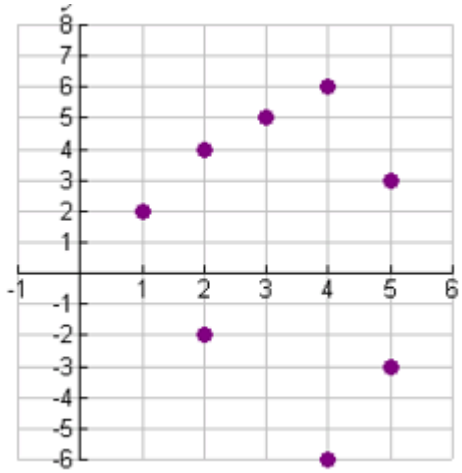
4.)



5.)



6.)

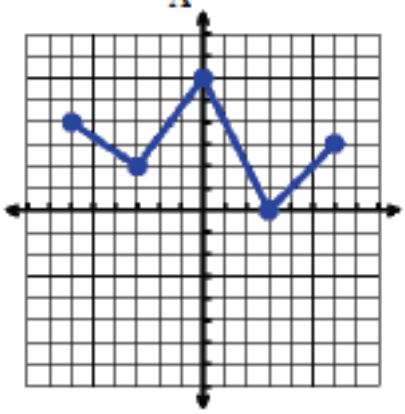


Domain and Range

Directions: Match each domain and range given in this table with a graph labeled from A to L on the attached page. Only use Graphs A – L for this page. Write the letter of your answer in the blank provided for each problem.

_____ 1. Domain: $\{-4 \le x \le 4\}$ Range: $\{-4 \le y \le 4\}$ Function: NO	_____ 2. Domain: $\{-3 < x \le 5\}$ Range: $\{y = -1\}$ Function: YES	_____ 3. Domain: $\{-4 \le x \le 2\}$ Range: $\{-2 \le y \le 4\}$ Function: YES
_____ 4. Domain: $\{x > 0\}$ Range: $\{y = 4\}$ Function: YES	_____ 5. Domain: $\{-6 \le x \le 6\}$ Range: $\{0 \le y \le 6\}$ Function: YES	_____ 6. Domain: $\{x = -5\}$ Range: $\{-2 < y < 6\}$ Function: NO
_____ 7. Domain: $\{x \ge 0\}$ Range: {all real numbers} Function: NO	_____ 8. Domain: $\{-3 \le x \le 4\}$ Range: $\{-2 \le y \le 4\}$ Function: NO	_____ 9. Domain: {all real numbers} Range: {all real numbers} Function: YES
_____ 10. Domain: $\{-7 \le x < 5\}$ Range: $\{-3 \le y < 1\}$ Function: YES	_____ 11. Domain: {all real numbers} Range: $\{y \ge 0\}$ Function: YES	_____ 12. Domain: $\{-3 < x < 4\}$ Range: $\{0 \le y \le 5\}$ Function: YES

A



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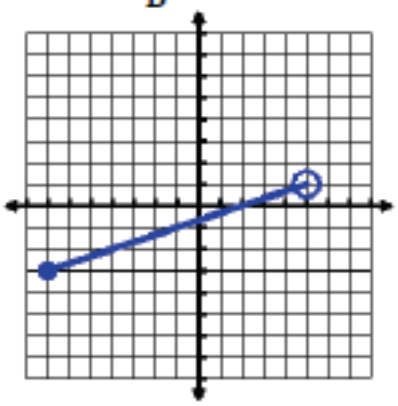

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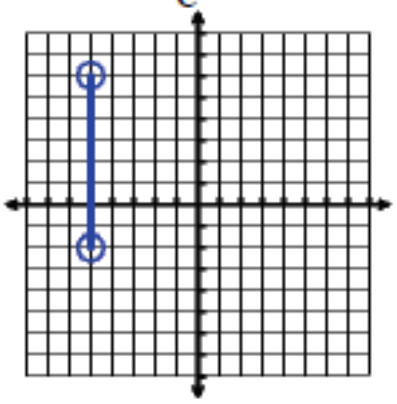

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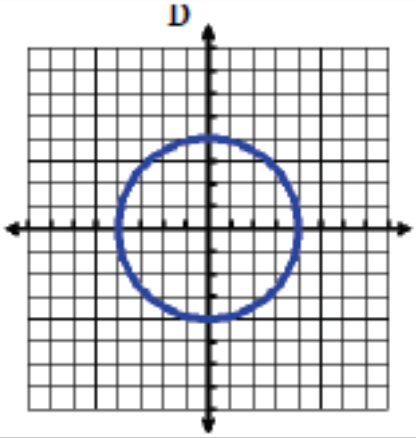

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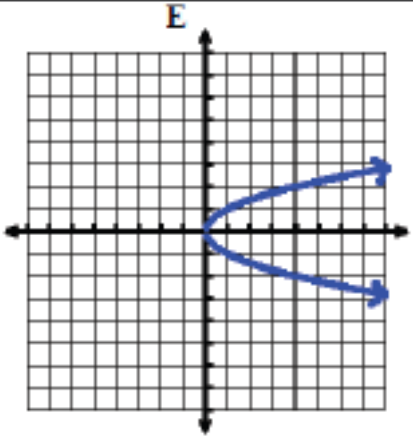

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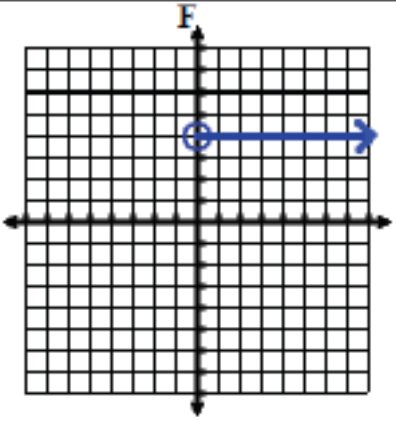

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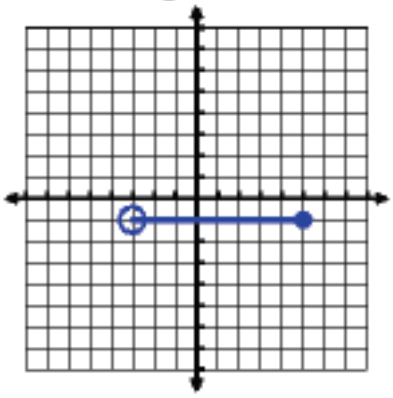
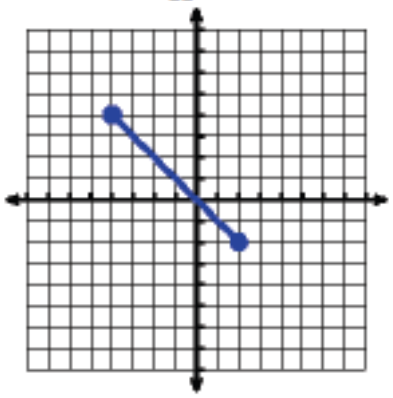
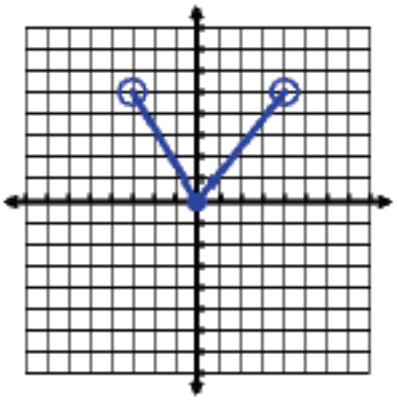


H



I



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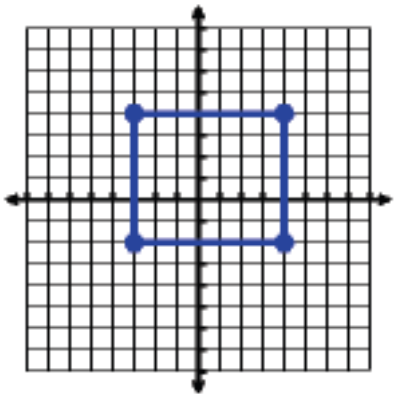
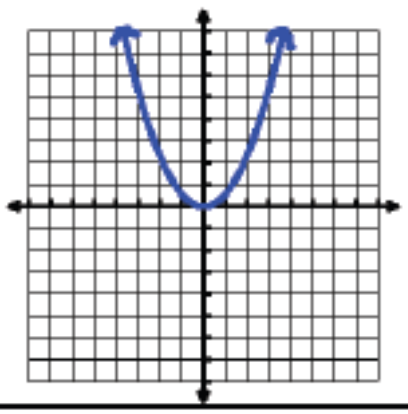
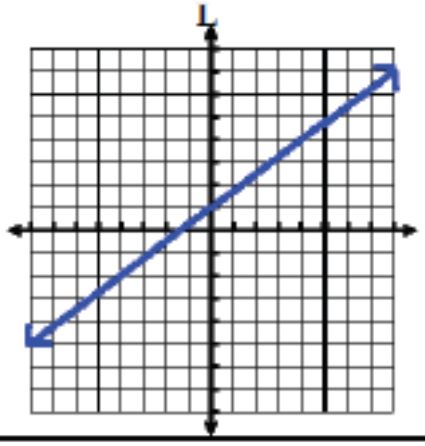


K



L

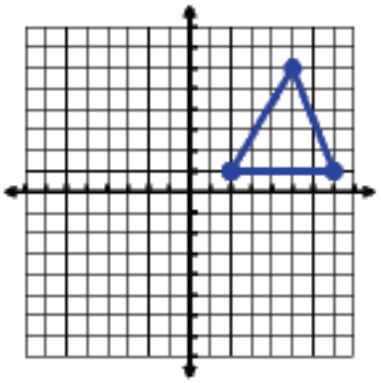


Domain and Range - 2

Directions: Match each domain and range given in this table with a graph labeled from M to X on the attached page. Only use Graphs A – L for this page. Write the letter of your answer in the blank provided for each problem.

_____ 13. Domain: $\{-6 \le x \le 3\}$ Range: $\{-6 \le y \le -1\}$ Function: YES	_____ 14. Domain: $\{0 \le x < 5\}$ Range: $\{0 \le y < 7\}$ Function: YES	_____ 15. Domain: $\{-5 \le x < 0\}$ Range: $\{-5 < y \le -1\}$ Function: YES
_____ 16. Domain: $\{-6 \le x \le 3\}$ Range: $\{-5 \le y \le -1\}$ Function: YES	_____ 17. Domain: $\{0 \le x \le 6\}$ Range: $\{0 \le y \le 7\}$ Function: YES	_____ 18. Domain: $\{-4 \le x \le 7\}$ Range: $\{-7 \le y \le -2\}$ Function: NO
_____ 19. Domain: $\{x \le 0\}$ Range: $\{y \ge 0\}$ Function: YES	_____ 20. Domain: $\{2 \le x \le 7\}$ Range: $\{1 \le x \le 6\}$ Function: NO	_____21. Domain: $\{0 \le x \le 4\}$ Range: $\{0 \le y \le 6\}$ Function: YES
_____ 22. Domain: $\{-4 < x < 5\}$ Range: $\{-2 \le y < 5\}$ Function: YES	_____ 23. Domain: $\{x \le 5\}$ Range: $\{y = 0\}$ Function: YES	_____ 24. Domain: $\{-7 < x < 0\}$ Range: $\{-3 < y < 4\}$ Function: YES

M



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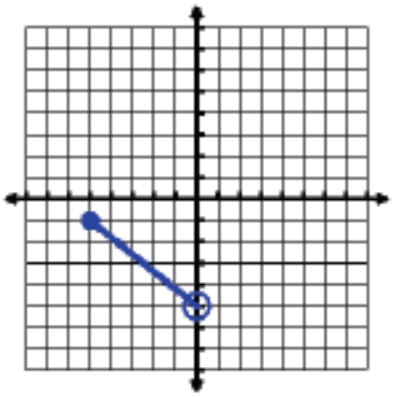

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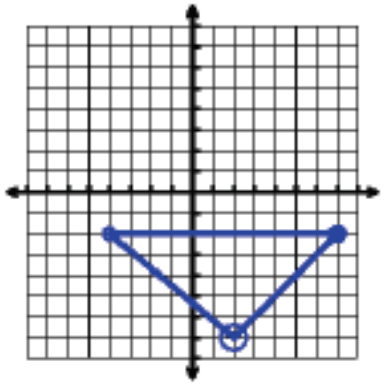

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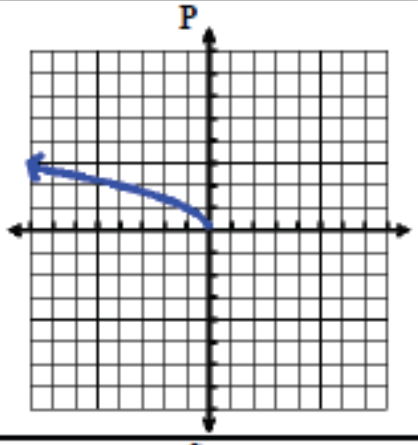

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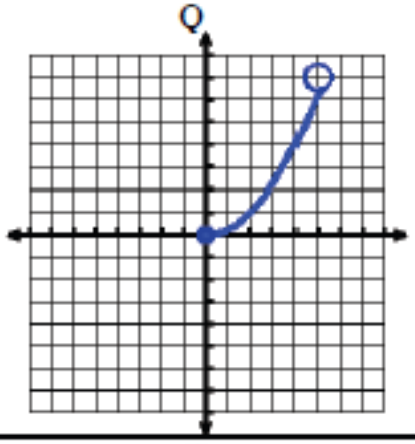

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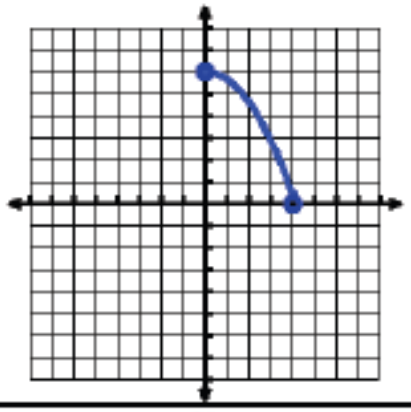
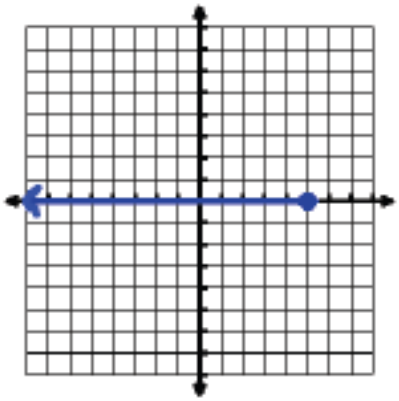


S



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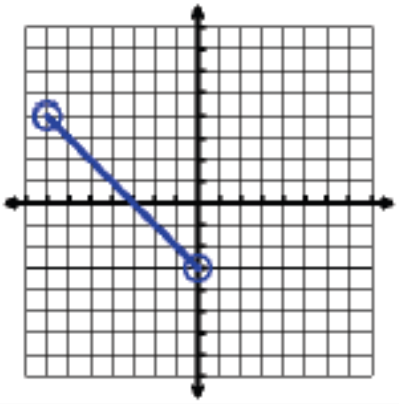
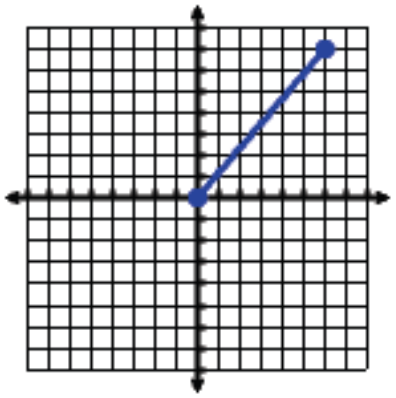
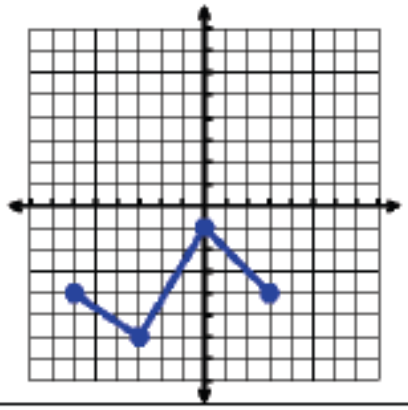


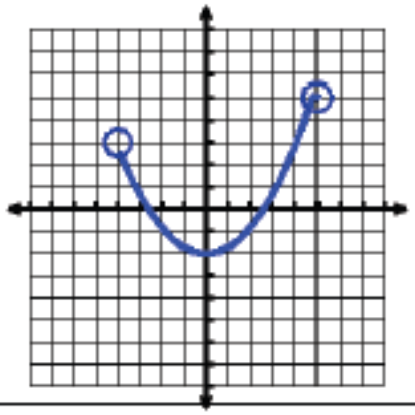
U



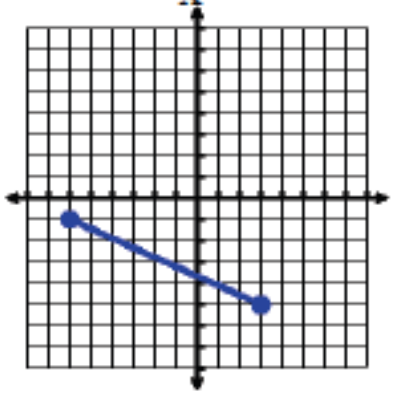
V



W



X



Writing Function Rules

Find the missing values and write a function rule for the table.

Input	Output
3	5
8	15
	21
21	

Rule:

Find f(2)

Find f(5)

Input	Output
2	24
0	0
–2	–24
5	60
10	120

Rule:

Find f(1)

Find f(100)

Input	Output
5	3.5
2	2
0	1
10	6
–5	–1.5

Rule:

Find f(8)

Write a function rule for each situation:

1.) A long-distance phone company charges its customers a monthly fee of $4.95 plus 9¢ for each minute of a long distance call. Write a function rule that relates the total monthly bill to the number of minutes a customer spent on long-distance calls.

2.) The Museum of Science in Boston, MA has an exhibit called *The Walk Through Computer TM 2000*. It is a scale model of a desktop computer. It is about 20 times the size of a normal sized desktop computer. Write a function rule to describe the relationship between the normal sized computer and the size of the exhibit.

b.) A space bar on a normal sized computer is 4 3/8 " long. About how long is the space bar in the exhibit?

3.) Write a function rule for the area of a square when you know the length of a side.

4.) Write a function rule that represents a linear relationship. Describe a situation in which it would be applicable.

5.) Write a function rule that represents a nonlinear relationship. Describe a situation in which it would be applicable.

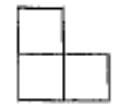
Writing Function Rules

Patterns Task
Dave's Towers of Terror

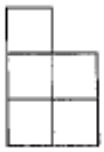
Name: _____

Period: _____ Date: _____

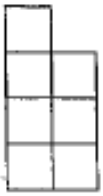
Dave had some blocks, so he stacked them into three scary towers that show a growing pattern. He's kind of a nerd, so he decided to represent those three scary towers mathematically in three ways.



Tower 1

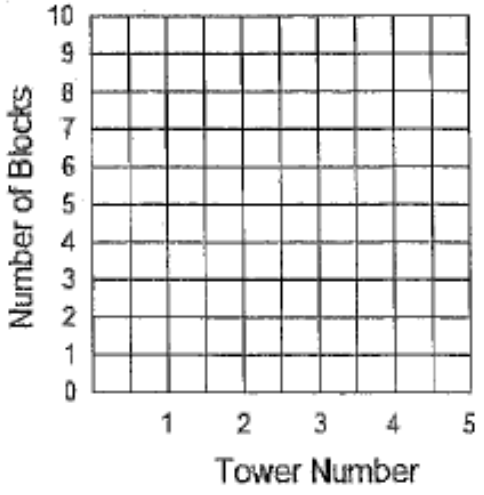


Tower 2



Tower 3

1. Represent Dave's data from the mosaics problem in three ways – a graph, a table, and a general function rule (an equation). The data should include the tower number and the number of blocks used to build the towers.

Graph	Table	Function Rule
		Let t = the tower number Let b = the number of blocks Write the function rule using the listed variables. _____

Tower	Blocks
1	
2	
3	
4	
5	

2. Write a description of how your function rule is related to the tower picture. Include a description of what is constant and what is changing as blocks are added.

3. How many blocks would be in the 12^{th} tower? Show how you determined your answer.

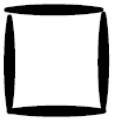
4. Would there be a mosaic in Dave's set that uses exactly 22 blocks? Explain your reasoning?

5. In Dave's towers, there is a single block on top. How would the function rule change if the block on the top of the tower was a stack of two blocks instead of just one? Show your answer showing two different representations (write a function rule and then choose to either draw a graph or a table for the second representation).

Writing Function Rules

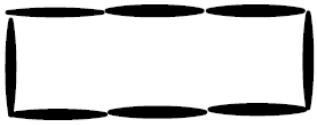
Toothpick Tasks

Shape 1



Shape 2

Shape 3



Shape 4

Shape 5

Table

Shape #	Perimeter	Area
1	4	1
2	6	2
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
N		

Graph

Graph

Represent the data from the toothpick problem in the following ways (D-PETS):

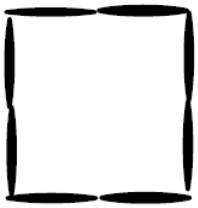
- **D**iagrams (draw shapes 4 and 5 – think about what is being done to create the next shape)
- **P**lot or Graph (plot points and label axes in the boxes above)
- **E**quation – write a general function rule for the perimeter and write a function rule for the area (let N = the shape number, P = perimeter, and A = area)

- **T**able (finish filling it out)
- **S**tory/Verbal description – Write a description of how your function rule is related to the toothpick pictures above. Include a description of what is constant and what is changing as toothpicks are added, and how this affects the perimeter and the area.

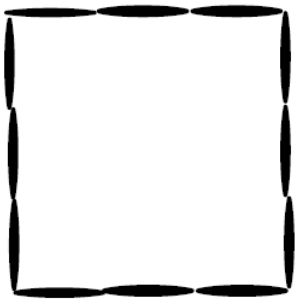
Would there be a shape in the pattern above with a perimeter of 21? Explain your reasoning using at least one representation.

Shape 1

Shape 2



Shape 3



Table

Shape #	Perimeter	Area
1	4	1
2	8	4
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
N		

Graph

Graph

Represent the data from the toothpick problem in the following ways (PETS):

- **P**lot or Graph (plot points and label axes in the boxes above)
- **E**quation – write a general function rule for the perimeter and write a function rule for the area (let N = the shape number, P = perimeter, and A = area)

- **T**able (finish filling it out)
- **S**tory/Verbal description – Write a description of how your function rule is related to the toothpick pictures above. Include a description of what is constant and what is changing as toothpicks are added, and how this affects the perimeter and the area.

Would there be a shape in the pattern above with an area of 225? Explain your reasoning using at least one representation.

Writing Function Rules

Garrett and Juan are tossing a basketball underhand back and forth in the gym. It takes 1.5 seconds for the ball to go from one person to the other.

1.) Is there a functional relationship between the height of the ball from the ground and time for a single toss? Explain.

2.) Which variable would be the independent variable? The dependent variable?

3.) Sketch and label a possible graph of one toss. Include units on your axes.

4.) What would be a reasonable domain and range for this single toss? Explain how you determined the possible values for the range.
Domain =
Range =

5.) While playing catch, suppose 0 was in the range. What would that mean?

6.) What would it mean if (0, 0) were a point on the graph that someone drew for this situation?

7.) Is there a functional relationship between the height of the ball from the ground and time over three tosses of the ball?

8.) Sketch and label a possible graph for three tosses of the ball. Include units on your axes.

9.) Describe the domain and range for three tosses of the ball.
Domain =
Range =

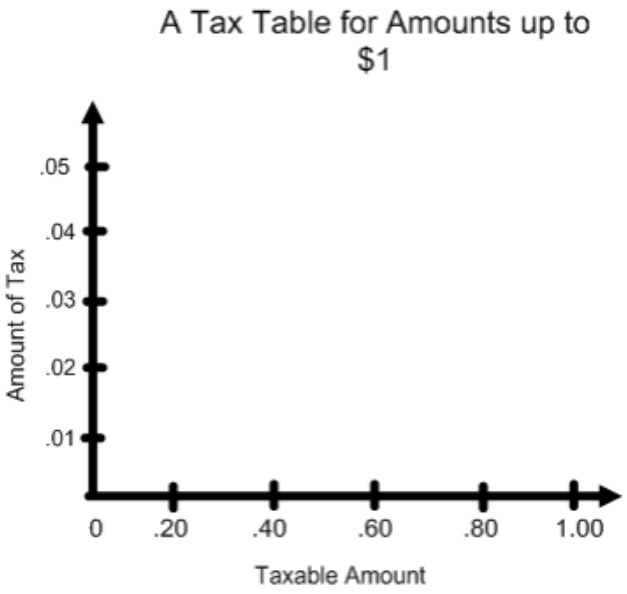
10.) Now, Garrett shoots the ball into a 10-ft tall basketball hoop. The height, h (in feet), of the ball depends on the time, t (in seconds), it has been in the air. His shot has a height which is modeled by the function $h(t) = -16t^2 + 40t$. What is the height of the ball at *h(1.5)* seconds?

Graphing Step Functions

You are selling candy bars. The taxable amounts and tax imposed up to $1 are shown below.

- For amounts between $0.01 and $0.20, the tax is $.01.
- For amounts greater than $0.20 and less than or equal to $0.40, the tax is $0.02.
- For amounts greater than $0.40 and less than or equal to $0.60, the tax is $0.03.
- For amounts greater than $0.60 and less than or equal to $0.80, the tax is $0.04
- For amounts greater than $0.80 and less than or equal to $1.00, the tax is $0.05.

1) Complete the graph to show the tax imposed on the candy bars.



Use the graph to answer the following questions:

2) A candy bar costs $0.55. What is the total cost with tax?

3) Your aunt purchased three candy bars at $0.55 apiece. What is the total cost with tax?

4) Someone purchased 4 candy bars at $0.55 apiece. They gave you $2 and a quarter. Is this enough money to cover the candy bars and the tax? Explain your answer.

5.) What is the domain and range of the graph?

Graphing Step Functions

Directions: Use a piece of graph paper to graph the following step functions.

1.)
$$f(x)=\begin{cases}5 & -2\le x<0\\ 3 & \text{if } 0\le x<2\\ 1 & 2\le x<4\end{cases}$$

2.)
$$t(x)=\begin{cases}8 & 0\le x<3\\ 5 & \text{if } 3\le x<6\\ 2 & 6\le x<9\end{cases}$$

3.)
$$g(x)=\begin{cases}7 & -5\le x<-1\\ 3 & \text{if } -1\le x<3\\ -1 & 3\le x<7\end{cases}$$

4.)
$$f(x)=\begin{cases}-2 & -6<x<0\\ 2 & if \quad 0<x<3\\ 7 & 4<x<7\end{cases}$$

5.)
$$g(x)=\begin{cases}4 & -10<x\le -8\\ 6 & -8<x\le -6\\ 8 & if \quad -6<x\le -4\\ 9 & -4<x\le -2\\ 10 & -2<x\le 0\end{cases}$$