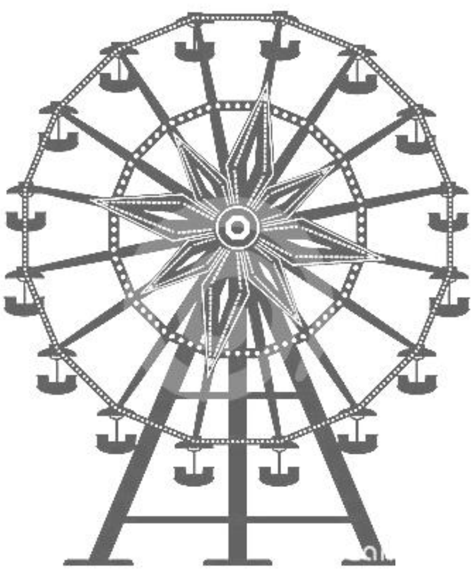
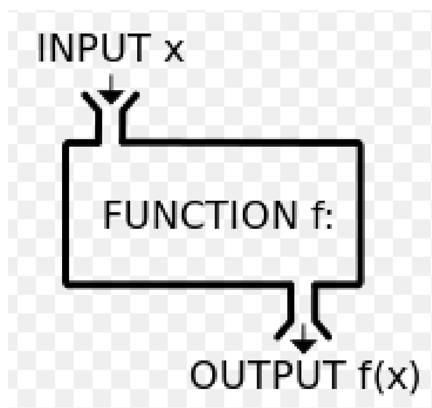
Beaumont Middle School
8th Grade, 2018-2019
Advanced Algebra I
Topic 3a

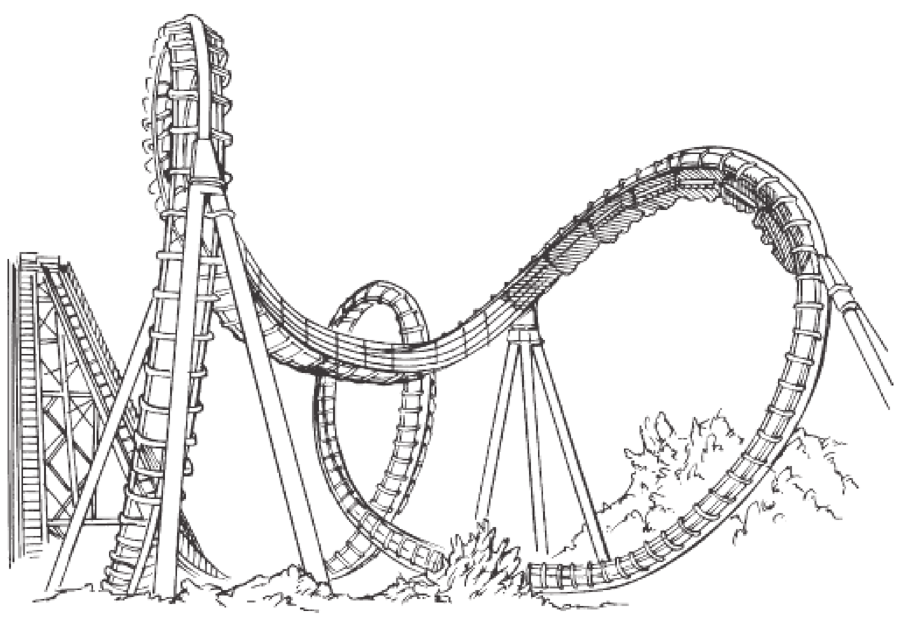
Name: ______________________________

Introduction to Functions

- I can model a life situation with a graph.
- I can distinguish between a function and a relation.
- I can represent ordered pairs as a list, a map, a table, and a graph.
- I can identify the domain and range.
- I can evaluate an equation utilizing function notation.







Graphs to Model Real-Life Situations

This assignment will be completed in class as an activity for more than one day.

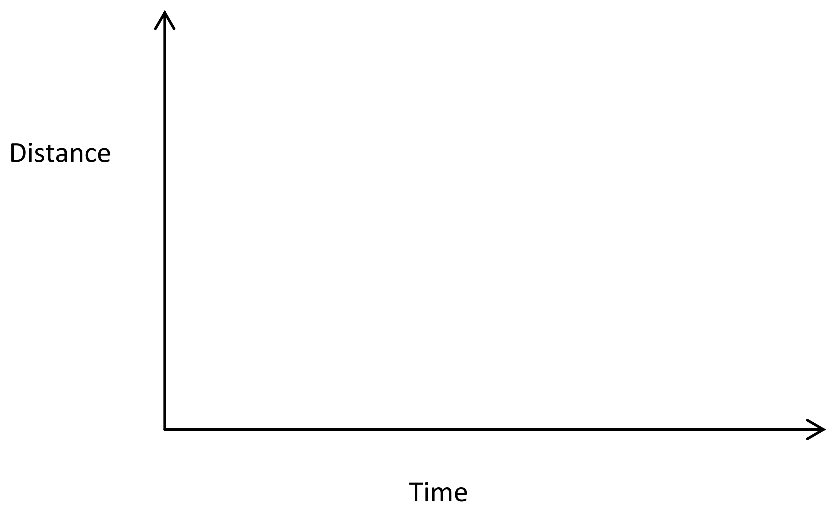
A. CHOOSE THE CORRECT GRAPH THAT DEPICTS THE SITUATION.

1. _____ Train Station 2. ______ Ferris Wheel 3. ______ Hill Climbing

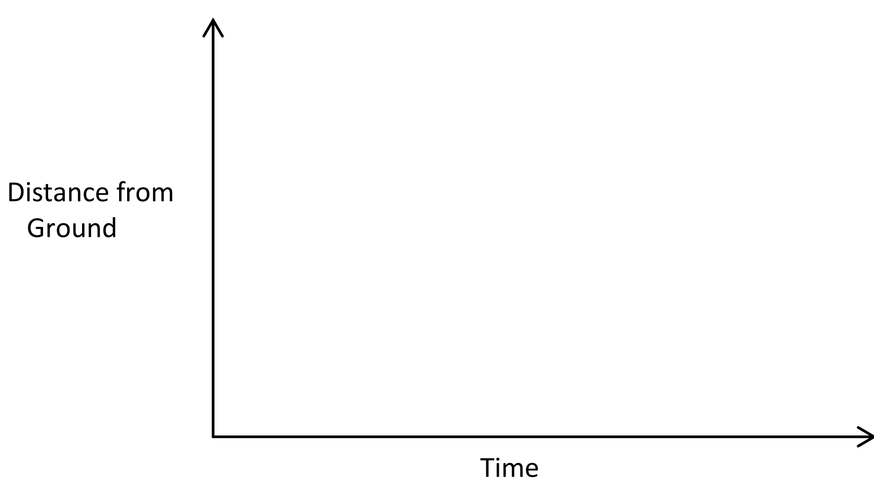
4. _____ Child Swinging 5. _____ Child on Slide

B. SKETCH A GRAPH OF THE FOLLOWING SITUATIONS.

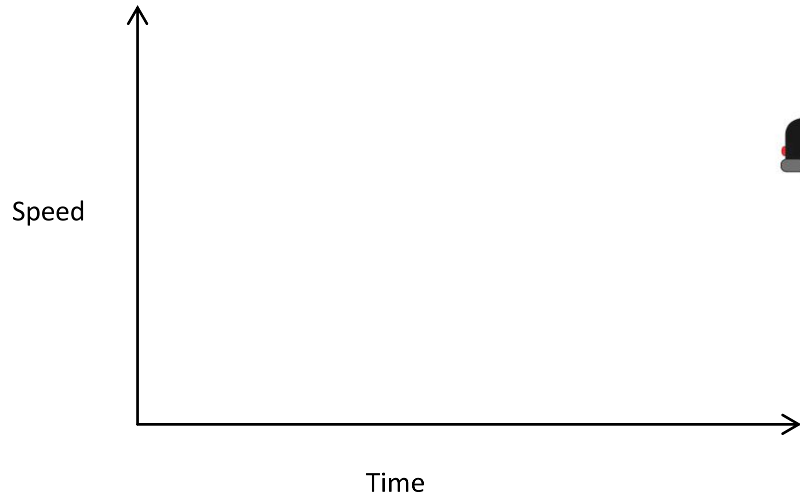
1. Sara



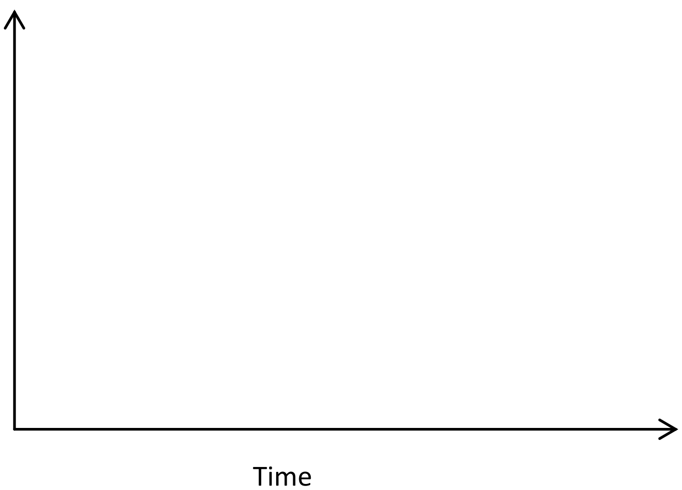
2. Rashid



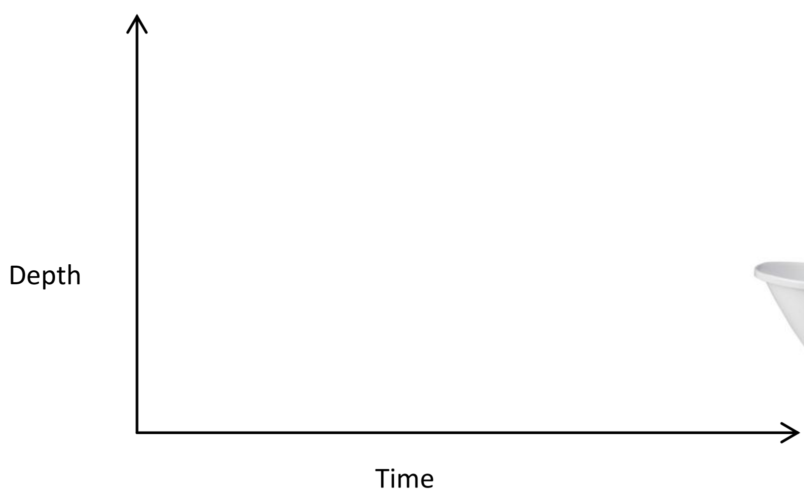
3. Kendra



4. Frozen Dinners

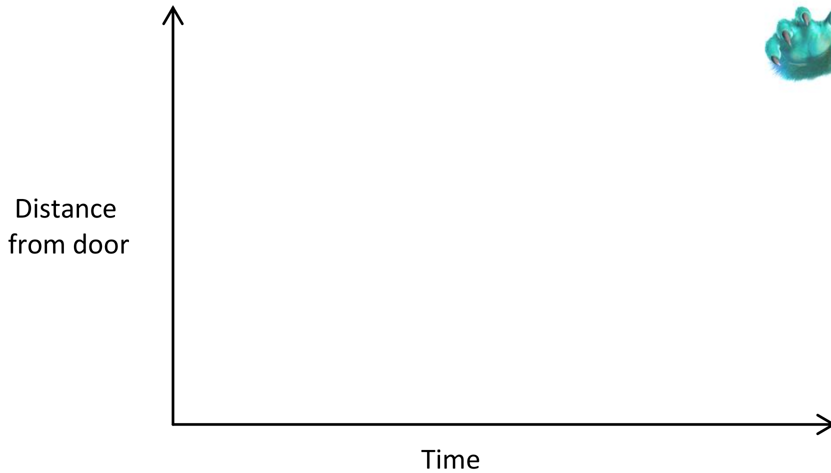


5. Water Level

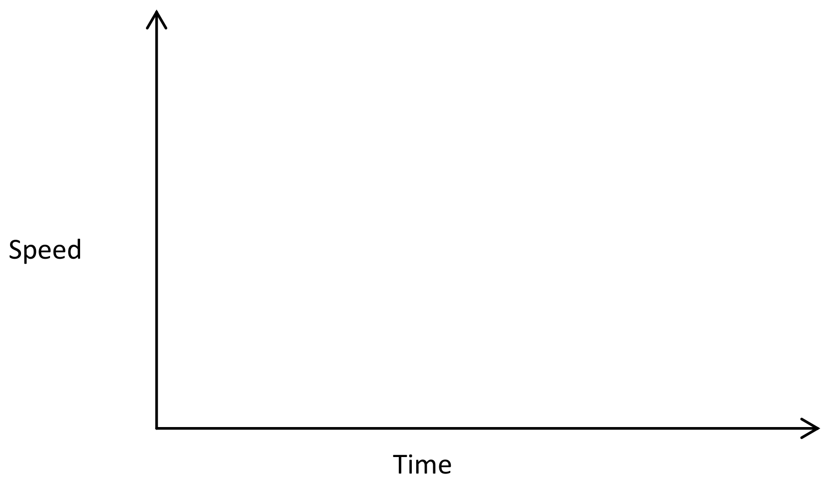


C. SKETCH A GRAPH OF THE ACTION IN EACH MOVIE CLIP.

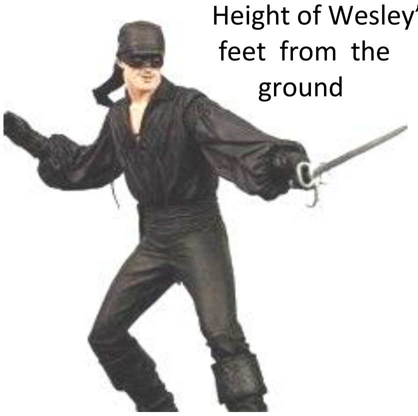
1. Sully

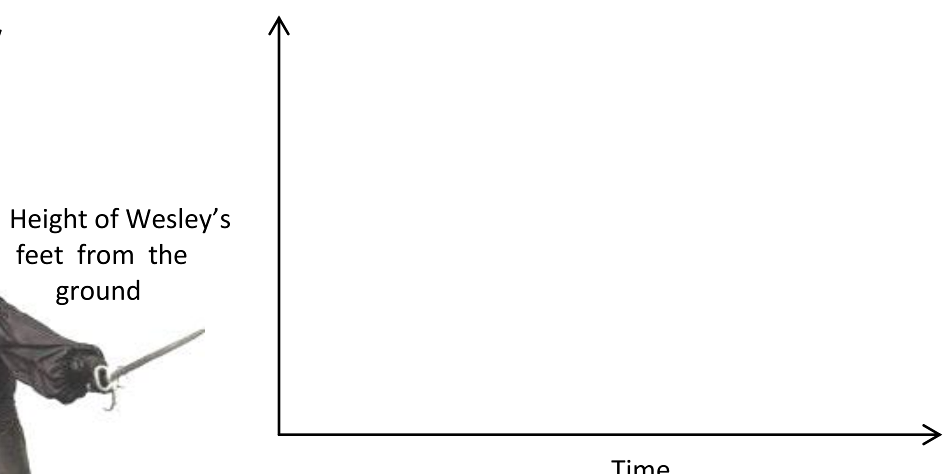


2. Dash

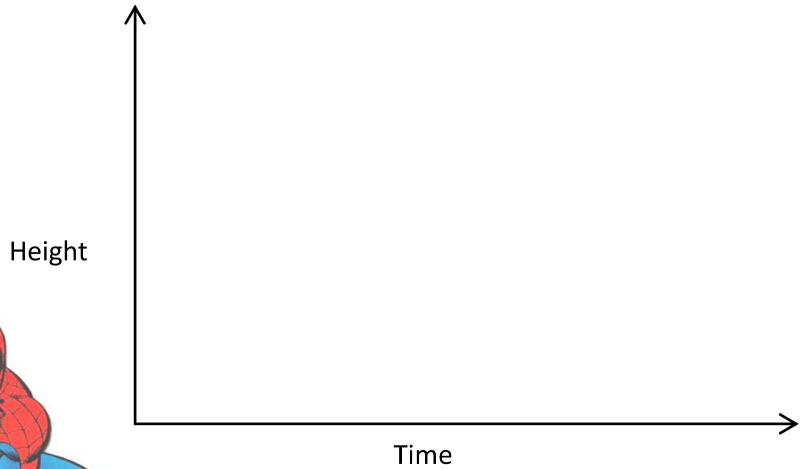


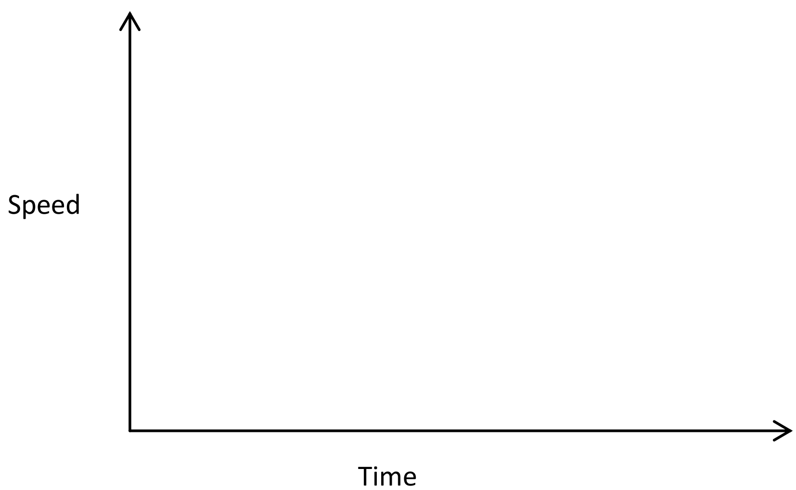
3. Wesley



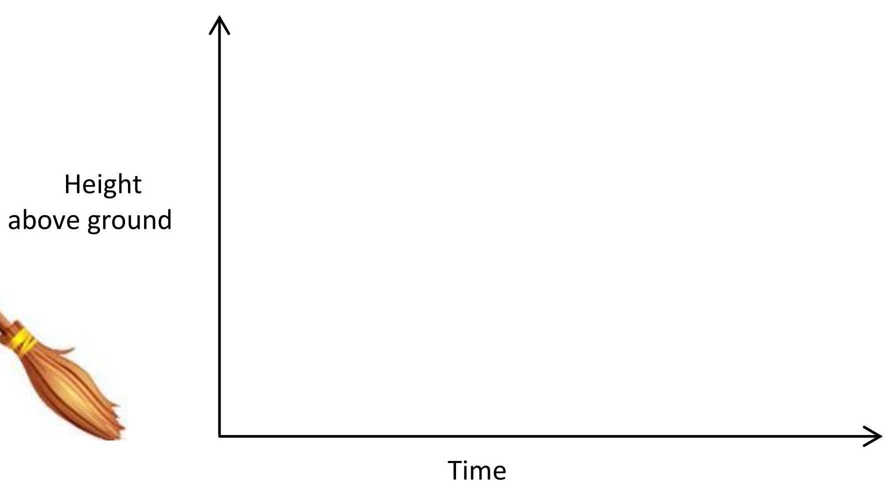


4. Spiderman





5. Neville

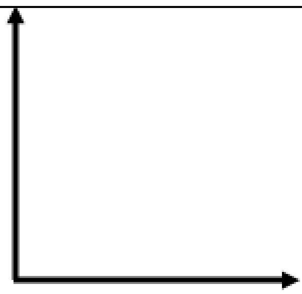


Graphing Situations Practice #1

Choose the best graph for the given situation. Copy the graph and label the axes with the variables given in parentheses. The first variable named goes on the x-axis, the second goes on the y-axis.

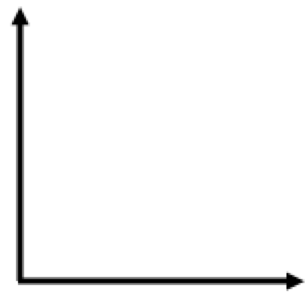
1) Allison walked from home to the library, did some homework, then walked back.

(Variables: **time** and **distance from home**)

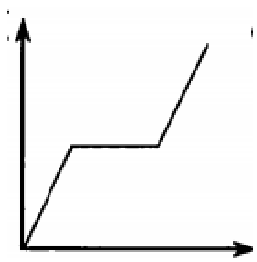


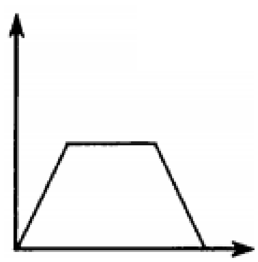
2) Allison walked from home to the library, did some homework, then walked back.

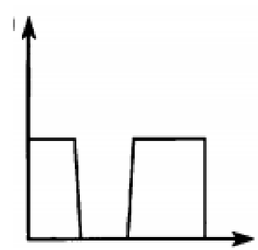
(Variables: **time** and **speed**)



Choices for #1 and #2:

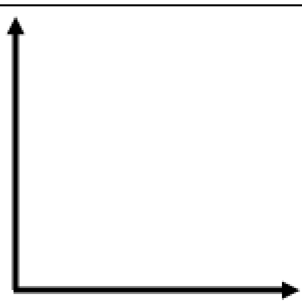






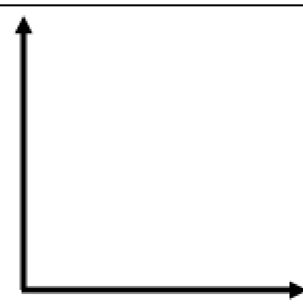
3) When jogging, Gavin starts slowly, builds up to a comfortable speed, then slows down near the end.

(Variables: **time** and **distance**)

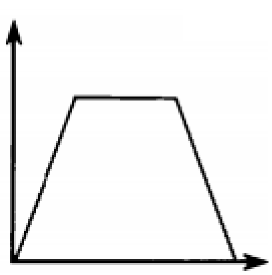


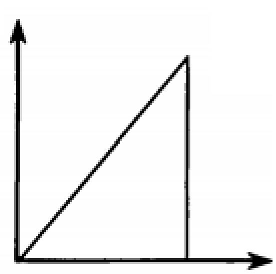
4) When jogging, Gavin starts slowly, builds up to a comfortable speed, then slows down near the end.

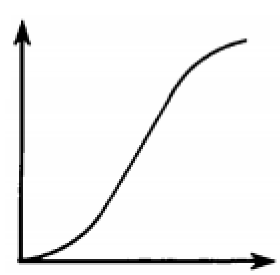
(Variables: **time** and **speed**)



Choices for #3 and #4:







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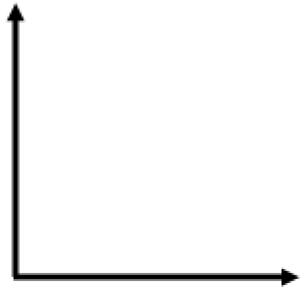
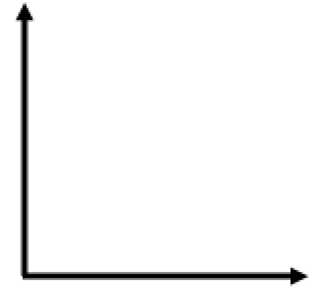
5) Mr. Thompson walked to the subway station, waited a few minutes, then got on a train.

(Variables: **time** and **distance**)

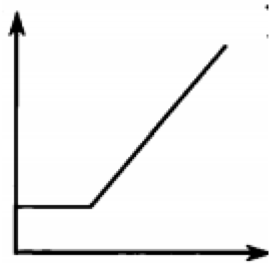


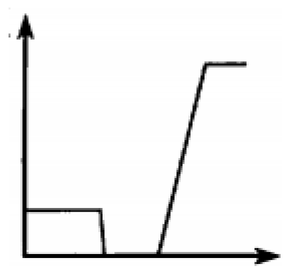
6) Mr. Thompson walked to the subway station, waited a few minutes, then got on a train.

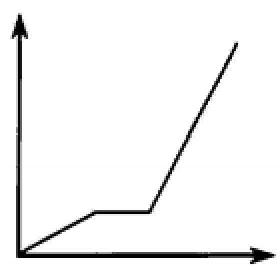
(Variables: **time** and **speed**)



Choices for #5 and #6:

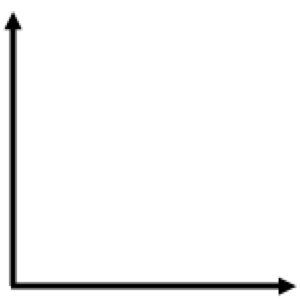






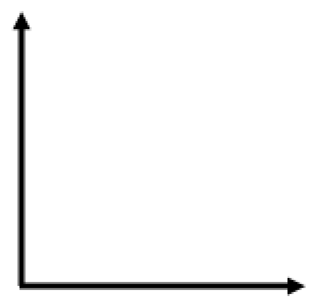
7) Mr. Randall carried a box of yearbooks from the office to his classroom.

(Variables: # **of books in box** and **weight of box**)

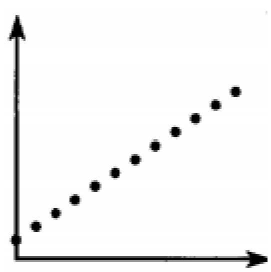


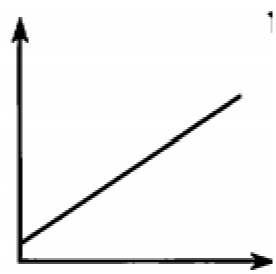
8) Every week the plant in our classroom is taller than the week before.

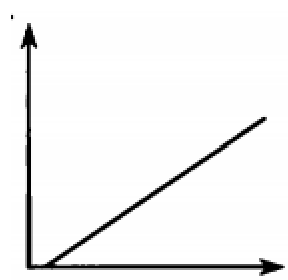
(Variables: # **of weeks** and **height of plant**)



Choices for #7 and #8:







Homework is continued on the next page

Review

Simplify without a calculator. You should be able to calculate these mentally.

1) $\frac{480}{6} =$ **2)** $\frac{300}{50} =$ **3)** $\frac{42000}{700} =$ **4)** $\frac{72000}{90} =$

5) $\frac{\mathbf{52}}{\mathbf{2}} =$ **6)** $\frac{246}{2} =$ **7)** $\frac{963}{3} =$ **8)** $\frac{562}{2} =$

Construct a number line on the grid and then graph the following sets of numbers.

5) $\{-2, -4, 1\}$ using an interval of 1

6) $\left\{\frac{23}{10}, \frac{8}{3}, \frac{9}{4}\right\}$ using an interval of 0.1

Solve the following equations.

7) $\frac{2x+6}{5} = -8$

8) $\frac{x}{7} - 4 = 3$

9) $7 - (2x - 4) = -3x$

10) $6(2x + 4) - 7 = 3(-4x + 5) + 2$

11) $4(-2x + 3) - 10 = -8(x - 2) - 7$

12) $9 - \frac{2}{3}x = 17$

13) $5 - \frac{x}{4} = 12$

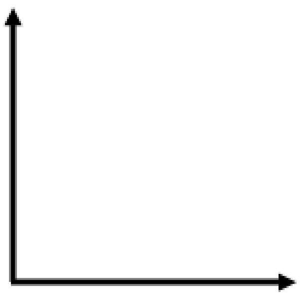
14) $6x - \frac{2}{3}(9x + 12) = -8$

Graphing Situations Practice #2

Choose the best graph for the given situation. Copy the graph and label the axes with the variables given in parentheses. The first variable named goes on the x-axis, the second goes on the y-axis.

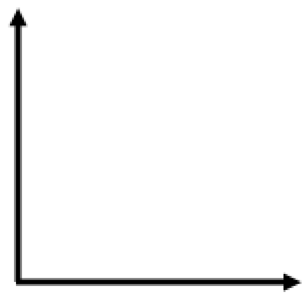
1) Each month the baby hippo weighed twice as much as it had weighed the month before.

(Variables: **time** and **weight**)

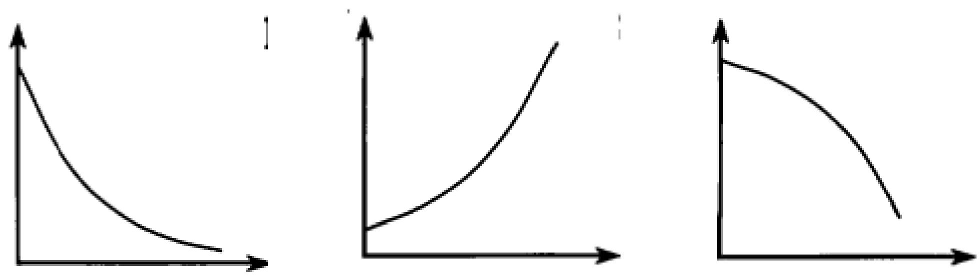


2) Each hour there was half as much medication in the blood as there had been an hour before.

(Variables: **time** and **medication**)

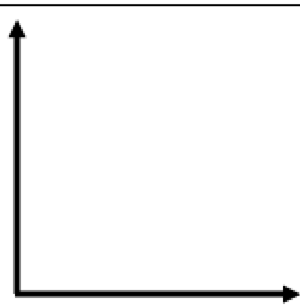


Choices for #1 and #2:



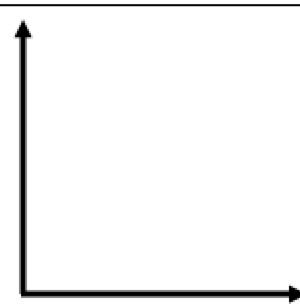
3) Erica walked from home to a friend's house, watched TV for a while, then walked back home.

(Variables: **time** and **Erica's distance from home**)

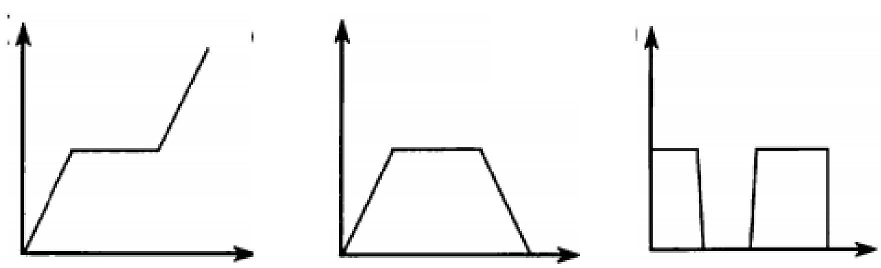


4) Erica walked from home to a friend's house, watched TV for a while, then walked back home.

(Variables: **time** and **Erica's speed**)



Choices for #3 and #4:



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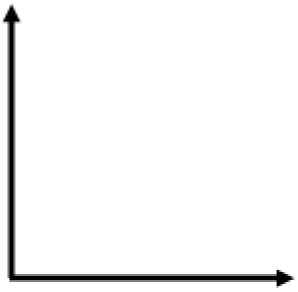
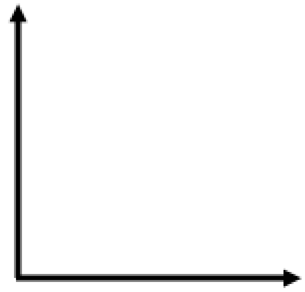
5) As our subway train leaves Station A, it accelerates to top speed, then maintains this speed until it begins to slow down and finally stops at Station B.

(Variables: **time** and **distance from Station A**)

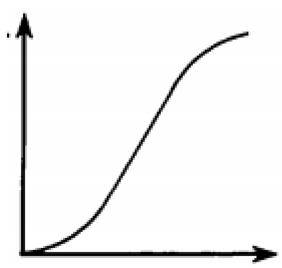


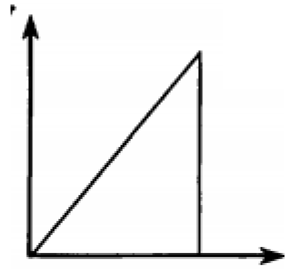
6) As our subway train leaves Station A, it accelerates to top speed, then maintains this speed until it begins to slow down and finally stops at Station B.

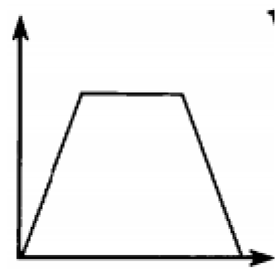
(Variables: **time** and **speed from Station A**)



Choices for #5 and #6:

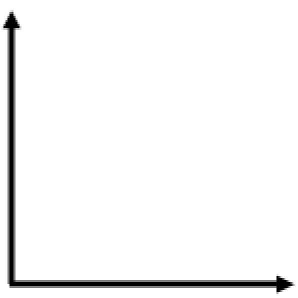






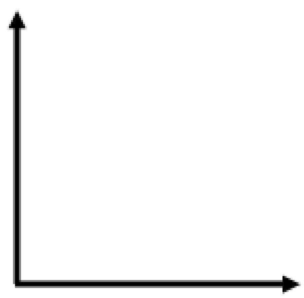
7) A backpacker hikes toward a campsite at a steady rate until he stops for a while to rest. Then he continues at the original rate until he stops at the campsite.

(Variables: **time** and **distance from campsite**)

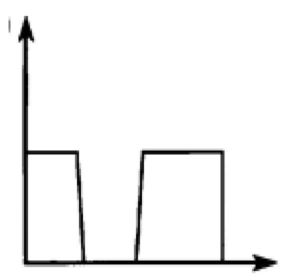


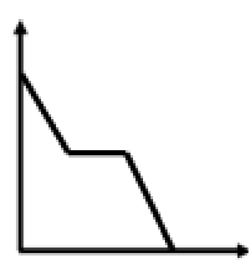
8) A backpacker hikes toward a campsite at a steady rate until he stops for a while to rest. Then he continues at the original rate until he stops at the campsite.

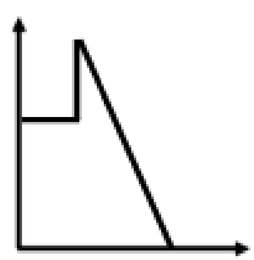
(Variables: **time** and **speed**)



Choices for #7 and #8:







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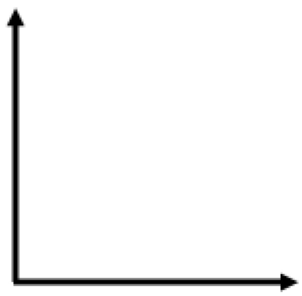
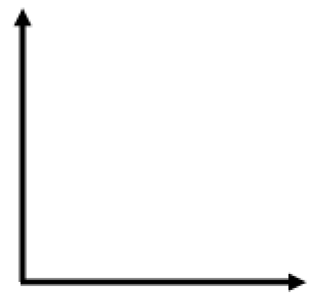
9) The roller coaster goes slower and slower as it rolls uphill. Then it goes faster and faster as we roll down the other side.

(Variables: **time** and **distance travelled**)

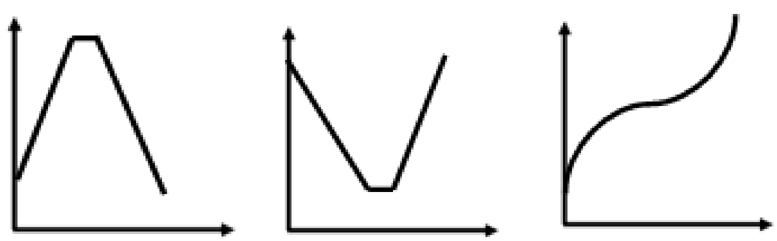


10) The roller coaster goes slower and slower as it rolls uphill. Then it goes faster and faster as we roll down the other side.

(Variables: **time** and **speed of the coaster**)



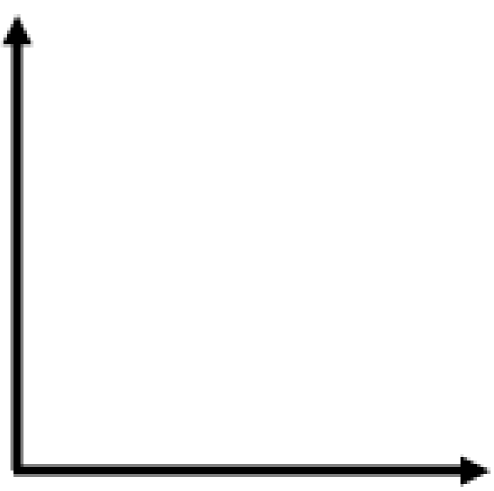
Choices for # 9 and 10:



Sketch a graph for each situation. Label each axis as indicated.

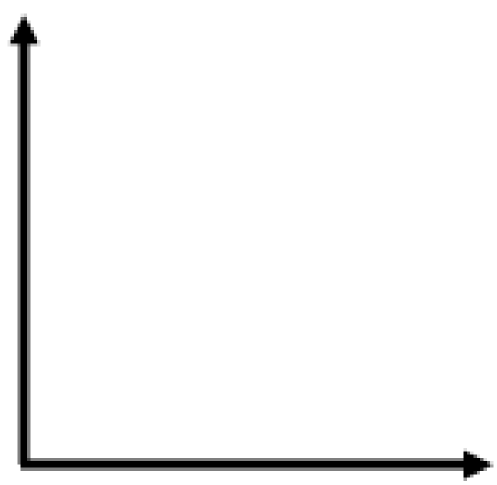
11) Katie walked to school from home at a steady rate, then realized she was late and ran the rest of the way at top speed.

(Variables: **time** and **distance from home**)



12) Jude rode his bike up a hill at a slow but steady speed, then went faster and faster as he rode down the other side.

(Variables: **time** and **speed**)



Homework is continued on the next page

Review

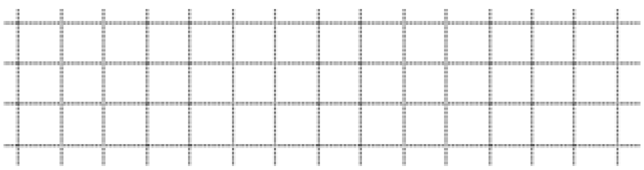
Simplify without a calculator.   You should be able to calculate these mentally.

1) $\frac{5600}{80} =$ **2)** $\frac{45000}{90} =$ **3)** $\frac{6400}{800} =$ **4)** $\frac{240000}{600} =$

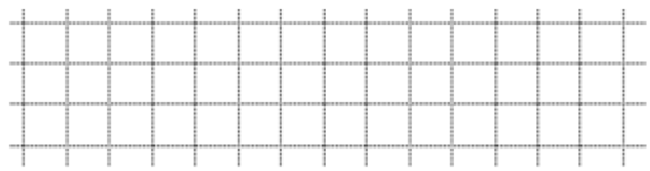
5) $\frac{\mathbf{2005}}{\mathbf{5}} =$ **6)** $\frac{633}{3} =$ **7)** $\frac{460}{4} =$ **8)** $\frac{7204}{2} =$

Construct a number line on the grid and then graph the following sets of numbers.

5) $\{3, -5, -2\}$ using an interval of 1



6) $\left\{-\frac{39}{10}, -\frac{15}{4}, -\frac{10}{3}\right\}$ using an interval of 0.1



Solve the following equations.

7) $\frac{-5x+6}{7} = -2$

8) $-\frac{x}{3} + 4 = 8$

9) $9-(-3x - 7) = 2x$

10) $\frac{2}{7}\left[x-(3x-21)\right] = 18$

11) $8(-2x + 3) - 1 = -4(4x - 2) + 17$

12) $16-\frac{4}{5}x = -24$

13) $9 - \frac{x}{7} = -2$

14) $6x - \frac{1}{4}(8x - 12) = -17$

Relations and Functions

A relation is a set of ordered pairs.

{(2,3), (-1,5), (4,-2), (9,9), (0,-6)} ← This is a relation

The **domain** is the set of all x values in the relation

{(2,3), (-1,5), (4,-2), (9,9), (0,-6)}

These are the x values written in a set from smallest to largest

domain = {-1,0,2,4,9}

The **range** is the set of all y values in the relation

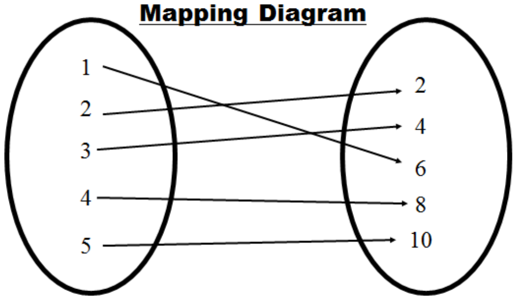
{(2,3), (-1,5), (4,-2), (9,9), (0,-6)}

These are the y values written in a set from smallest to largest

range = {-6,-2,3,5,9}

A relation assigns the x's with y's

Mapping Diagram



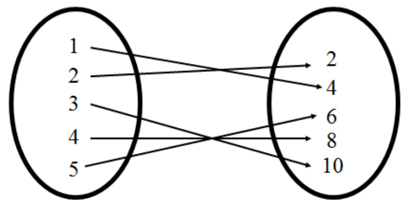
Domain (set of all x's)

Range (set of all y's)

This relation can be written {(1,6), (2,2), (3,4), (4,8), (5,10)}

A function *f* from set A to set B is a rule of correspondence that assigns to each element *x* in the set A **exactly** one element *y* in the set B.

All x's are assigned



No x has more than one y assigned

Set A is the domain

Set B is the range

This is a function ---it meets our conditions

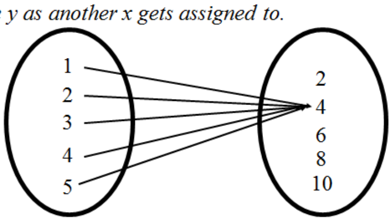
Must use all the x's

The x value can only be assigned to one y

Let's look at another relation and decide if it is a function.

*The second condition says each x can have only one y, but it **CAN** be the same y as another x gets assigned to.*

All x's are assigned



No x has more than one y assigned

Set A is the domain

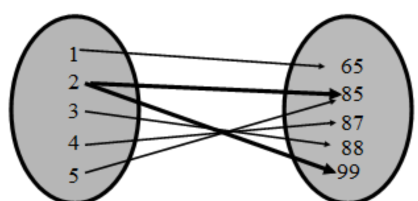
Set B is the range

This is a function ---it meets our conditions

Must use all the x's

The x value can only be assigned to one y

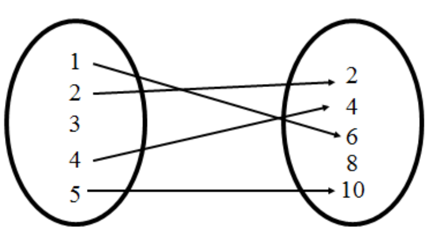
A good example that you can "relate" to is students in our maths class this semester are set A. The grade they earn out of the class is set B. Each student must be assigned a grade and **can only be assigned ONE grade**, but more than one student can get the same grade (we hope so---we want lots of A's). The example shown on the previous screen had each student getting the same grade. That's okay.



Is the relation shown above a function? ***NO*** **Why not???**

Student #2 was assigned both 85 and 99

Check this relation out to determine if it is a function.



Set A is the domain

Set B is the range

This is not a function---it doesn't assign each x with a y

Must use all the x's

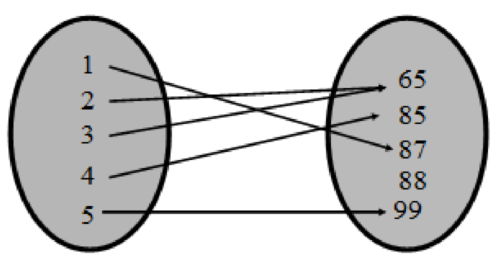
It is not---3 didn't get assigned to anything

Comparing to our example, a student in math must receive a grade

The x value can only be assigned to one y

Check this relation out to determine if it is a function.

This is fine—each student gets only one grade. More than one can get an A and I don't have to give any D's (so all y's don't need to be used).



Set A is the domain

Set B is the range

This is a function

Must use all the x's

The x value can only be assigned to one y

Notes: Function or Not a Function????

Determine which of the relations below are functions. Circle the correct answer.

Sets of Coordinates:

1) {(−2, 7), (−1, 5), (0, 3), (1, 1), (2, 1)} — Function or Not a Function

2) {(−7, 20), (3, 5), (0, 5), (−2, 0), (6, −4), (−6, −9), (4, 4)} — Function or Not a Function

3) {(4, 8), (−3, −2), (9, 6), (2, −1), (−4, −5), (2, 7), (−8, 0)} — Function or Not a Function

Tables of Values:

4)

x	y
0	−19
1	−12
2	−4
3	3
4	13
5	27

Function or Not a Function

5)

x	y
−5	8
−3	8
−1	−2
1	−2
3	11
5	23

Function or Not a Function

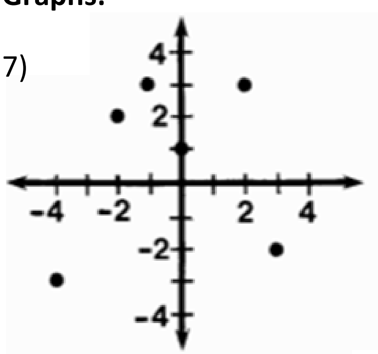
6)

x	y
−2	−7
−2	5
0	−16
2	0
2	6

Function or Not a Function

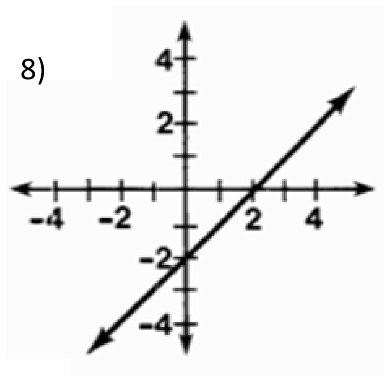
Graphs:

7)



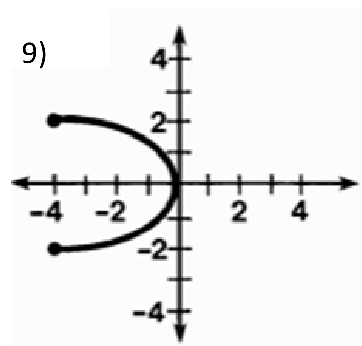
Function or Not a Function

8)



Function or Not a Function

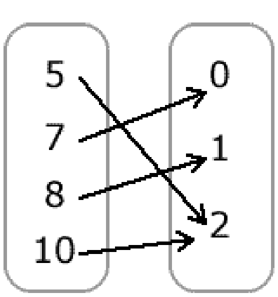
9)



Function or Not a Function

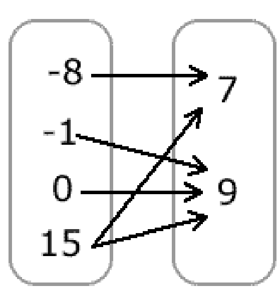
Mapping Diagrams:

10)



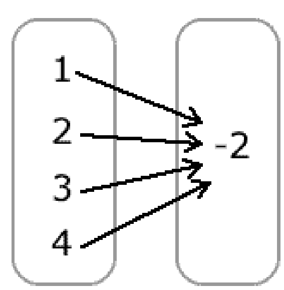
Function or Not a Function

11)



Function or Not a Function

12)



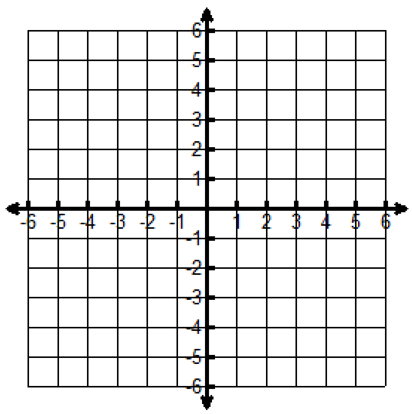
Function or Not a Function

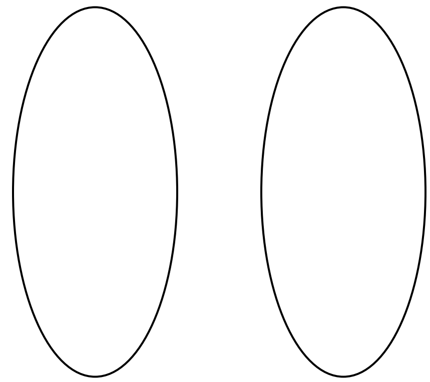
More Notes: Representing Relations

Express the relation as a table, a graph, and a mapping. Then determine the domain and range. Determine whether each relation is a function.

13) $\{(-1,-1),(1,1),(2,5),(3,2)\}$

x	y





Domain: ______________________ Range: ________________________ Function? ______

Homework: Function or Not a Function???

Determine which of the relations below are functions. Circle the correct answer.

1) $\{(1, -2), (-2, 0), (-1, 2), (1, 3)\}$ Function or Not a Function

2) $\{(1, 1), (2, 2), (3, 5), (4, 10), (5, 15)\}$ Function or Not a Function

3) $\left\{\left(17,\frac{15}{4}\right),\left(\frac{15}{4},17\right),\left(15,\frac{17}{4}\right),\left(\frac{17}{4},15\right)\right\}$ Function or Not a Function

4)

x	y
-5	-2
-4	-1
-3	0
-4	1
-5	2

Function or Not a Function

5)

x	y
-5	-2
-4	-1
-3	0
-2	-1
-1	-2

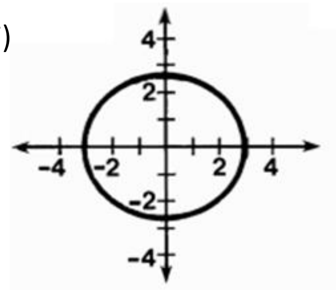
Function or Not a Function

6)

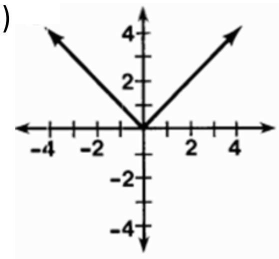
x	y
-5	-2
-4	2
-3	-2
-2	2
-1	-2

Function or Not a Function

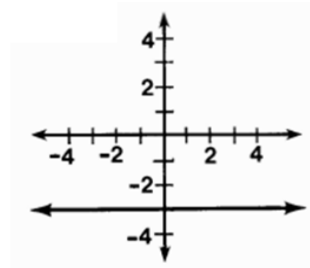
Homework is continued on the next page

7) 

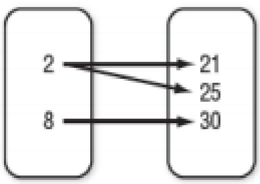
Function or Not a Function

8) 

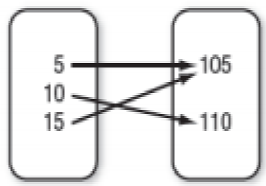
Function or Not a Function

9) 

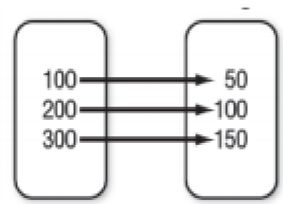
Function or Not a Function

10) 

Function or Not a Function

11) 

Function or Not a Function

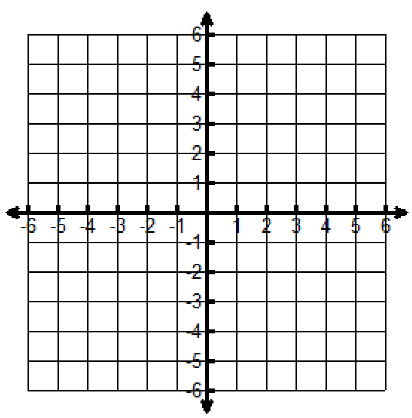
12) 

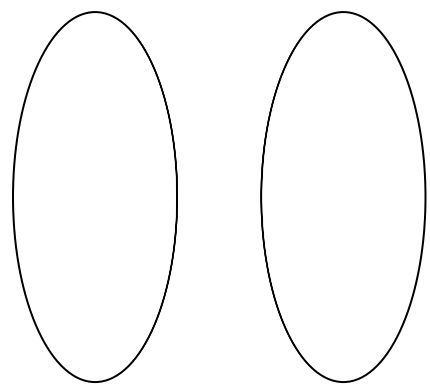
Function or Not a Function

Representing Relations: Express the relation as a table, a graph, and a mapping. Then determine the domain and range. Determine whether each relation is a function.

13) $\{(0,4),(-4,-4),(-2,3),(4,0)\}$

x	y

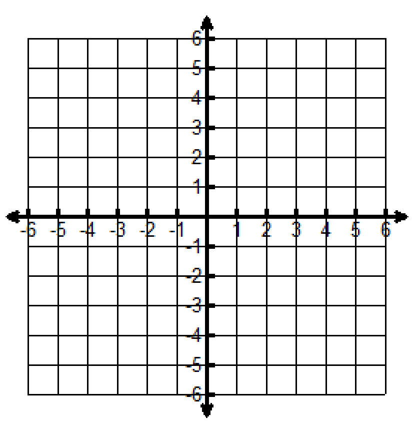


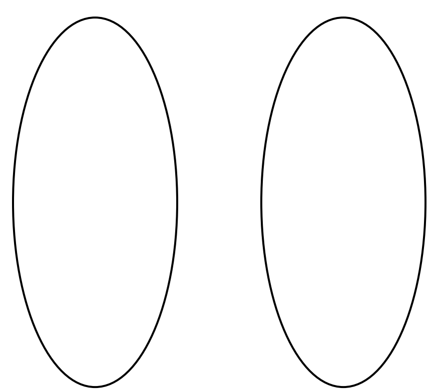


Domain: ______________________ Range: ________________________ Function? ______

14) $\{(3,-2),(1,0),(-2,4),(3,1)\}$

x	y





Domain: ______________________ Range: ________________________ Function? ______

Function Notation

We commonly call functions by letters. Because function starts with *f*, it is a commonly used letter to refer to functions.

$$f(x) = 2x^2 - 3x + 6$$

This means the right hand side is a function called *f*

This means the right hand side has the variable x in it

The left side DOES NOT MEAN f times x like brackets usually do, it simply tells us what is on the right hand side.

The left hand side of this equation is the function notation. It tells us two things. We called the function *f* and the variable in the function is *x*.

Remember---this tells you what is on the right hand side---it is not something you work. It says that the right hand side is the function f and it has x in it.

$$f(x) = 2x^2 - 3x + 6$$

$$f(2) = 2(2)^2 - 3(2) + 6$$

$$f(2) = 2(4) - 3(2) + 6 = 8 - 6 + 6 = 8$$

So we have a function called *f* that has the variable *x* in it.

Using function notation we could then ask the following:

Find *f* (2).

This means to find the function f and instead of having an x in it, put a 2 in it. So let's take the function above and make brackets everywhere the x was and in its place, put in a 2.

Don't forget order of operations---powers, then multiplication, finally addition & subtraction

Find *f* (-2).

$$f(x) = 2x^2 - 3x + 6$$

$$f(-2) = 2(-2)^2 - 3(-2) + 6$$

$$f(-2) = 2(4) - 3(-2) + 6 = 8 + 6 + 6 = 20$$

This means to find the function f and instead of having an x in it, put a -2 in it. So let's take the function above and make brackets everywhere the x was and in its place, put in a -2.

Don't forget order of operations---powers, then multiplication, finally addition & subtraction

Definition of Function:
A **function** is a relation in which each element of the domain is paired with exactly one element of the range.

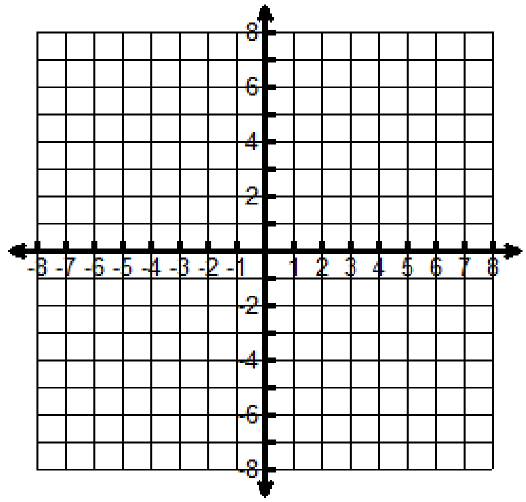
Notes: Using Function Notation

From a given rule for a relation, you can write a table of values.

Choose convenient x-values (domain or input).
Evaluate for corresponding y-values (range or output).

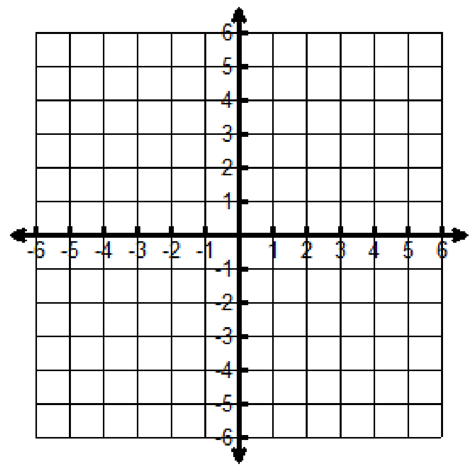
1) Write a table of values and graph.
$f(x) = 2x^2$

x	$2x^2$	$f(x)$
-2	$2(\quad)^2 = 2(\quad) =$	
-1	$2(\quad)^2 = 2(\quad) =$	
0	$2(\quad)^2 = 2(\quad) =$	
1	$2(\quad)^2 = 2(\quad) =$	
2	$2(\quad)^2 = 2(\quad) =$	



2) Write a table of values and graph.
$f(x) = -x^2$

x	$-x^2$	$f(x)$
-2	$-(\quad)^2 =$	
-1	$-(\quad)^2 =$	
0	$-(\quad)^2 =$	
1	$-(\quad)^2 =$	
2	$-(\quad)^2 =$	



The rule for a function f is written with the symbol $f(x)$, read "f of x", where x is the variable of the domain.

Rule

$y = x + 4$

Function notation $f(x) = x + 4$
Find $f(3)$ means evaluate this function for $x = 3$.
$f(3) = 3 + 4 = 7$

Evaluate each function for the given x-value.

3) $f(x) = 2x - 7$

$f(-5) = 2(-5) - 7$
$= -10 - 7$
$= -10 + -7$
$= -17$

4) $g(x) = 5x^2 + 1$

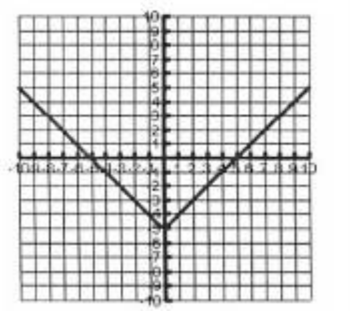
$g(3) = 5(\_\_\_)^2 + 1$

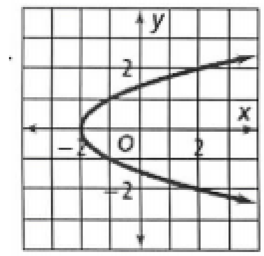
5) $f(x) = 8x^2 + 5$

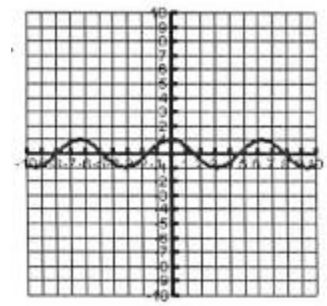
$f(-1) =$

Homework: Using Function Notation:

Determine whether each relation is a function. (Write "function" or "not a function".)

1) 

2) 

3) 

_________________________ _________________________ _________________________

4) $\{(4, 2), (2, 3), (6, 1)\}$

____

5) $\{(-3, -3), (-3, 4), (-2, 4)\}$

____

6) $\{(-1, 0), (1, 0), (3, 0)\}$

____

Given $f(x) = 2x - 4$ and $g(x) = x^2 - 4x$, find each value. Show all work.

7) $f(4)$ _________________________

8) $g(2)$ _________________________

9) $f(-5)$ _________________________

10) $g(-3)$ _________________________

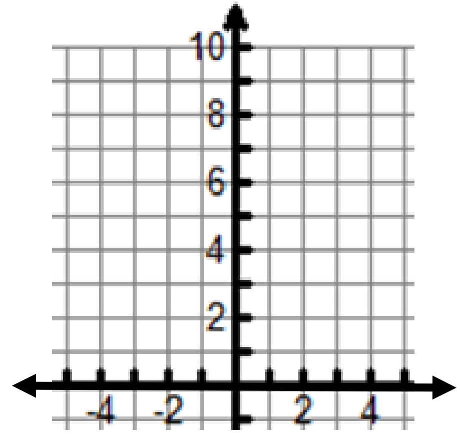
11) $f\left(\frac{1}{4}\right)$ _________________________

12) $g\left(\frac{1}{2}\right)$ _________________________

Homework is continued on the next page

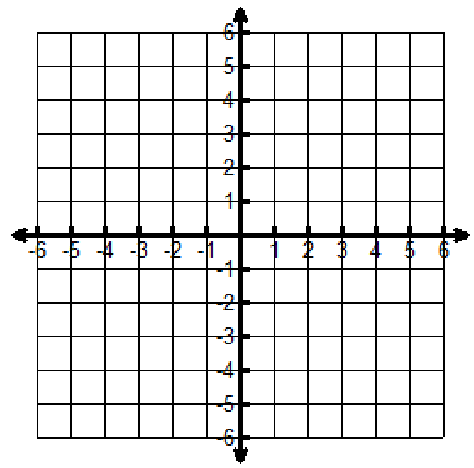
Complete the table and graph each function.

13) $f(x) = -2x + 5$



x	$-2x+5$	$f(x)$
-2	$-2(-2) + 5 = 4 + 5 =$	9
-1		
0		
1		
2		

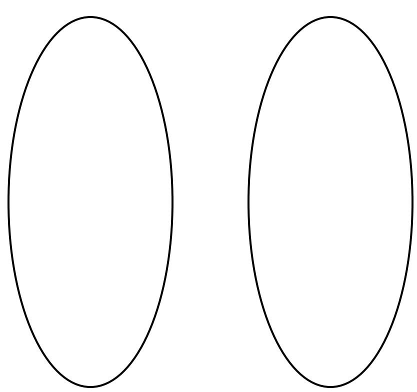
13) $f(x) = x^2 - 4$



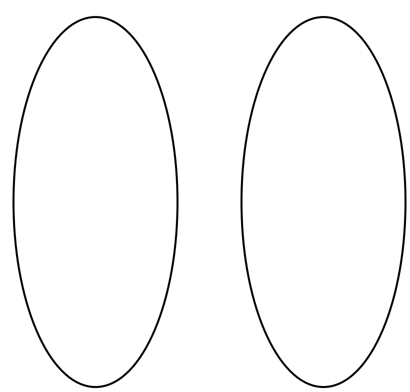
x	$x^2 - 4$	$f(x)$
-2		
-1		
0		
1		
2		

Draw a mapping diagram of the set of ordered pairs.

14) $\{(1,3),(5,7),(8,10),(14,16)\}$



15) $\{(0,10),(4,6),(6,4),(7,3)\}$

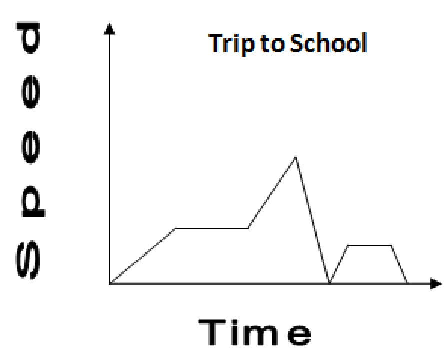


16) The graph shows the speed a student travelled on the way to school.

a) What do the flat parts of the graph represent?

____

b) Circle the sections of the graph that show speed decreasing.



Review: PRACTICE WITH FUNCTION NOTATION

In Exercises 1-3, find the domain and range of the relation.

Age (years)	Height (inches)
4	41
8	49
12	58
16	67

time (hours)	distance (miles)
0	60
4	120
8	240
12	480

time (years)	population
0	1000
5	1050
10	1000
15	1100

1. Domain:___________________ Range: ___________________
2. Domain: ____________________ Range: _____________________
3. Domain: ________________________ Range: _________________________

In Exercises 4-7, find the indicated values for the function.

4. **Example:** $f(x) = 4x - 7$ a. $f(3)$ b. $f(-5)$

x	$f(x) = 4x - 7$	f(x)
3	$f(3) = 4(3) - 7$	5
-5	$f(-5) = 4(-5) - 7$	-27

5. $f(x) = -3x + 10$ a. $f(4)$ b. $f(-9)$

x	$f(x) = -3x + 10$	$f(x)$

6. $f(x) = x^2 + 5x - 1$ a. $f(6)$ b. $f(-4)$

x	$f(x) =$	f(x)

7. $f(x) = -2x^2 - 3x + 8$ a. $f(5)$ b. $f(0)$

x	$f(x) =$	f(x)

8. $f(x) = 2x + 7$ $\{5, 18, -5\}$

x	$f(x) =$	f(x)

9. $g(x) = 9 - 4x$ $\{-2, 10, -1\}$

x	$f(x) =$	f(x)

10. $f(x) = 3x^2 - 1$ $\{2, 4, -3\}$

x	$f(x) =$	f(x)

11. $h(x) = x^2 + 8x - 3$ $\{1, 5, -2\}$

x	$f(x) =$	f(x)

Homework is continued on the next page ⇨

Determine whether each relation is a function. (Write "function" or "not a function".)

x	y
-1	10
-2	13
-3	16

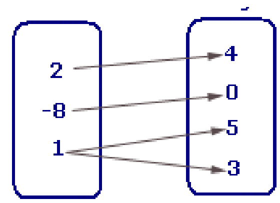
12. ________________

x	y
2	0
2	-1
3	-4

13. ________________

x	y
-1	1
-3	1
-5	1

14. ________________

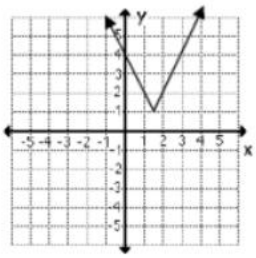


15. ________________

16. $\{(7,4),(6,3),(5,2)\}$ ________________

17. $\{(15,0), 15,-2), (15,-4)\}$ ________________

18.



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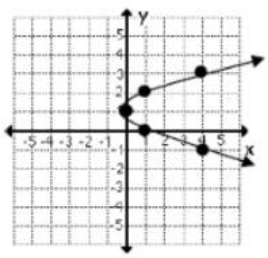

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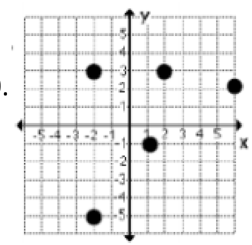

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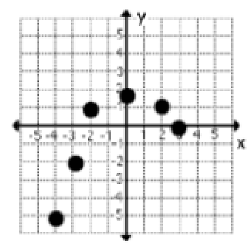
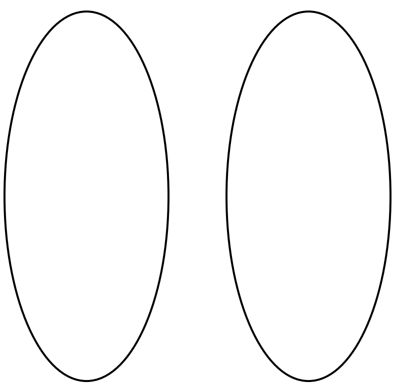
21.



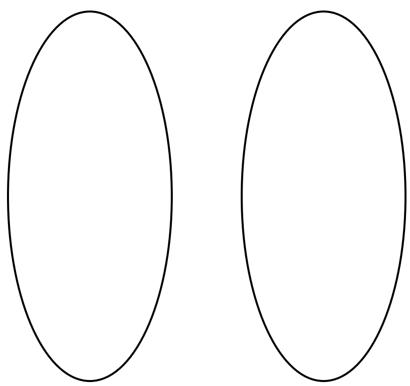
____

Complete a mapping diagram and then state if the relation is a function.

22. $\{(0,11),(1,8),(4,15),(6,19)\}$ ________________



23. $\{(1,0),(2,0),(3,0),(4,2),(5,2)\}$ ________________



24. The graph shows the relationship between time and total distance traveled by a teacher riding a bus.

a. What does the flat part of the graph represent?

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b.) The first section of the graph is steeper than the last section.
Was the bus traveling faster in the first part of the trip or the last?

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