Name _____

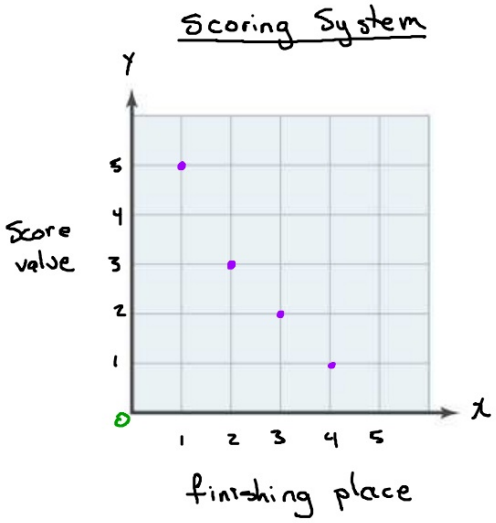
4-5 Formalizing Relations

OBJECTIVE: I can wdetermine whether a relation is a function to find domain and range and use function notation

Warm-Up

In a scoring system of some track meets, first place is woth 5 point, second place is worth 3 point, third place is worth 2 point, and fourth place is worth 1 point. This scoring system is a relation, so it can be shown as ordered pairs, { (1,5), (2,3), (3,2), (4,1) }. Please fill the table and graph the ordered pairs.

X	Y
1	5
2	3
3	2
4	1



Essential Understanding

Essential Understanding A function is a special type of relation in which each value in the domain is paired with exactly one value in the range.

A relation is a pairing of numbers in one set, called the domain, with numbers in another set, called the range. A relation is often represented as a set of ordered pairs (x, y). In this case, the domain is the set of x-values and the range is the set of y-values.

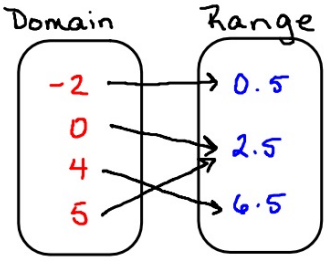
Example #1 Identifying Functions Using Mapping Diagrams

Identify the domain and range of each relation. Represent the relation with a mapping diagram. Is the relation a function?

A $\{(-2, 0.5), (0, 2.5), (4, 6.5), (5, 2.5)\}$

x The domain is $\{-2, 0, 4, 5\}$

y The range is $\{0.5, 2.5, 6.5\}$

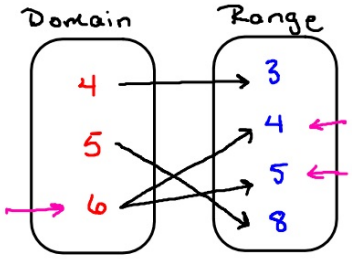


This is a function because each domain value is mapped to one range value

B $\{(6, 5), (4, 3), (6, 4), (5, 8)\}$

The domain is $\{4, 5, 6\}$

The range is $\{3, 4, 5, 8\}$



The Domain value 6 has two mapped values in the range 4 & 5.

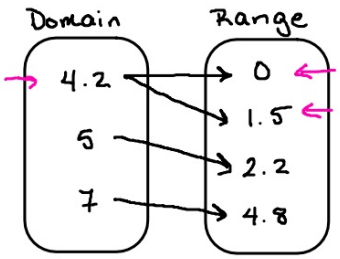
This is not a function

Your Turn to Work it Out

1. Identify the domain and range of each relation. Represent the relation with a mapping diagram. Is the relation a function?

a. {(4.2, 1.5), (5, 2.2), (7, 4.8), (4.2, 0)}

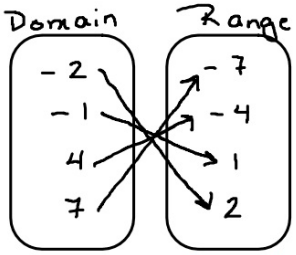
domain { 4.2 , 5 , 7 }
range { 0 , 1.5 , 2.2 , 4.8 }



This is not a function

b. {(-1, 1), (-2, 2), (4, -4), (7, -7)}

domain { -2 , -1 , 4 , 7 }
range { -7 , -4 , 1 , 2 }



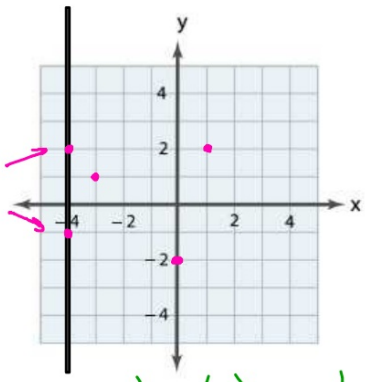
This is a function

Example #2 Identifying Functions Using the Vertical Line Test

Another way to decide if a relation is a function is to analyze the graph of the relation using the **vertical line** test. If any vertical line passes through more than one point of the graph, then for some domain value there is more than one range value. So the relation is not a function.

Is the relation a function? Use the vertical line test.

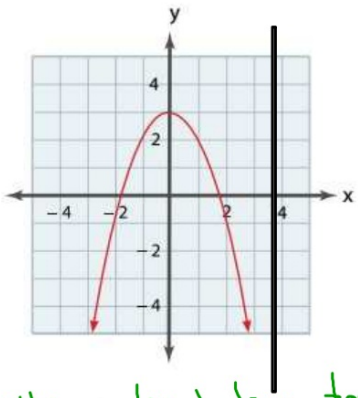
A $\{(-4, 2), (-3, 1), (0, -2), (-4, -1), (1, 2)\}$



There are two (2) points on the same vertical line

This is not a function

B $y = -x^2 + 3$

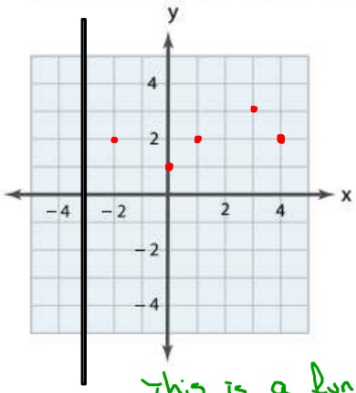


the vertical line tests verifies that there are no overlapping values.

Your Turn to Work it Out

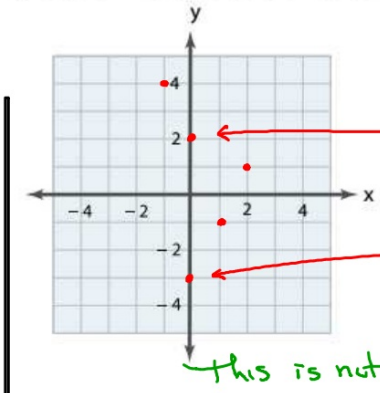
2. Is the relation a function? Use the vertical line test.

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



This is a function

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



these two points overlap using the vertical line test

This is not a function

Example #3 Evaluating a Function

You have seen functions represented as equations involving x and y, such as $y = -3x + 1$. Below is the same equation written using **function notation**.

$$f(x) = -3x + 1$$

Notice that f (x) replaces y. It is read "**f of x**." The letter f is the name of the function, not a variable. Function notation is used to emphasize that the function value f (x) depends on the independent variable x. Other letters besides f can also be used, such as g and h.

Reading The function w(x) = 250x represents the number of words w(x) you can read in x-minutes. How many words can you read in 8 min?

$w(x) = 250x$

$w(8) = 250(8)$

$w(8) = 2000$

You can read 2000 words in 8 minutes.

Your Turn to Work it Out

3. Use the function in Problem 3. How many words can you read in 6 min?

$w(x) = 250x$

$w(6) = 250(6)$

$w(6) = 1500$

Example #4 Finding the Range of a Function

Multiple Choice The domain of f (x)= –1.5x + 4 is {1, 2, 3, 4}. What is the range?

● {-2, -0.5, 1, 2.5}

B {5-2.5, -1, 0.5, 2}

C {-2.5, -1, -0.5, 2}

D {-2.5, -0.5, 1, 2}

x	f(x)= –1.5x + 4	f(x)
1	$-1.5(1)+4 = 2.5$	(1, 2.5)
2	$-1.5(2)+4 = 1$	(2, 1)
3	$-1.5(3)+4 = -0.5$	(3, -0.5)
4	$-1.5(4)+4 = -2$	(4, -2)

Your Turn to Work it Out

4. The domain of g (x) = 4x – 12 is {1, 3, 5, 7}. What is the range?

the range is $\{-8, 0, 8, 16\}$

x	$g(x) = 4x - 12$	g(x)
1	$4(1) - 12$	-8
3	$4(3) - 12$	0
5	$4(5) - 12$	8
7	$4(7) - 12$	16