3-1 Functions and Their Graphs

Function – rule that shows a relationship between two quantities

*has inputs and outputs

*__ONLY__ one output for each input

(x,y) = ordered pair

(D,R) domain, range

Input-Output Tables

Example: $y = 2x + 1$

Input		Output
0	$\rightarrow 2(0) + 1 \rightarrow$	1
1	$\rightarrow 2(1) + 1 \rightarrow$	3
2	$\rightarrow 2(2) + 1 \rightarrow$	5

Domain – all the inputs (x-values)

X	Y
Input	Output
0	1
1	3
2	5

Range – all the outputs (y-values)

(0,1)
(1,3)
(2,5)
} ordered pairs

Example: Make an input-output table for $y = x^2 + 3$.

An equation is a function if there is **only one** output for each input. (No inputs repeat)

No repeating x-values.

Input	Output
0	3
1	4
2	7

0^2+3
1^2+3
2^2+3

(0,3), (1,4), (2,7)

Example: Do each of the following tables represent a function?

Input	Output
2	5
4	5
6	5

diff.

same

Yes, because no repeating x-values.

Input	Output
1	3
1	4
2	7

No, because x=1 repeats.

Input	Output
0	3
1	8
2	8

Yes, no repeating x-values.

Make an Input-Output Table for each using 0, 1, 2, 3 as the domain.

1) $y = 5x - 6$

$Y = 5 \cdot 0 - 6 = 0 - 6 = -6$
$Y = 5 \cdot 1 - 6 = 5 - 6 = -1$
$Y = 5 \cdot 2 - 6 = 10 - 6 = 4$
$Y = 5 \cdot 3 - 6 = 15 - 6 = 9$

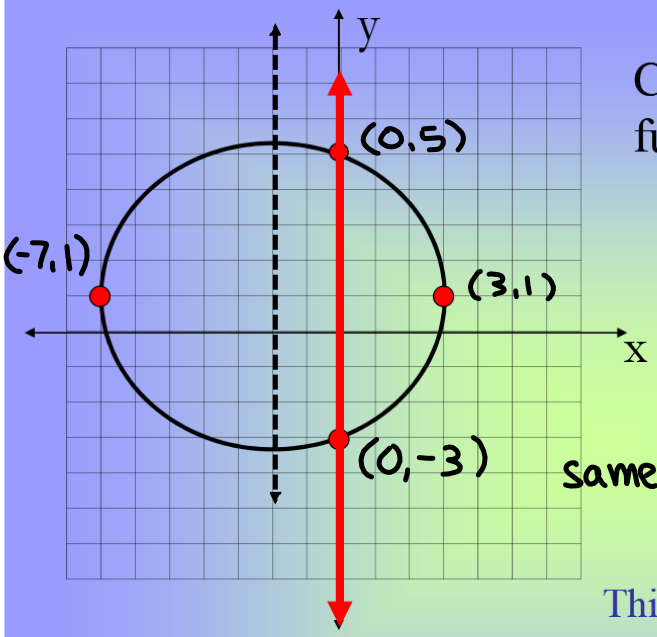
X Input	Y Output	
0	-6	= (0, -6)
1	-1	= (1, -1)
2	4	= (2, 4)
3	9	= (3, 9)

2) $y = 2x^2 + 1$

$Y = 2 \cdot 0^2 + 1 = 2 \cdot 0 + 1$
$Y = 2 \cdot 1^2 + 1 = 2 \cdot 1 + 1$
$Y = 2 \cdot 2^2 + 1 = 2 \cdot 4 + 1$
$Y = 2 \cdot 3^2 + 1 = 2 \cdot 9 + 1$

X Input	Y Output	
0	1	= (0, 1)
1	3	= (1, 3)
2	9	= (2, 9)
3	19	= (3, 19)

This relation is a circle.



Could this be the graph of a function? How can we tell?

Make an input-output table!

Input	Output
3	1
0	5
-7	1
0	-3

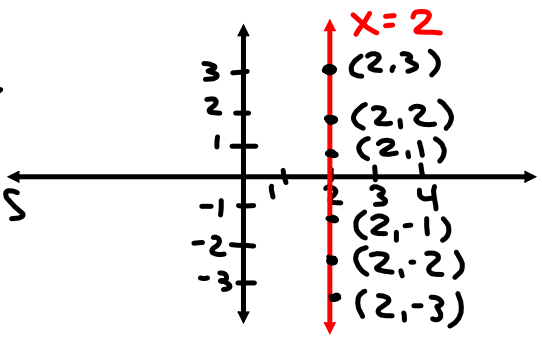
Same

This is not a function! The input of 0 has an output of both 5 and -3.

The Vertical Line Test: An equation is a function if and only if no vertical line intersects the graph at more than one point.

Vertical lines have an equation in the form of $x = a$ (a is where the vertical line crosses the x-axis).

Vertical lines are NOT functions



The vertical line $x = 2$ is not a function.

NAME _____ DATE _____ PERIOD _____

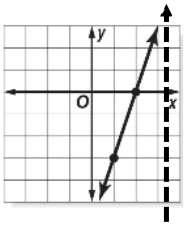
3-1 Functions

Identify Functions Relations in which each element of the domain is paired with exactly one element of the range are called **functions**.

Example 1
Determine whether the relation {(6, –3), (4, 1), (7, –2), (–3, 1)} is a function. Explain.

Yes, because no x-values repeat.

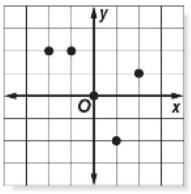
Example 2
Determine whether $3x - y = 6$ is a function.



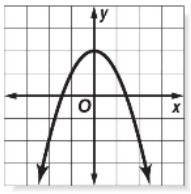
Yes, passed V.L.T.

Exercises
Determine whether each relation is a function.

1.



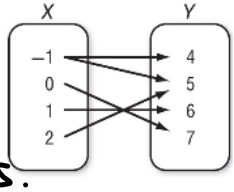
2.



no, because x = -1 repeats.

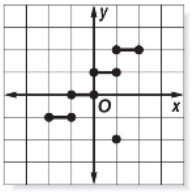
mapping

3.

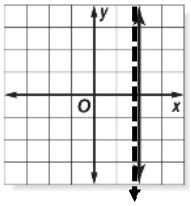


(-1,4)
(-1,5)
(0,7)
(1,6)
(2,5)

4.

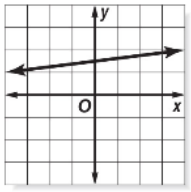


5.



no, fails V.L.T

6.



7. {(4, 2), (2, 3), (6, 1)}

8. {(–3, –3), (–3, 4), (–2, 4)}

no, x = -3 repeats

9. {(–1, 0), (1, 0)}

~~A~~ $y = \frac{1}{2}x$

~~B~~ $x = -4$