1.1 Functions, Domain, and Range - Lesson
MCR3U
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Section 1: Relation vs. Function

Definitions

Relation –

Functions –

> ***Note:*** *All functions are relations but not all relations are functions. For a relation to be a function, there must be only one 'y' value that corresponds to a given 'x' value.*

Function or Relation Investigation

1) Complete the following tables of values for each relation:

$y = x^2$

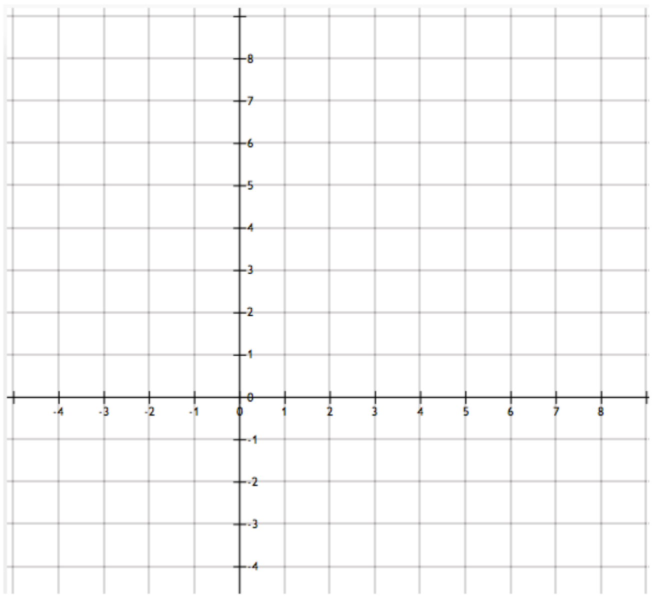
x	y
-3	
-2	
-1	
0	
1	
2	
3	

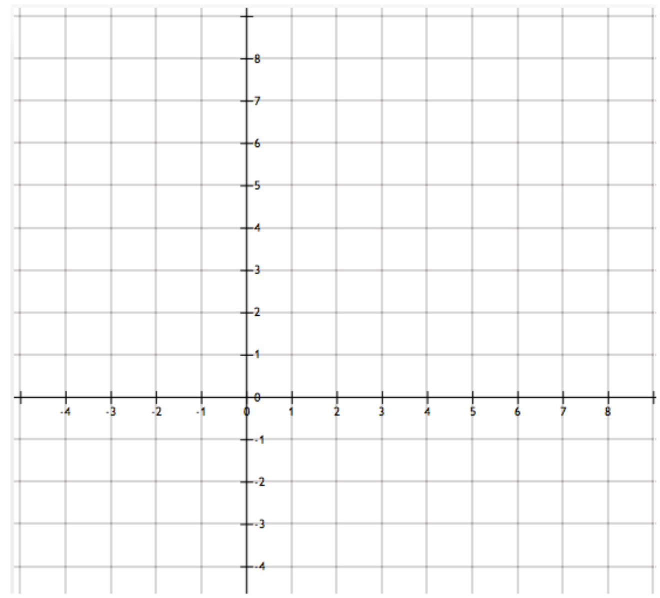
$x = y^2$

x	y
	-3
	-2
	-1
	0
	1
	2
	3

2) Graph both relations

$y = x^2$ $\qquad\qquad$ $x = y^2$





3) Draw the vertical lines $x = -2,\ x = -1,\ x = 0,\ x = 1$, and $x = 2$ on the graphs above.

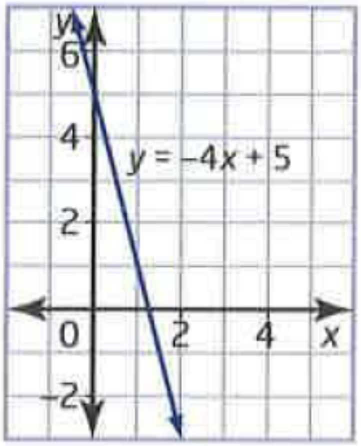
4) Compare how the lines drawn in step 3 intersect each of the relations. Which relation is a function? Explain why.

Section 2: Vertical Line Test

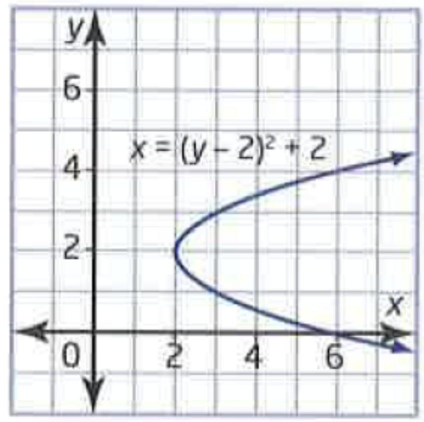
Vertical line test:

Example 1: Use the vertical line test to determine whether each relation is a function or not.

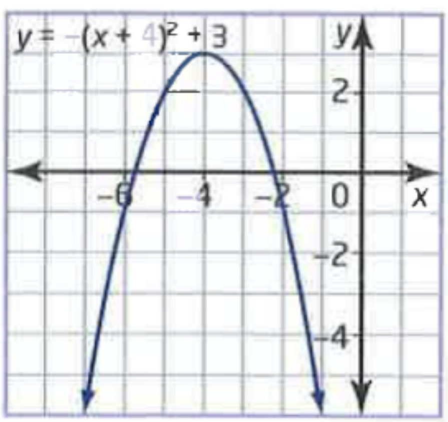
a)



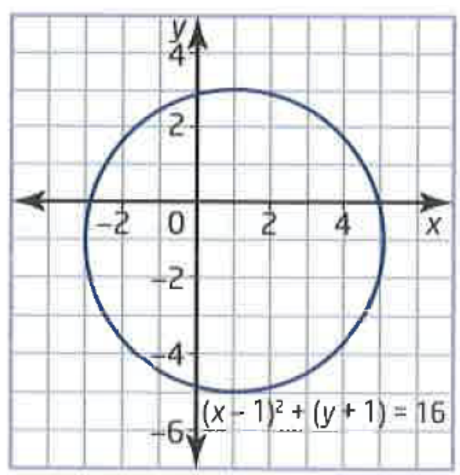
b)



c)



d)



Section 3: Domain and Range

For any relation, the set of values of the independent variable (often the *x*-values) is called the ____________________ of the relation. The set of the corresponding values of the dependent variable (often the *y*-values) is called the _______________ of the relation.

Note: *For a function, for each given element of the domain there must be exactly one element in the range.*

Domain:

Range:

General Notation

Real number: *a number in the set of all integers, terminating decimals, repeating decimals, non-terminating decimals, and non repeating decimals. Represented by the symbol* $\mathbb{R}$

Example 2: Determine the domain and range of each relation from the data given.

a) { (-3, 4), (5, -6), (-2, 7), (5, 3), (6, -8) }

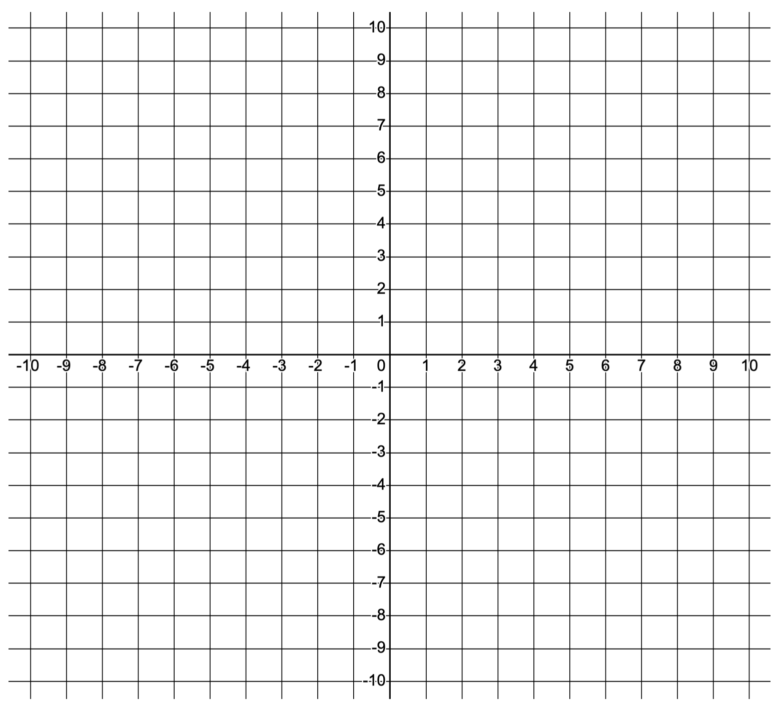
b)

Age	*Number*
4	8
5	12
6	5
7	22
8	14
9	9
10	11

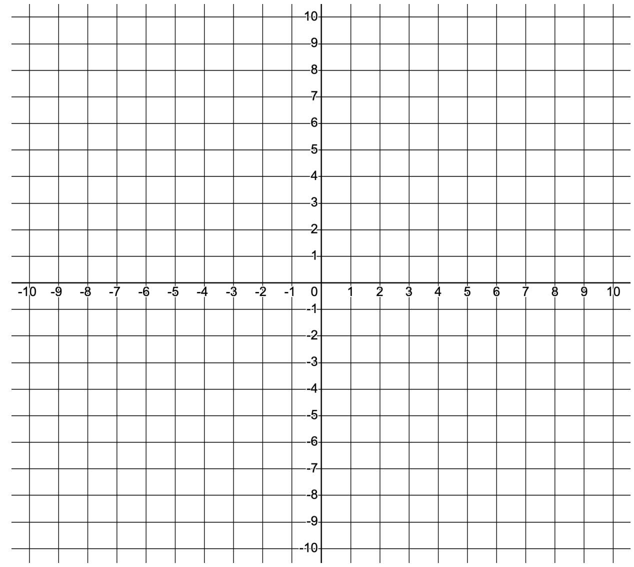
Are each of these relations functions?

Example 3: Determine the domain and range of each relation. Graph the relation first.

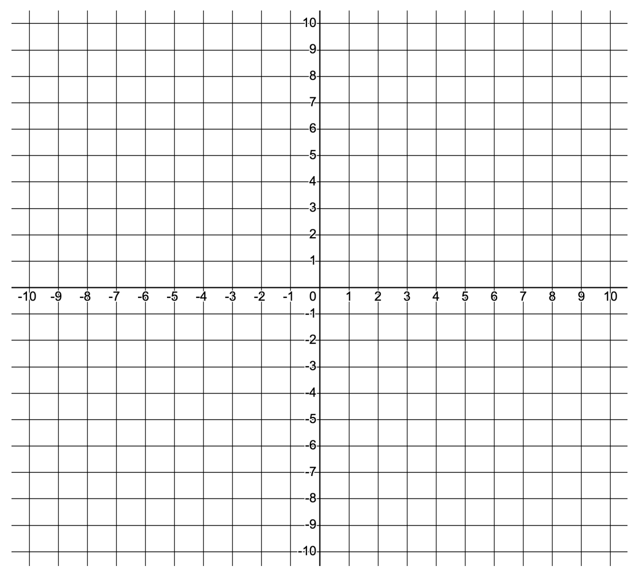
a) $y = 2x - 5$



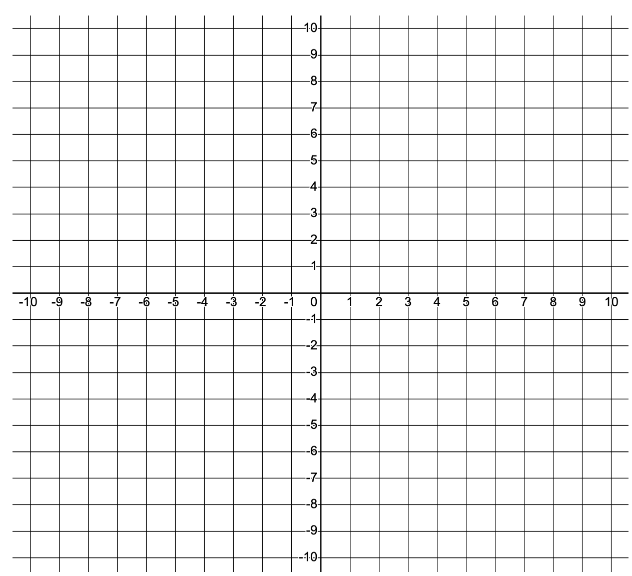
b) $y = (x-1)^2 + 3$



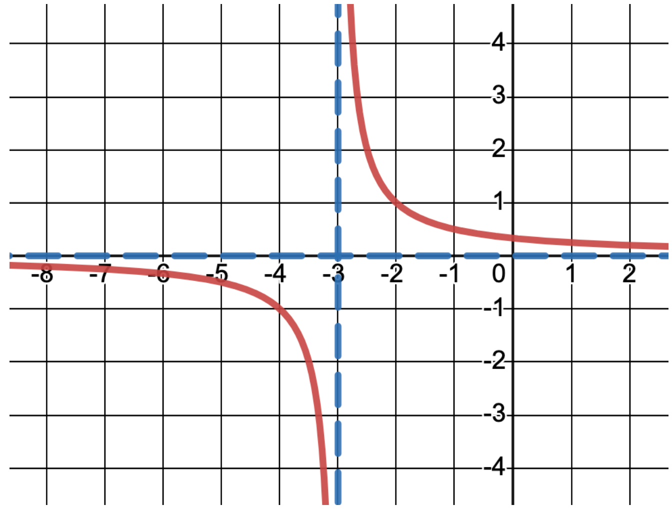
c) $y = \sqrt{x-1} + 3$



d) $x^2 + y^2 = 36$



e) $y = \frac{1}{x+3}$



Asymptotes

Asymptote:

The function $\boldsymbol{y = \frac{1}{x+3}}$ has two asymptotes:

Vertical Asymptote: Division by zero is undefined. Therefore the expression in the denominator of the function can not be zero. Therefore $x \neq -3$. This is why the vertical line $x = -3$ is an asymptote for this function.

Horizontal Asymptote: For the range, there can never be a situation where the result of the division is zero. Therefore the line $y = 0$ is a horizontal asymptote. For all functions where the denominator is a higher degree than the numerator, there will by a horizontal asymptote at $y = 0$.