Functions

Relations

The number of Drug Law Violations per year at Mt. SAC is given by the following table:

Year	# of Drug Law Violations
2007	**3**
2008	**4**
2009	**2**
2010	**4**

(Source: http://www.mtsac.edu/safety/stats/)

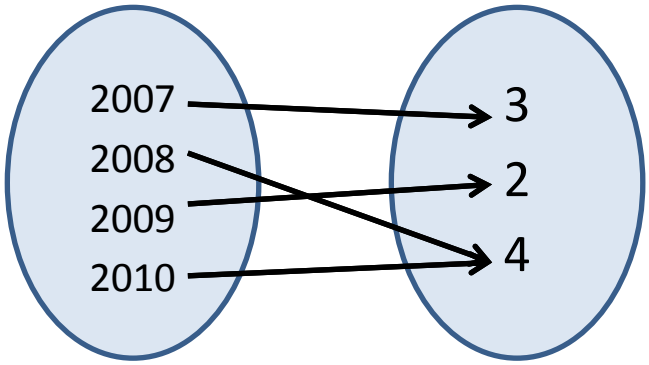
We can write this as a set of ordered pairs (called a _____):

{(2007, 3), (2008, 4), (2009, 2), (2010, 4)}

The set of all the first components is called the _____. Above, it is _____.

The set of all the second components is called the _____. Above, it is _____.

Relations can be visualized like this (called an "arrow diagram"):



Ex 1.

Find the domain and range of the relation {(3, 5), (-2, 1), (3,7), (0, 5)}.

Functions

A relation in which each member of the domain corresponds to exactly one member of the range is called a _____. (That is, **each input** has only **one output**.)

ex: {(2007, 3), (2008, 4), (2009, 2), (2010, 4)} is a function since each input has only one output.

ex: {(3, 5), (-2, 1), (3,7), (0, 5)} is not a function since 3 has two outputs: ___ and ___.

Functions as Equations

For this class, we'll focus on functions in the form of equations. For example, $y = x^2 - 3x + 2$

We often give functions names (like f, g, h, F, G, H) and use special notation to define them.

For example, $f(x) = x^2 - 3x + 2$.

$f(x)$ is read "f of x".

$f(x)$ represents the value of the function at x (that is, the output of f).

For example, $f(2) = (2)^2 - 3(2) + 2 = 0$, that is "$f$ of 2 is 0". So, if you input 2, the output is 0.

Ex 2.

Find $h(-2)$ for the function $h(x) = 2x^2 + 3x - 1$.

Ex 3.

Find $F(a + h)$ for $F(x) = 5x + 7$.

Ex 4.

Find $f(71)$ for $f(x) = 46$.

Functions as Tables

Ex 5.

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

What are the domain and range of the table to the left?

$f(-1) =$

Find x such that $f(x) = 4$.

Interval Notation

Suppose you wanted to write "the set of all real numbers between 3 and 5, including 3, but not 5."

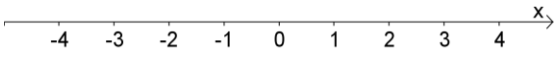
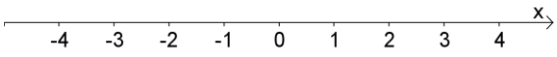
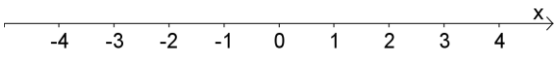
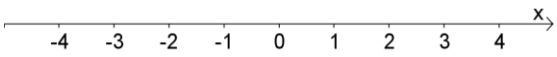
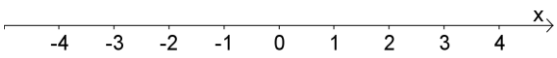
That is, the set of all real numbers x, such that $3 \leq x < 5$.

Here's how to write it using **interval notation**: _____

Interval Notation	Inequality	Graph
(a, b)	$a < x < b$	
$[a, b]$	$a \leq x \leq b$	
$[a, b)$	$a \leq x < b$	
$(a, b]$	$a < x \leq b$	
(a, ∞)	$x > a$	
$[a, \infty)$	$x \geq a$	
$(-\infty, b)$	$x < b$	
$(-\infty, b]$	$x \leq b$	
$(-\infty, \infty)$	$\mathbb{R}$	

Ex 6.

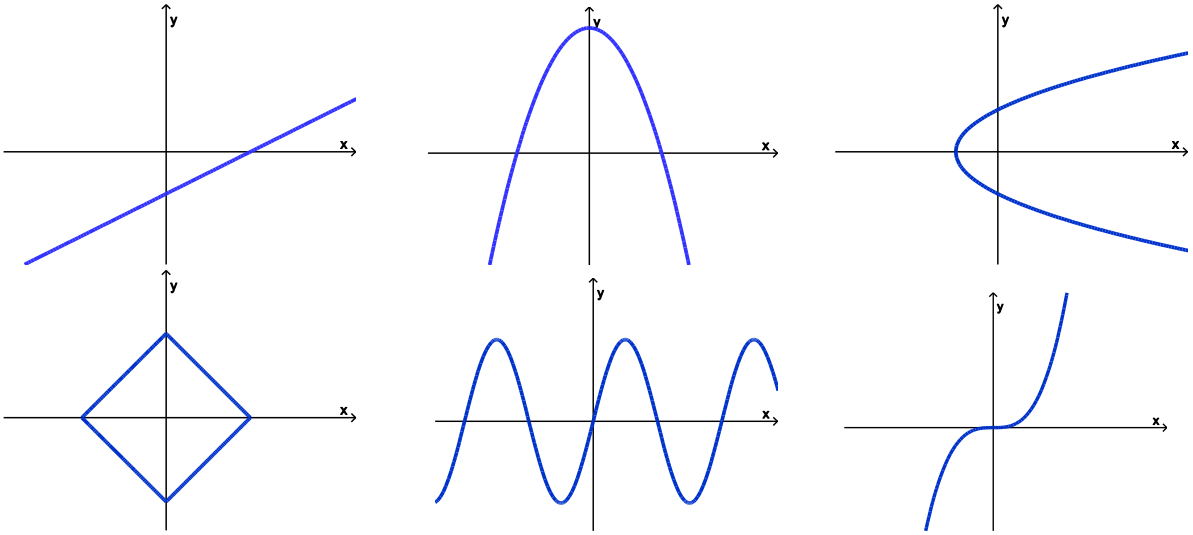
Fill in the table:

Interval Notation	Inequality	Graph
	$-3 \leq x < 1$	
$(-2, 3]$		
	$x \geq 2$	
$[2.5, 4]$		
$(-\infty, -1)$		

If you plot all of a function's ordered pairs, then you create the _____ of the function.
To test if a graph is a function we can use the _____. If any vertical line intersects a graph in two or more points, then the graph does not represent a function.

Ex 7.

Which of the following graphs are functions?

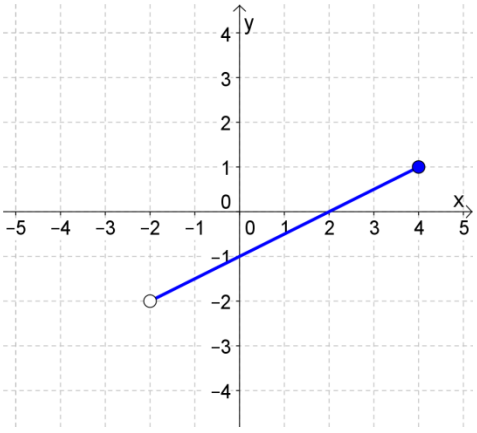


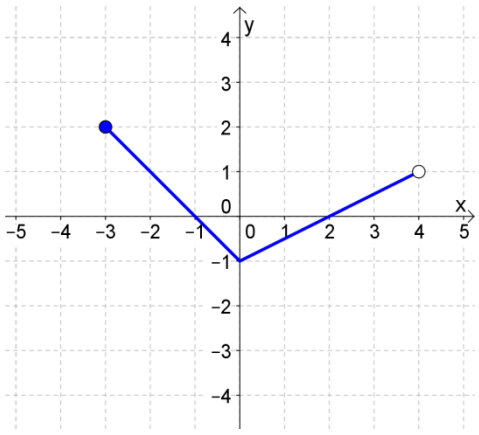
The _____ of a function is the set of all possible _____.

The _____ of a function is the set of all possible _____.

Ex 8.

Use the graph of each function to find its domain and range.



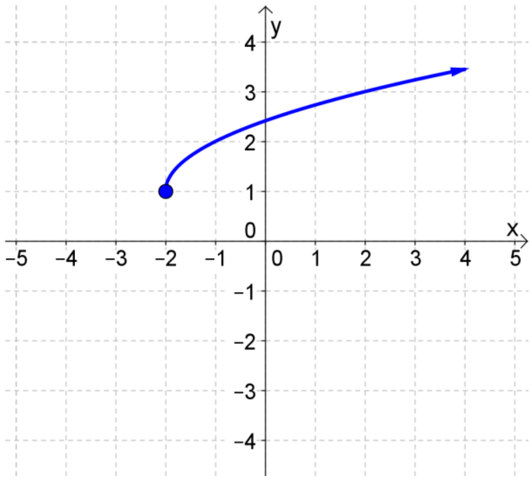


Domain _____

Range _____

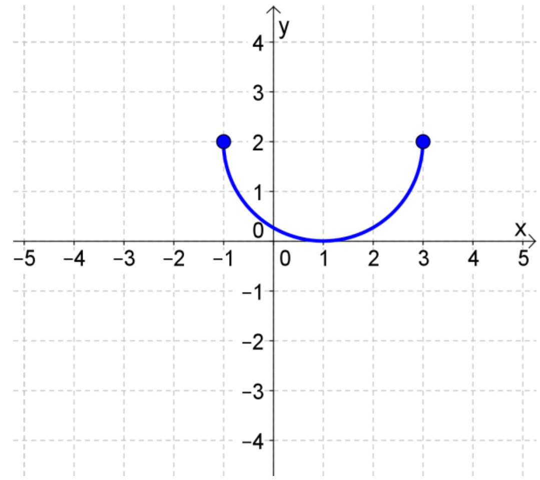
Domain _____

Range _____



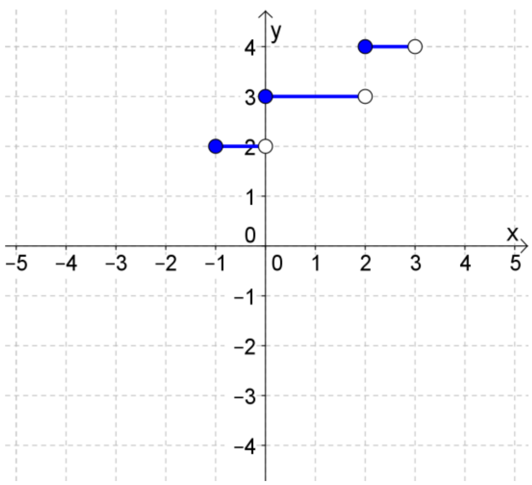
Domain ____________________________

Range ____________________________



Domain ____________________________

Range ____________________________

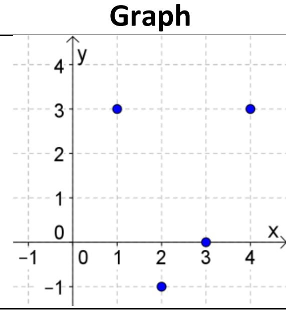
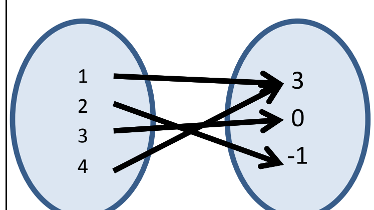


Domain ____________________________

Range ____________________________

Summary

Here is the same function represented in different ways.

<table>
<tr><th>Set of Ordered Pairs</th><th>Table</th><th>Graph</th><th>Arrow Diagram</th></tr>
<tr>
<td>$\{(1,3),(2,-1),(3,0),(4,3)\}$</td>
<td>
<table>
<tr><th>x</th><th>$f(x)$</th></tr>
<tr><td>1</td><td>3</td></tr>
<tr><td>2</td><td>-1</td></tr>
<tr><td>3</td><td>0</td></tr>
<tr><td>4</td><td>3</td></tr>
</table>
</td>
<td>  </td>
<td>  </td>
</tr>
</table>

The domain of the above function is _____________.

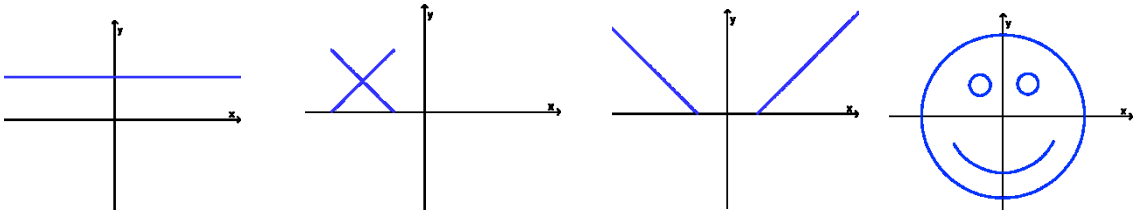
The range of the above function is _____________.

Practice

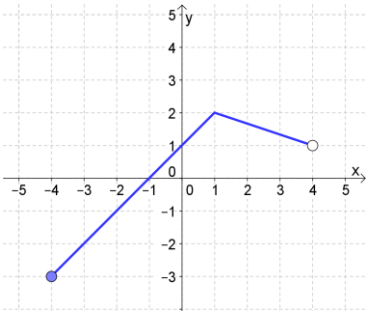
1. Find the domain and range of the relation $\{(4,1),(5,1),(6,1)\}$. Also, is the relation a function?
2. For the function $f(x) = 4x - 3$, find $f(-2)$, $f\left(\frac{3}{4}\right)$, and $f(a+2)$. Be sure to simplify your results.
3. For the function $g(x) = 2x^2 - 3x + 1$, find $g(-1)$ and $g(2x)$. Be sure to simplify your results.
4. Use the table to the right to answer the following questions.

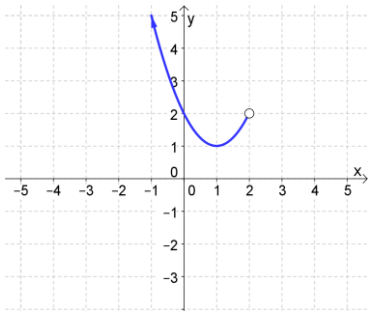
x	$f(x)$
-5	3
-3	12
0	2
3	7
5	12

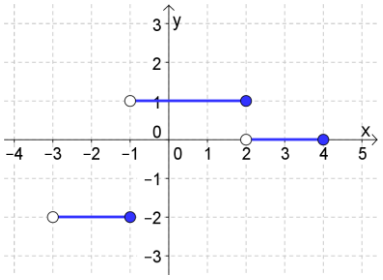
   a) What are the domain and range of f? b) Find $f(3)$ and $f(0)$.
   c) Find x such that $f(x) = 12$.
5. Which of the following graphs are functions?



6. Use the graph of each function to find its domain and range.

d) 

e) 

f) 

Q: What can you catch, but not throw?