

Tuesday, May 7th

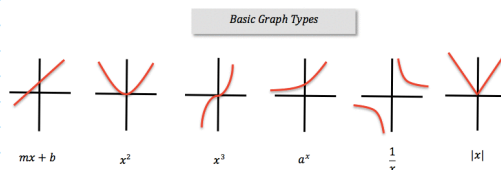
## Plan For Today:

1. Any questions about material from Ch1?

- \* **DO CH1: GEOMETRIC SEQUENCES & SERIES TEST ~60MIN**
- \* **HAND-IN CH1 PROJECT**

2. Start Working on Chapter 2

- \* **2.0 Graphing Review**
- \* **2.4 Horizontal and Vertical Translations**
- \* **2.4 Reflections and Stretches**
- \* **2.5 Inverse of a Relation**
- \* **2.6 Combining Transformations**



6. Work on Graphing Review Handout.

$$f(x) = af(b(x - c)) + d$$

## Plan Going Forward:

1. Work on practice questions from 2.1 and 2.4 in the workbook. Start working on Ch1 Project (in Desmos).

Join my PC12 Class in Desmos: <https://tinyurl.com/PC12-Spring2024>

Start the Ch2 Transformations Project in Desmos: <https://tinyurl.com/Ch1-Project-Spring2024>

\* **2.1 & 2.4 TRANSFORMATIONS CHECK-IN QUIZ ON WEDNESDAY, MAY 8TH**

2. We will finish 2.4 and do 2.5 Inverse Functions with Combining in 2.6 on Thursday and review Ch1-2 for the U1 Exam.

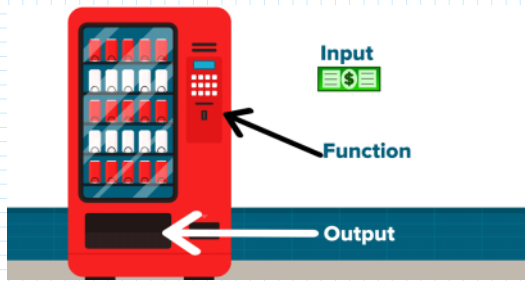
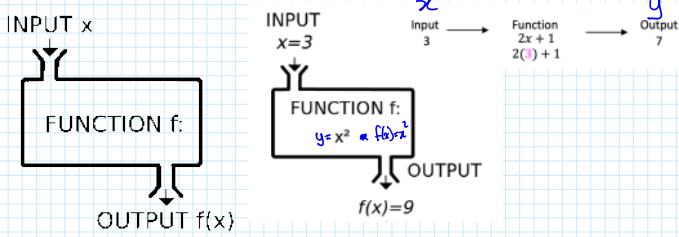
\* **UNIT 1 EXAM ON CH1&2 ON MONDAY, MAY 13TH**

- 10 Multiple Choice & 20 marks on the Written
- ~1.5 hours - please prepare so you are not "learning" while doing the test
- Closed-book - no notes, formula sheet provided
- I'll try to mark it for Tuesday

Please let me know if you have any questions or concerns about your progress in this course. The notes from today will be posted at [anurita.weebly.com](http://anurita.weebly.com) after class.  
Anurita Dhiman = [adhiman@sd35.bc.ca](mailto:adhiman@sd35.bc.ca)

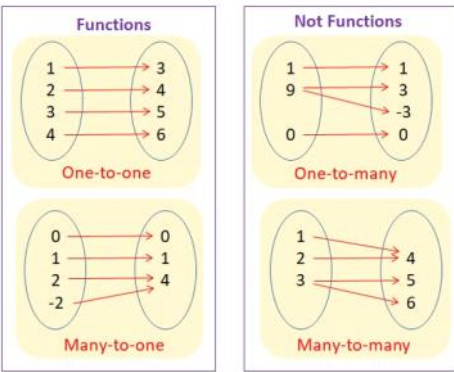
# Review: Functions and Graphs

What is a function?  $y = f(x)$   
 Vertical line test  
 Domain and Range



## Relations

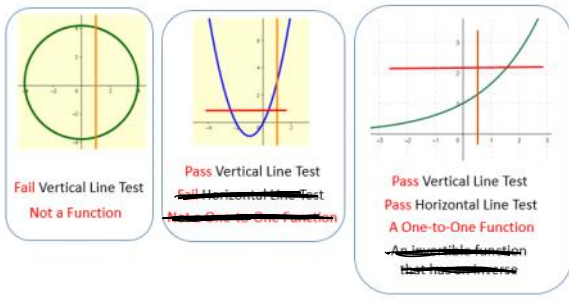
A relation shows a relationship between two values.  
 A function is a relation where each input has only one output.

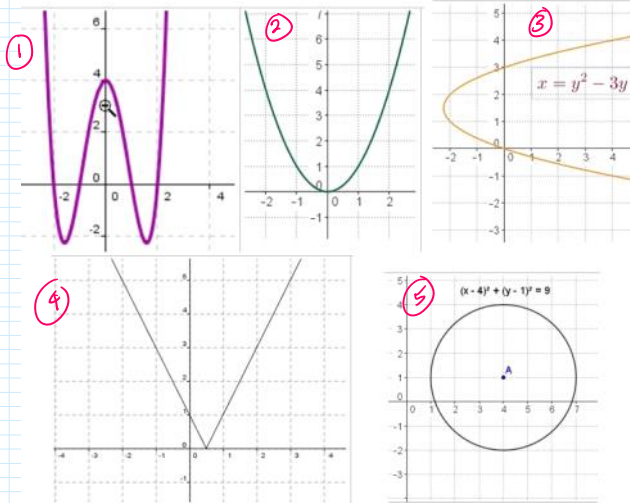


## Vertical and Horizontal Line Tests

**Pass Vertical Line Test:** Any vertical line drawn will intersect the graph at only one point.

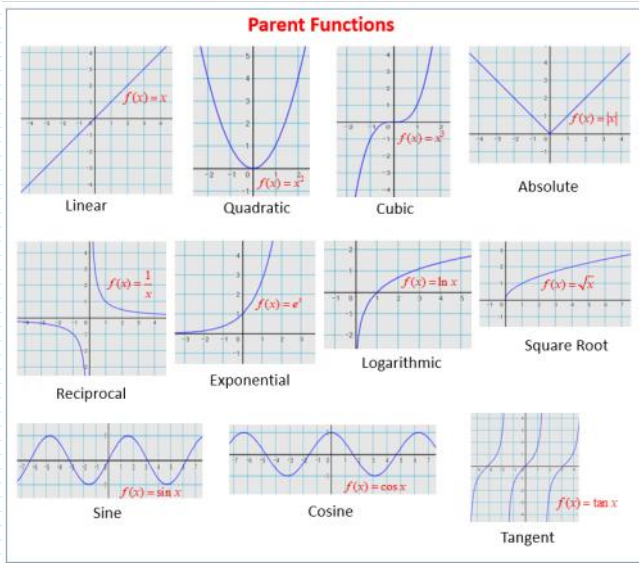
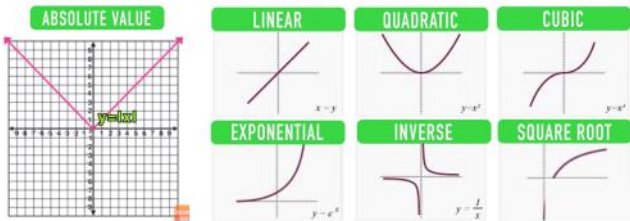
**Pass Horizontal Line Test:** Any horizontal line drawn will intersect the graph at only one point.

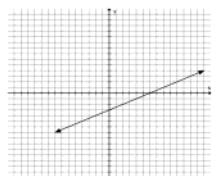
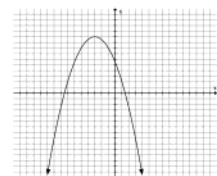
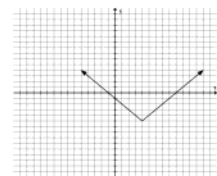
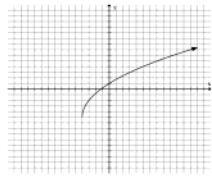
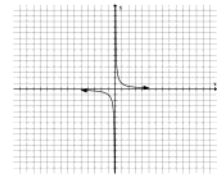




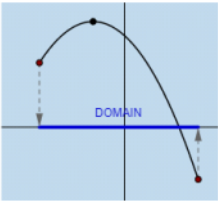
# WHAT ARE THE PARENT FUNCTION GRAPHS?

+ TRANSFORMATIONS

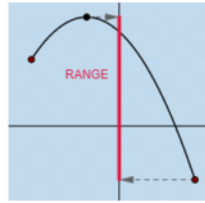




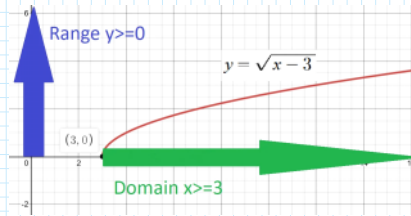
## Domain and Range



Domain is all the possible x values of a function.



Range is all the possible y values of a function.

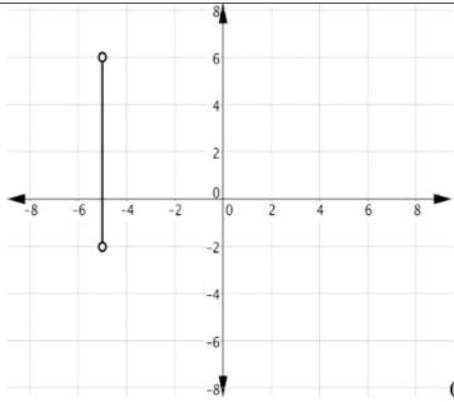


<p style="text-align: right; color: blue;">A1</p>	<p>Domain: <math>\{-6 \leq x \leq 6\}</math>                      Range: <math>\{0 \leq y \leq 6\}</math>                      Function: YES</p> <p style="text-align: right;">1</p>	<p style="text-align: right; color: blue;">E8</p>
<p style="text-align: right; color: blue;">B11</p>	<p>Domain: <math>\{-4 \leq x \leq 4\}</math>                      Range: <math>\{-4 \leq y \leq 4\}</math>                      Function: NO</p> <p style="text-align: right;">2</p>	<p style="text-align: right; color: blue;">F6</p>
<p style="text-align: right; color: blue;">C4</p>	<p>Domain: <math>\{-4 \leq x \leq 2\}</math>                      Range: <math>\{-2 \leq y \leq 4\}</math>                      Function: YES</p> <p style="text-align: right;">3</p>	<p style="text-align: right; color: blue;">G8</p>
<p style="text-align: right; color: blue;">D2</p>	<p>Domain: <math>\{x = -5\}</math>                      Range: <math>\{-2 &lt; y &lt; 6\}</math>                      Function: NO</p> <p style="text-align: right;">4</p>	<p style="text-align: right; color: blue;">H3</p>
<p style="text-align: right; color: blue;">A1</p>	<p>Domain: <math>\{-3 \leq x &lt; 5\}</math>                      Range: <math>\{y = -1\}</math>                      Function: YES</p> <p style="text-align: right;">5</p>	<p style="text-align: right; color: blue;">G8</p>
<p style="text-align: right; color: blue;">D2</p>	<p>Domain: <math>\{x &gt; 0\}</math>                      Range: <math>\{y = 4\}</math>                      Function: YES</p> <p style="text-align: right;">6</p>	<p style="text-align: right; color: blue;">H3</p>
<p style="text-align: right; color: blue;">D2</p>	<p>Domain: <math>\{x \geq 0\}</math>                      Range: {all real numbers}                      Function: NO</p> <p style="text-align: right;">8</p>	<p style="text-align: right; color: blue;">H3</p>
	<p>Domain: <math>\{-7 \leq x &lt; 5\}</math>                      Range: <math>\{-3 \leq y &lt; 1\}</math>                      Function: YES</p> <p style="text-align: right;">11</p>	

A1  
E8  
B11  
F6  
C4  
G5  
D2  
H3

# Function Practice

<p style="text-align: right;">A</p>	<p>Domain: <math>\{-6 \leq x \leq 6\}</math></p> <p>Range: <math>\{0 \leq y \leq 6\}</math></p> <p>Function: YES</p> <p style="text-align: right;">1</p>	<p style="text-align: right;">E</p>
<p style="text-align: right;">B</p>	<p>Domain: <math>\{-4 \leq x \leq 2\}</math></p> <p>Range: <math>\{-2 \leq y \leq 4\}</math></p> <p>Function: YES</p> <p style="text-align: right;">2</p>	<p style="text-align: right;">F</p>
	<p>Domain: <math>\{x = -5\}</math></p> <p>Range: <math>\{-2 &lt; y &lt; 6\}</math></p> <p>Function: NO</p> <p style="text-align: right;">3</p>	
	<p style="text-align: right;">4</p>	



C

Domain:  $\{-3 \leq x < 5\}$

Range:  $\{y = -1\}$

Function: YES

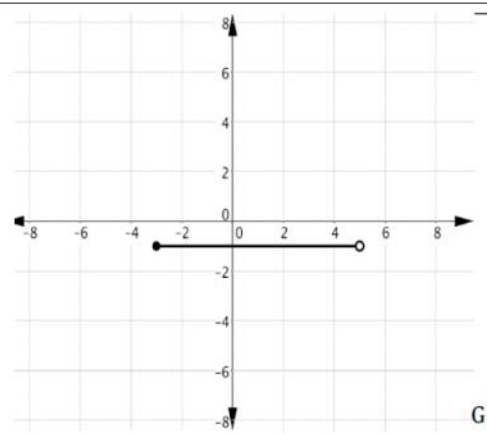
5

Domain:  $\{x > 0\}$

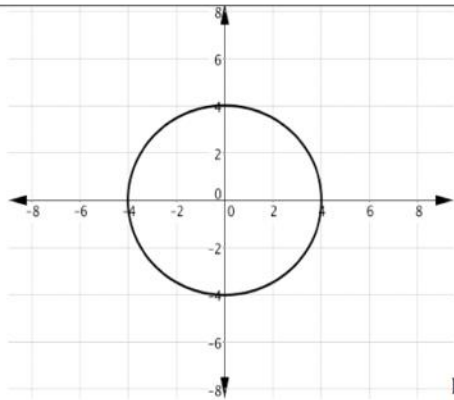
Range:  $\{y = 4\}$

Function: YES

6



G



D

Domain:  $\{x \geq 0\}$

Range:  $\{\text{all real numbers}\}$

Function: NO

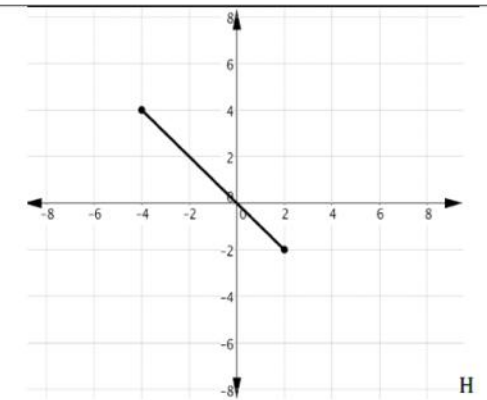
8

Domain:  $\{-7 \leq x < 5\}$

Range:  $\{-3 \leq y < 1\}$

Function: YES

11



H

Name: \_\_\_\_\_ Period: \_\_\_\_\_ Date: \_\_\_\_\_

## DOMAIN AND RANGE MATCHING ACTIVITY

Read the attached page of notes first below beginning this activity. It gives you examples of domain and range problems just like these.

Match each domain and range given in this table with a graph labeled from **A to L** on the attached page. Only use Graphs A – L for this page. Write the letter of your answer in the blank provided for each problem.

_____ 1. Domain: $\{-4 \leq x \leq 4\}$ Range: $\{-4 \leq y \leq 4\}$ Function: NO	_____ 2. Domain: $\{-3 < x \leq 5\}$ Range: $\{y = -1\}$ Function: YES	_____ 3. Domain: $\{-4 \leq x \leq 2\}$ Range: $\{-2 \leq y \leq 4\}$ Function: YES
_____ 4. Domain: $\{x > 0\}$ Range: $\{y = 4\}$ Function: YES	_____ 5. Domain: $\{-6 \leq x \leq 6\}$ Range: $\{0 \leq y \leq 6\}$ Function: YES	_____ 6. Domain: $\{x = -5\}$ Range: $\{-2 < y < 6\}$ Function: NO
_____ 7. Domain: $\{x \geq 0\}$ Range: $\{\text{all real numbers}\}$ Function: NO	_____ 8. Domain: $\{-3 \leq x \leq 4\}$ Range: $\{-2 \leq y \leq 4\}$ Function: NO	_____ 9. Domain: $\{\text{all real numbers}\}$ Range: $\{\text{all real numbers}\}$ Function: YES
_____ 10. Domain: $\{-7 \leq x < 5\}$ Range: $\{-3 \leq y < 1\}$ Function: YES	_____ 11. Domain: $\{\text{all real numbers}\}$ Range: $\{y \geq 0\}$ Function: YES	_____ 12. Domain: $\{-3 < x < 4\}$ Range: $\{0 \leq y \leq 5\}$ Function: YES

CONTINUES ON THE BACK SIDE!



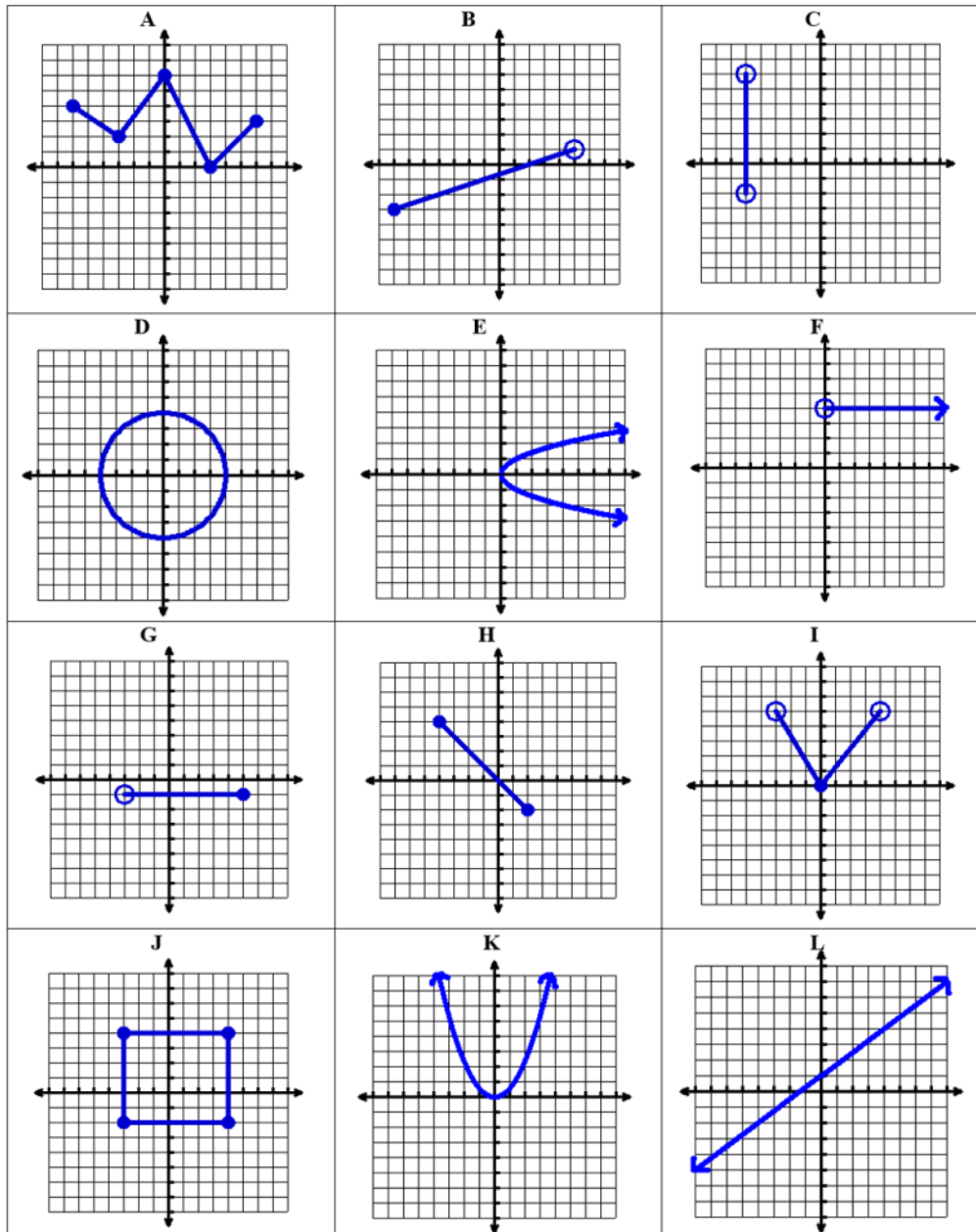
Name: \_\_\_\_\_ Period: \_\_\_\_\_ Date: \_\_\_\_\_

### DOMAIN AND RANGE MATCHING ACTIVITY

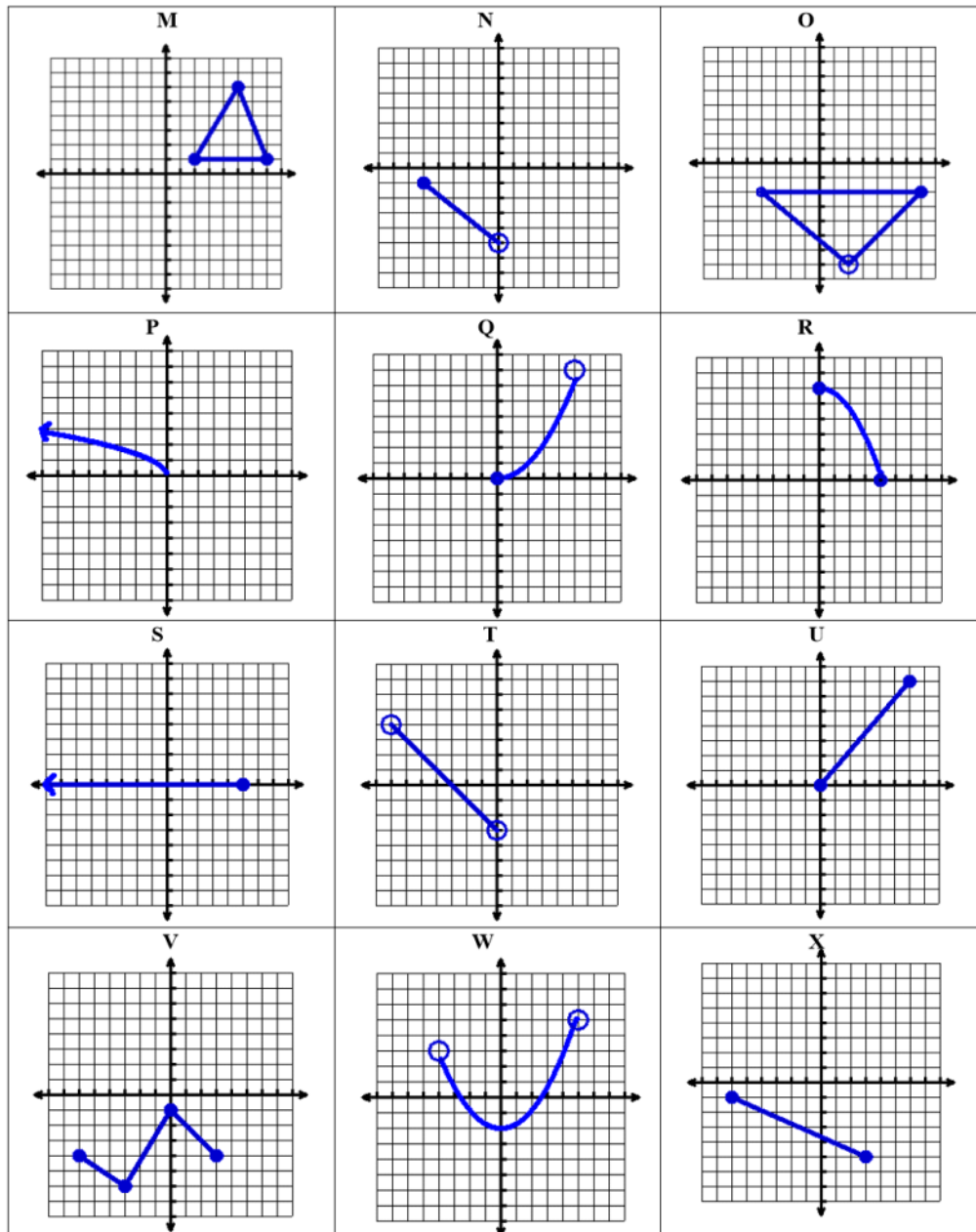
Match each domain and range given in this table with a graph labeled from **M to X** on the attached page. Only use Graphs M to X for this page. Write the letter of your answer in the blank provided for each problem.

_____ 13. Domain: $\{-6 \leq x \leq 3\}$ Range: $\{-6 \leq y \leq -1\}$ Function: YES	_____ 14. Domain: $\{0 \leq x < 5\}$ Range: $\{0 \leq y < 7\}$ Function: YES	_____ 15. Domain: $\{-5 \leq x < 0\}$ Range: $\{-5 < y \leq -1\}$ Function: YES
_____ 16. Domain: $\{-6 \leq x \leq 3\}$ Range: $\{-5 \leq y \leq -1\}$ Function: YES	_____ 17. Domain: $\{0 \leq x \leq 6\}$ Range: $\{0 \leq y \leq 7\}$ Function: YES	_____ 18. Domain: $\{-4 \leq x \leq 7\}$ Range: $\{-7 \leq y \leq -2\}$ Function: NO
_____ 19. Domain: $\{x \leq 0\}$ Range: $\{y \geq 0\}$ Function: YES	_____ 20. Domain: $\{2 \leq x \leq 7\}$ Range: $\{1 \leq x \leq 6\}$ Function: NO	_____ 21. Domain: $\{0 \leq x \leq 4\}$ Range: $\{0 \leq y \leq 6\}$ Function: YES
_____ 22. Domain: $\{-4 < x < 5\}$ Range: $\{-2 \leq y < 5\}$ Function: YES	_____ 23. Domain: $\{x \leq 5\}$ Range: $\{y = 0\}$ Function: YES	_____ 24. Domain: $\{-7 < x < 0\}$ Range: $\{-3 < y < 4\}$ Function: YES

USE THESE GRAPHS TO ANSWER QUESTIONS 1 – 12.



USE THESE GRAPHS TO ANSWER QUESTIONS 13 – 24.



Name: \_\_\_\_\_

KEY

Period: \_\_\_\_\_

Date: \_\_\_\_\_

### DOMAIN AND RANGE MATCHING ACTIVITY

Read the attached page of notes first below beginning this activity. It gives you examples of domain and range problems just like these.

Match each domain and range given in this table with a graph labeled from **A to L** on the attached page. Only use Graphs A – L for this page. Write the letter of your answer in the blank provided for each problem.

<u>D</u> 1. Domain: $\{-4 \leq x \leq 4\}$ Range: $\{-4 \leq y \leq 4\}$ Function: NO	<u>G</u> 2. Domain: $\{-3 < x \leq 5\}$ Range: $\{y = -1\}$ Function: YES	<u>H</u> 3. Domain: $\{-4 \leq x \leq 2\}$ Range: $\{-2 \leq y \leq 4\}$ Function: YES
<u>F</u> 4. Domain: $\{x > 0\}$ Range: $\{y = 4\}$ Function: YES	<u>A</u> 5. Domain: $\{-6 \leq x \leq 6\}$ Range: $\{0 \leq y \leq 6\}$ Function: YES	<u>C</u> 6. Domain: $\{x = -5\}$ Range: $\{-2 < y < 6\}$ Function: NO
<u>E</u> 7. Domain: $\{x \geq 0\}$ Range: $\{\text{all real numbers}\}$ Function: NO	<u>J</u> 8. Domain: $\{-3 \leq x \leq 4\}$ Range: $\{-2 \leq y \leq 4\}$ Function: NO	<u>L</u> 9. Domain: $\{\text{all real numbers}\}$ Range: $\{\text{all real numbers}\}$ Function: YES
<u>B</u> 10. Domain: $\{-7 \leq x < 5\}$ Range: $\{-3 \leq y < 1\}$ Function: YES	<u>K</u> 11. Domain: $\{\text{all real numbers}\}$ Range: $\{y \geq 0\}$ Function: YES	<u>I</u> 12. Domain: $\{-3 < x < 4\}$ Range: $\{0 \leq y \leq 5\}$ Function: YES

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Name: \_\_\_\_\_ Period: \_\_\_\_\_ Date: \_\_\_\_\_

## DOMAIN AND RANGE MATCHING ACTIVITY

Match each domain and range given in this table with a graph labeled from **M to X** on the attached page. Only use Graphs M to X for this page. Write the letter of your answer in the blank provided for each problem.

<p><u>X</u> 13.</p> <p>Domain: <math>\{-6 \leq x \leq 3\}</math></p> <p>Range: <math>\{-6 \leq y \leq -1\}</math></p> <p>Function: YES</p>	<p><u>Q</u> 14.</p> <p>Domain: <math>\{0 \leq x &lt; 5\}</math></p> <p>Range: <math>\{0 \leq y &lt; 7\}</math></p> <p>Function: YES</p>	<p><u>N</u> 15.</p> <p>Domain: <math>\{-5 \leq x &lt; 0\}</math></p> <p>Range: <math>\{-5 &lt; y \leq -1\}</math></p> <p>Function: YES</p>
<p><u>V</u> 16.</p> <p>Domain: <math>\{-6 \leq x \leq 3\}</math></p> <p>Range: <math>\{-5 \leq y \leq -1\}</math></p> <p>Function: YES</p>	<p><u>U</u> 17.</p> <p>Domain: <math>\{0 \leq x \leq 6\}</math></p> <p>Range: <math>\{0 \leq y \leq 7\}</math></p> <p>Function: YES</p>	<p><u>O</u> 18.</p> <p>Domain: <math>\{-4 \leq x \leq 7\}</math></p> <p>Range: <math>\{-7 \leq y \leq -2\}</math></p> <p>Function: NO</p>
<p><u>P</u> 19.</p> <p>Domain: <math>\{x \leq 0\}</math></p> <p>Range: <math>\{y \geq 0\}</math></p> <p>Function: YES</p>	<p><u>M</u> 20.</p> <p>Domain: <math>\{2 \leq x \leq 7\}</math></p> <p>Range: <math>\{1 \leq x \leq 6\}</math></p> <p>Function: NO</p>	<p><u>R</u> 21.</p> <p>Domain: <math>\{0 \leq x \leq 4\}</math></p> <p>Range: <math>\{0 \leq y \leq 6\}</math></p> <p>Function: YES</p>
<p><u>W</u> 22.</p> <p>Domain: <math>\{-4 &lt; x &lt; 5\}</math></p> <p>Range: <math>\{-2 \leq y &lt; 5\}</math></p> <p>Function: YES</p>	<p><u>S</u> 23.</p> <p>Domain: <math>\{x \leq 5\}</math></p> <p>Range: <math>\{y = 0\}</math></p> <p>Function: YES</p>	<p><u>T</u> 24.</p> <p>Domain: <math>\{-7 &lt; x &lt; 0\}</math></p> <p>Range: <math>\{-3 &lt; y &lt; 4\}</math></p> <p>Function: YES</p>

(3-)



# Graphing Review

Basic Graphing Review – Know these base functions and their graphs so you are able to apply transformations on them in the course.

- Label the  $x$ - and  $y$ - axis
- Make a table of values
- Plot the point on your grid
- Draw a line or smooth curve
- Domain: the set of  $x$  values valid in the equation
- Range: the set of  $y$  values valid in the equation

Use Set Notation for writing domain and range:

$\{x | x \in \mathbb{R}\}$  means  $x$  is in the set of real numbers

$\{x \in \mathbb{R}\}$

$\{y | y \in \mathbb{R}\}$  means  $y$  is in the set of real numbers

Use the following symbols:

$\leq$  for less than and equal to;  $<$  for only less than

$\geq$  for greater than and equal to;  $>$  for only greater than

$\neq$  for not equal to

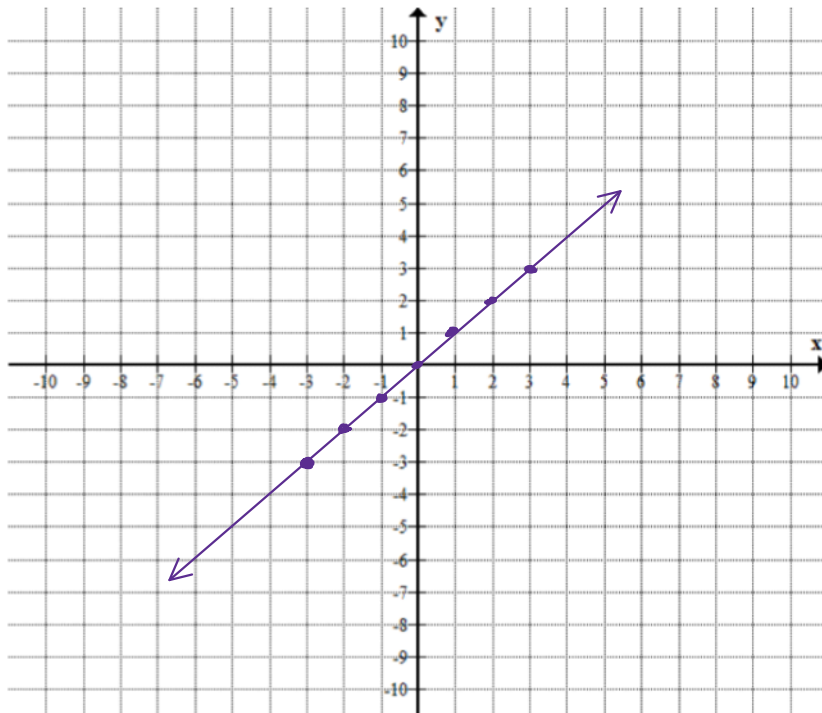
When graphing, start with a table of values. Look at restrictions and use your graphing calc to verify.

1. Graph:  $y = x$

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

input  
output

coordinates  
( $x, y$ )



$\{x \in \mathbb{R}\}$

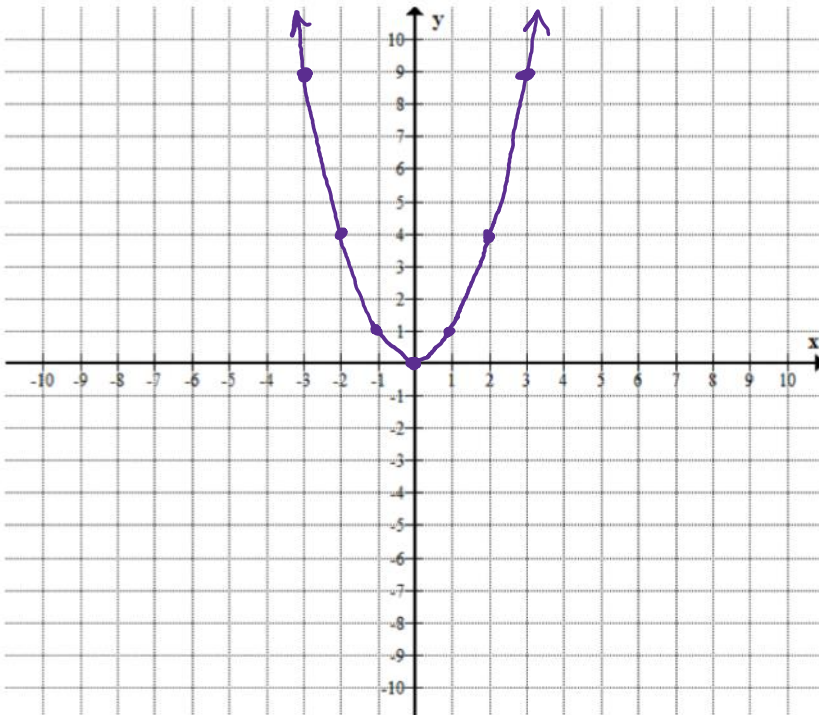
$\{y \in \mathbb{R}\}$

not in words "all real numbers"

2. Graph:  $y = x^2$

← called a quadratic function → graph is a parabola

input $x$	output $y$
-3	9
-2	4
-1	1
0	0
1	1
2	4
3	9

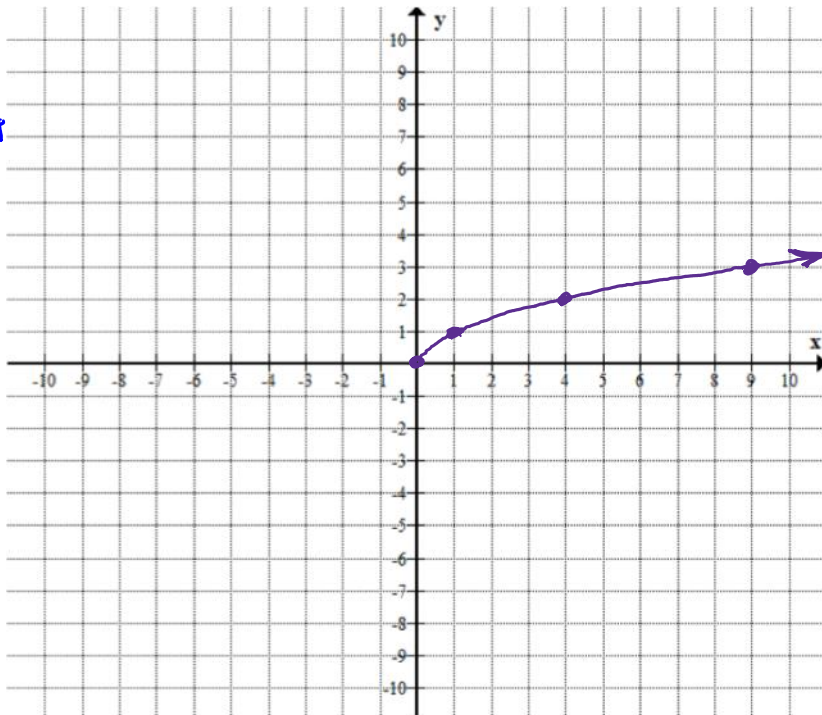


$\{x \in \mathbb{R}\}$   
 $\{y \geq 0, y \in \mathbb{R}\}$   
 OR  
 $\{y \geq 0\}$ .

3. Graph:  $y = \sqrt{x}$

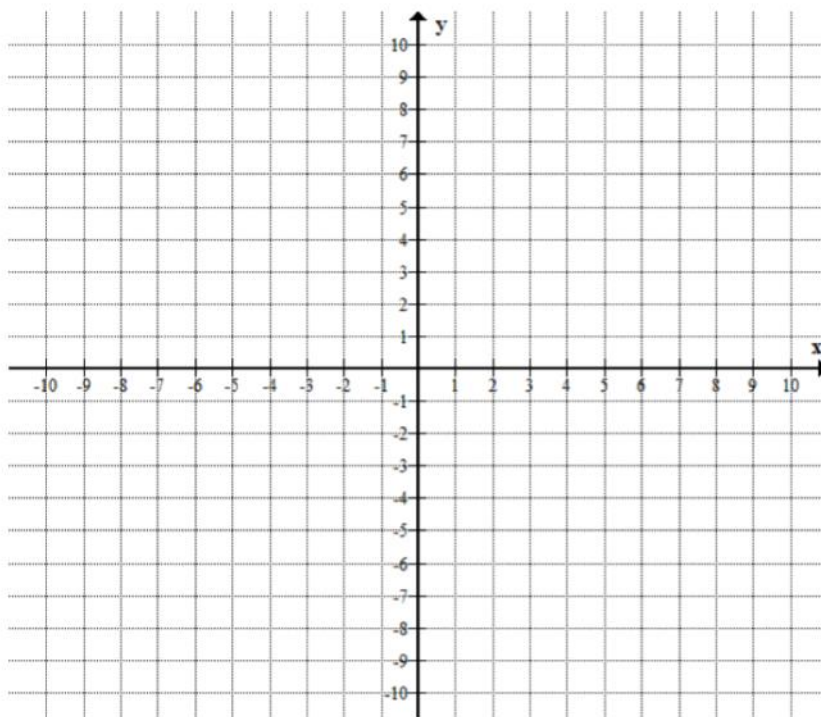
← called a radical function

input $x$	output $y$
0	0
1	1
4	2
9	3
16	4



$\{x \geq 0\}$   
 $\{y \geq 0\}$ .

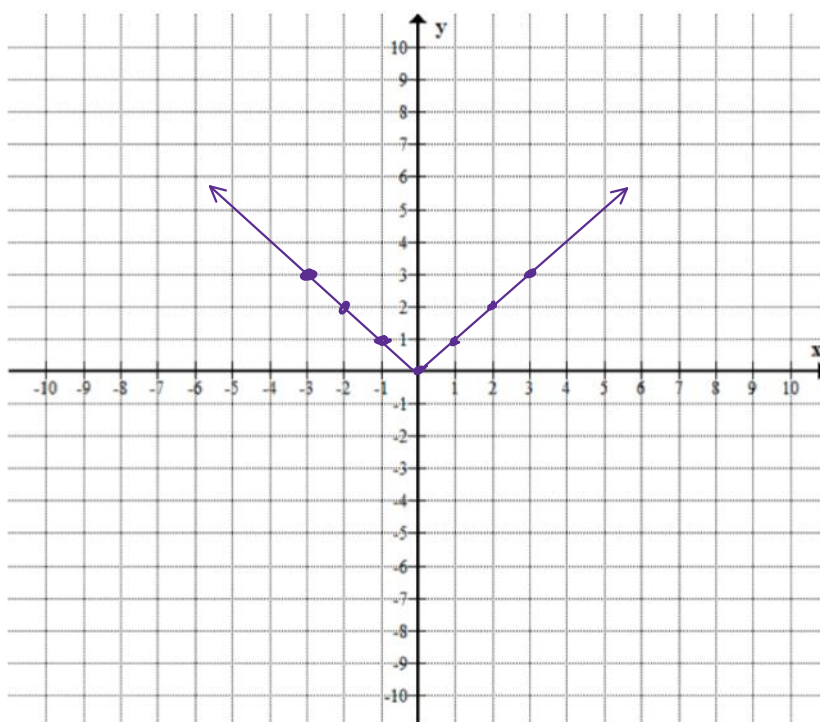
4. Graph:  $y = x^3$

5. Graph:  $y = |x|$

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

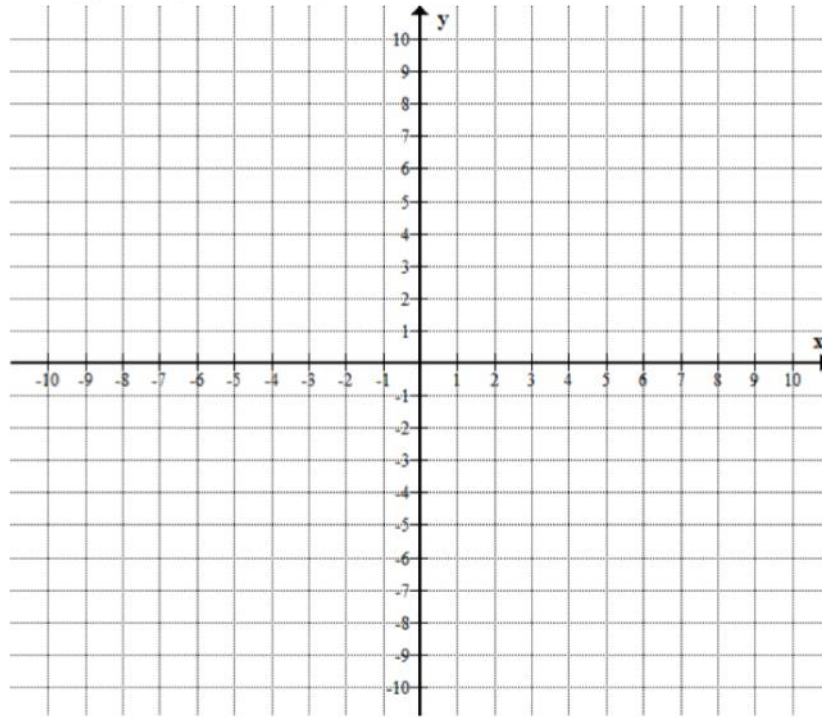
← called an absolute value function



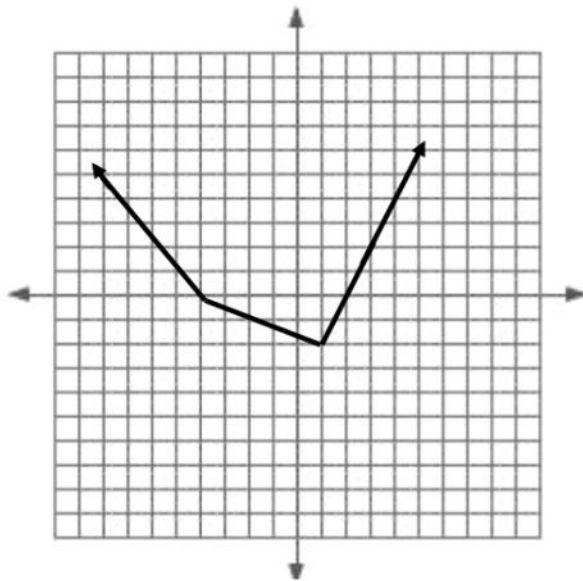
$\{x \in \mathbb{R}\}$   
 $\{y \geq 0\}$



6. Graph:  $y = \sqrt{25 - x^2}$  (general:  $y = \sqrt{r^2 - x^2}$ )

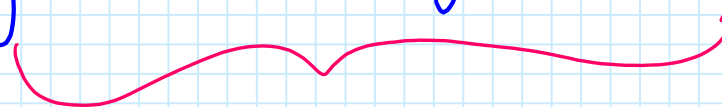
7. This is the graph of  $y = f(x)$ . List 4 or 5 points on this graph in the table of values.




## Vertical & Horizontal Translations

↓  
 $y = f(x) + k$

↓  
 $y = f(x - h)$



$$y = f(x - h) + k$$

h units  
right/left

k units  
up/down.

\* remember  
opposites.

(x + 1) 1 left

(x - 1) 1 right

Try #1 a, c, e

#2 a, b, c

## 2.4 Translations

A **transformation** of a function alters the equation and any combination of the location, shape, and orientation of the graph.

Points on the original graph correspond to points on the transformed, or image, graph. The relationship between these sets of points can be called a **mapping**.

Mapping notation can be used to show a relationship between the coordinates of a set of points,  $(x, y)$ , and the coordinates of a corresponding set of points,  $(x, y + 3)$ , for example, as  $(x, y) \rightarrow (x, y + 3)$ .

### Did You Know?

*Mapping notation* is an alternate notation for function notation. For example,  $f(x) = 3x + 4$  can be written as  $f: x \rightarrow 3x + 4$ . This is read as "f is a function that maps x to 3x + 4."

One type of transformation is a **translation**. A translation can move the graph of a function up, down, left, or right. A translation occurs when the location of a graph changes but not its shape or orientation.

### transformation

- a change made to a figure or a relation such that the figure or the graph of the relation is shifted or changed in shape

### mapping

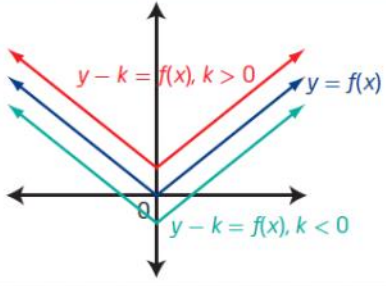
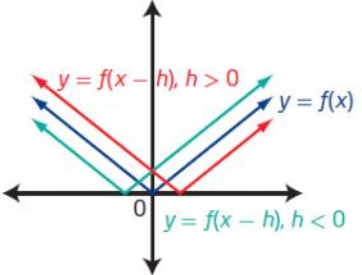
- the relating of one set of points to another set of points so that each point in the original set corresponds to exactly one point in the image set

### translation

- a slide transformation that results in a shift of a graph without changing its shape or orientation
- vertical and horizontal translations are types of transformations with equations of the forms  $y - k = f(x)$  and  $y = f(x - h)$ , respectively
- a translated graph is congruent to the original graph

## Key Ideas

- Translations are transformations that shift all points on the graph of a function up, down, left, and right without changing the shape or orientation of the graph.
- The table summarizes translations of the function  $y = f(x)$ .

Function	Transformation from $y = f(x)$	Mapping	Example
$y - k = f(x)$ or $y = f(x) + k$	A vertical translation If $k > 0$ , the translation is up. If $k < 0$ , the translation is down.	$(x, y) \rightarrow (x, y + k)$	
$y = f(x - h)$	A horizontal translation If $h > 0$ , the translation is to the right. If $h < 0$ , the translation is to the left.	$(x, y) \rightarrow (x + h, y)$	

- A sketch of the graph of  $y - k = f(x - h)$ , or  $y = f(x - h) + k$ , can be created by translating key points on the graph of the base function  $y = f(x)$ .

$$y = f(x) \rightarrow y = f(x - h) + k$$

horizontal translation  
 $h > 0$ : move to the right  
 $h < 0$ : move to the left  
 $h = 0$ : don't move

$$f(x) = f(x - h) + k$$

horizontal translation  
 $h > 0$ : move to the right  
 $h < 0$ : move to the left  
 $h = 0$ : don't move

$$f(x) = f(x - h) + k$$

vertical translation  
 $k > 0$ : move upward  
 $k < 0$ : move downward  
 $k = 0$ : don't move

The following table shows the coordinates of the point on the different curves after translation:

The point on $f(x)$	The point on $f(x + k)$	The point on $f(x - k)$
$(x, y)$	$(x - k, y)$	$(x + k, y)$

Meanwhile, the shape of the function and domain of the function remains the same.

The following table shows the coordinates of the point on the different curves after translation:

The point on $f(x)$	The point on $f(x) + C$	The point on $f(x) - C$
$(x, y)$	$(x, y + C)$	$(x, y - C)$

Meanwhile, the shape of the function and domain of the function remains the same.

