STARKVILLE OKTIBBEHA SCHOOL DISTRICT

Continuity of Learning Assignments

Grade: 8th grade Subject: Algebra I

Day 11 and 12	Day 13 and 14	Day 15 and 16	Day 17 and 18	Day 19 and 20
Essential Activity **Algebra 1** Algebra Nation Section 3: Lesson 1 (Input and Output Values p. 53 - 56) and Lesson 2 (Representing,Naming, and Evaluating Functions p. 56-58) Complete Check Your Understanding Quiz Watch Video If You Miss More than 2 Questions	**Essential Activity** **Algebra 1** Algebra Nation Section 3: Lesson 3 (Adding and Subtracting Functions p. 58-60) and Lesson 4 (Multiplying Functions p. 60 - 63). Complete Check Your Understanding Quiz Watch Video If You Miss More than 2 Questions	**Essential Activity** **Algebra 1** Algebra Nation Section 3: Lesson 5 (Closure Property p. 64 - 66) and Lesson 6 (Key Functions of Graphs of Functions Part 1 p. 66-69). Complete Check Your Understanding Quiz Watch Video If You Miss More than 2 Questions	**Essential Activity** **Algebra 1** Algebra Nation Section 3: Lesson 7 (Key Features of Graphs of Functions p. 70 - 72) and Lesson 8 (Average Rate of Change Over an Intervalp. M72 - 75) Complete Check Your Understanding Quiz Watch Video If You Miss More than 2 Questions	**Essential Activity** **Algebra 1** Algebra Nation Section 3: Lesson 9 (Transformations of Functions p. 75 – 79). Complete Check Your Understanding Quiz Watch Video If You Miss More than 2 Questions Complete Test Yourself Practice Test End of Section 2 in Algebra Nation
Extension **Algebra 1** Complete Khan Academy Lesson and Practice https://www.khanacademy.org/math/algebra/x2f8bb11595	**Extension** **Algebra 1** Complete Khan Academy Lesson and Practice	**Extension** **Algebra 1** Complete Khan Academy Lesson and Practice	**Extension** **Algebra 1** Complete Khan Academy Lesson and Practice https://www.khanacademy.org/math/algebra/x	**Extension** **Algebra 1** Complete Khan Academy Lessons and Practice https://www.khanacademy.org/math/algebra2/x2ec2f6f8

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Continuity of Learning Assignments

Grade: 8th grade Subject: Algebra I

b61c86:functions/x2f8bb11595b61c86:evaluating-functions/v/what-is-a-function	https://www.khanacademy.org/math/algebra-home/alg-polynomials/alg-adding-and-subtracting-polynomials/v/adding-and-subtracting-polynomials-1	https://www.khanacademy.org/math/algebra2/x2ec2f6f830c9fb89:poly-arithmetic/x2ec2f6f830c9fb89:bi-by-poly/v/multiplying-polynomials-using-area-model	2f8bb11595b61c86:functions/x2f8bb11595b61c86:average-rate-of-change/v/introduction-to-average-rate-of-change	30c9fb89:transformations/x2ec2f6f830c9fb89:trans-all-together/v/shifting-and-reflecting-functions

Name _____ Date _____

Introduction to Functions
Input and Output Values
Independent Practice

1. A giraffe's hunger level depends on the size of its last meal.

   Part A: What is the independent variable?

   Part B: What is the dependent variable?

2. You earn $\$20$ per hour doing landscaping work. Your total earnings depend on the amount of hours you spend landscaping.

   Part A: What is the independent variable?

   Part B: What is the dependent variable?

   Part C: Write a function to represent the situation.

3. Mr. Khans is buying staplers for his office. Each stapler costs $\$16.99$.

   Part A: What does his final total cost depend upon?

   Part B: In this scenario, what is the input? What is the output?

   Part C: Write a function to represent the situation.

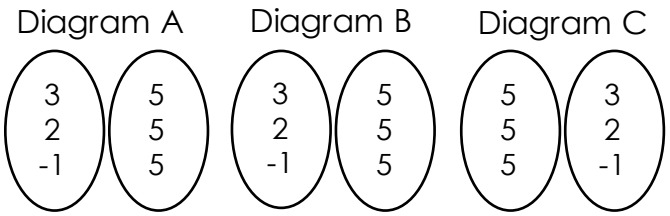
   Part D: If Mr. Khans buys 15 staplers, it would cost him $\$254.85$. How would you write this using function notation?

4. Cristiano Ronaldo has a messy house. The function that represents the total cost Cristiano spends having his house cleaned is $C(v) = 125v$, where v represents the number of visits.

   Part A: How much does Cristiano spend per visit?

   Part B: Define the input and output in the given scenario.

5. Consider the following incomplete mapping diagrams.



Part A: Complete Diagram A so that it is a function.

Part B: Is it possible to complete Diagram B so that it is NOT a function. If so, complete the diagram to show a relation, but not a function. If not, justify your reasoning.

Part C: Is it possible to complete the mapping diagram for Diagram C so it represents a function? If so, complete the diagram to show a function. If not, justify your reasoning.

6. The cost to manufacture x chairs can be represented by the function $C(x) = 36x$. Circle the pair of numbers (one in each box) that correctly completes the statement about the function.

If $C(63) = 2268$, then

0
6
63
378

chairs cost \$

6.
189.
378.
2,268.

7. Which of the following relations are not functions? Select all that apply.

- ☐ $\{(1,3),(3,7),(5,11),(7,15),(9,19)\}$
- ☐ $\{(1,3),(1,7),(5,11),(5,15),(9,19)\}$
- ☐ $\{(-2,4),(-1,1),(0,0),(1,1),(2,4)\}$
- ☐ $\{(2,4),(1,1),(0,0),(1,-1),(2,-4)\}$
- ☐ $\{(6,3),(4,1),(2,1),(0,-1),(-2,-3)\}$
- ☐ $\{(1,3),(3,7),(3,11),(7,15),(9,19)\}$
- ☐ $\{(1,3),(3,7),(5,11),(9,15),(9,19)\}$

 Name_____

Adding and Subtracting Polynomials

Date_____ Period____

Simplify each expression.

1) $(5p^2 - 3) + (2p^2 - 3p^3)$

2) $(a^3 - 2a^2) - (3a^2 - 4a^3)$

3) $(4 + 2n^3) + (5n^3 + 2)$

4) $(4n - 3n^3) - (3n^3 + 4n)$

5) $(3a^2 + 1) - (4 + 2a^2)$

6) $(4r^3 + 3r^4) - (r^4 - 5r^3)$

7) $(5a + 4) - (5a + 3)$

8) $(3x^4 - 3x) - (3x - 3x^4)$

9) $(-4k^4 + 14 + 3k^2) + (-3k^4 - 14k^2 - 8)$

10) $(3 - 6n^5 - 8n^4) - (-6n^4 - 3n - 8n^5)$

11) $(12a^5 - 6a - 10a^3) - (10a - 2a^5 - 14a^4)$

12) $(8n - 3n^4 + 10n^2) - (3n^2 + 11n^4 - 7)$

13) $(-x^4 + 13x^5 + 6x^3) + (6x^3 + 5x^5 + 7x^4)$

14) $(9r^3 + 5r^2 + 11r) + (-2r^3 + 9r - 8r^2)$

15) $(13n^2 + 11n - 2n^4) + (-13n^2 - 3n - 6n^4)$

16) $(-7x^5 + 14 - 2x) + (10x^4 + 7x + 5x^5)$

 Name_____

Multiplying Polynomials

Date_____ Period____

Find each product.

1) $6v(2v + 3)$

2) $7(-5v - 8)$

3) $2x(-2x - 3)$

4) $-4(v + 1)$

5) $(2n + 2)(6n + 1)$

6) $(4n + 1)(2n + 6)$

7) $(x - 3)(6x - 2)$

8) $(8p - 2)(6p + 2)$

9) $(6p + 8)(5p - 8)$

10) $(3m - 1)(8m + 7)$

11) $(2a - 1)(8a - 5)$

12) $(5n + 6)(5n - 5)$

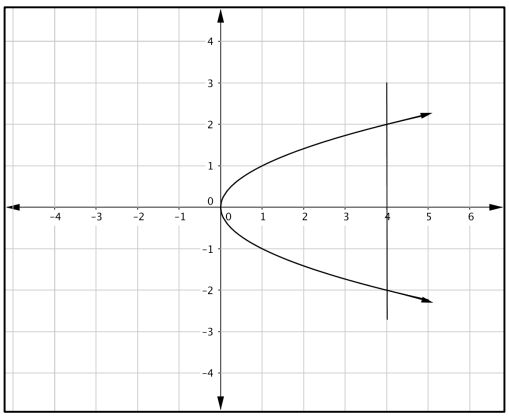
Name_____ Date_____

Introduction to Functions
Key Features of Graphs of Functions – Part 1
Independent Practice

1. The following statement is false. Highlight the two words that should be interchanged to make it a true statement.

   In a function, every output value corresponds to exactly one input value.

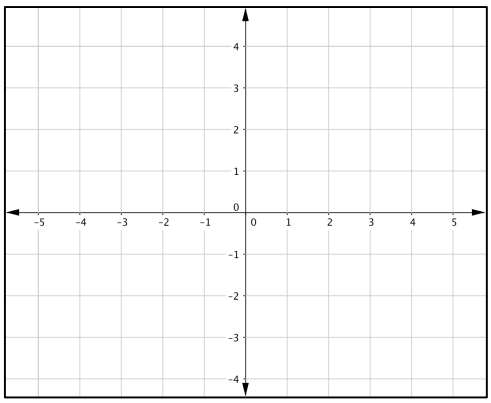
2. The following graph fails the vertical line test and is not a function.



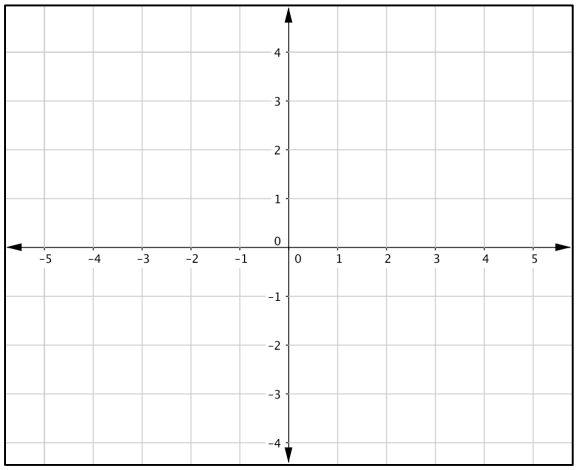
   a. Explain how the vertical line test shows that this relation is NOT a function.

   b. Name two points on the graph that show that this relation is NOT a function.

3. Sketch the graph of a relation that is a function.



4. Sketch the graph of a relation that is NOT a function.



5. Consider the following scenarios. Determine if each one represents a function or not. Explain your answer.

   a. A golf ball is hit down a fairway. The golfer relates the time passed to the height of the ball.

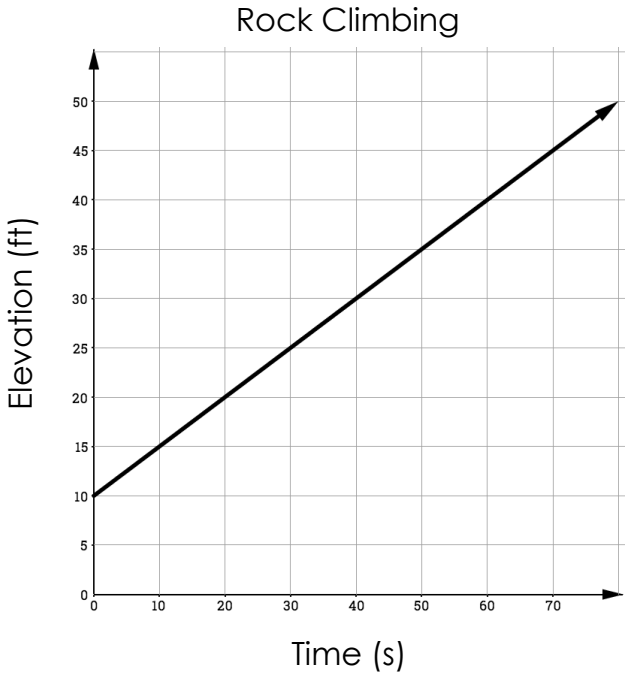
   b. A trainer takes a survey of all the athletes in a school about their height, rounded to the nearest inch, and their grade level. The trainer relates their grade levels to their heights.

6. Use the word bank to complete the sentences below.

x –coordinate	y –coordinate	x –intercept	y –intercept	solution

   a. The _____ of a graph is the location where the graph crosses the x –axis.
   b. The _____ of a graph is the location where the graph crosses the y –axis.
   c. The _____ of the y –intercept is always zero.
   d. The _____ of the x –intercept is always zero.
   e. The x –intercept is the _____ to a function or group.

7. The graph below represents a rock climber's height as she ascends a hill.



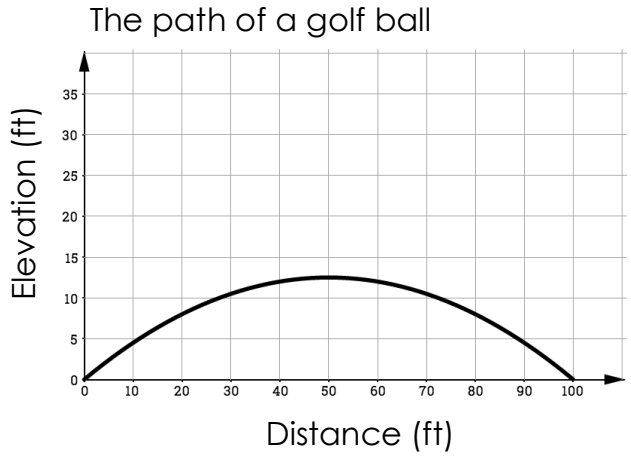
a. The above graph is (circle one) linear/nonlinear.

b. Is the above graph a function? Explain.

c. What is the y –intercept and what does the y –intercept represent?

d. Why would there not be an x –intercept for this situation?

8. The graph below represents the path of a golf ball.



a. The above graph is (circle one) linear/nonlinear.

b. Is the above graph a function? Explain.

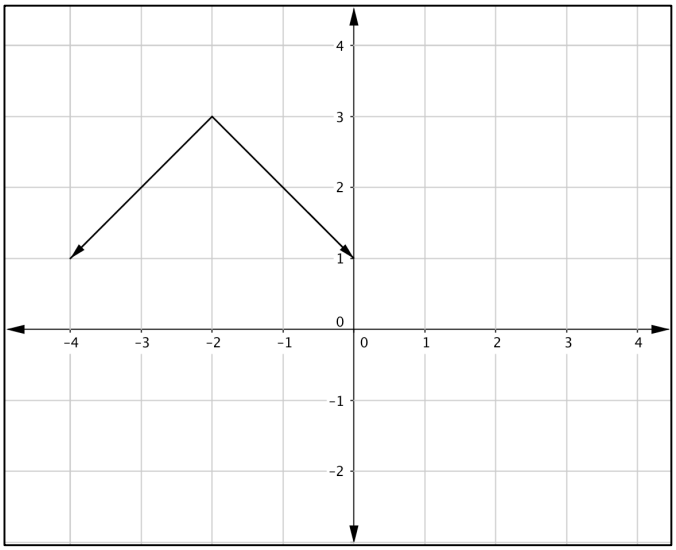
c. What is the y –intercept and what does the y –intercept represent?

d. What is the solution to this graph and what does it represent in this situation?

Name _____ Date_____

Introduction to Functions
Key Features of Graphs of Functions – Part 2
Independent Practice

1. Consider the following graph of an absolute value function.



a. Define the domain.

b. Define the range.

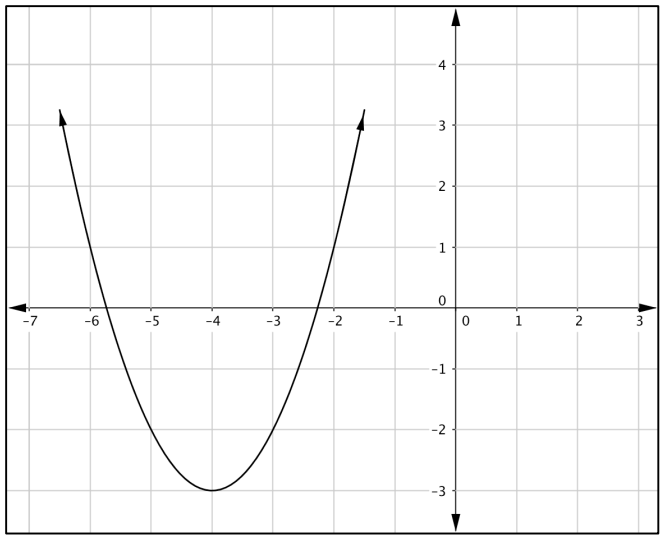
c. Where is the graph increasing?

d. Where is the graph decreasing?

e. Identify any relative maximums.

f. Identify any relative minimums.

2. Consider the following graph of a quadratic function.



a. Define the domain.

b. Define the range.

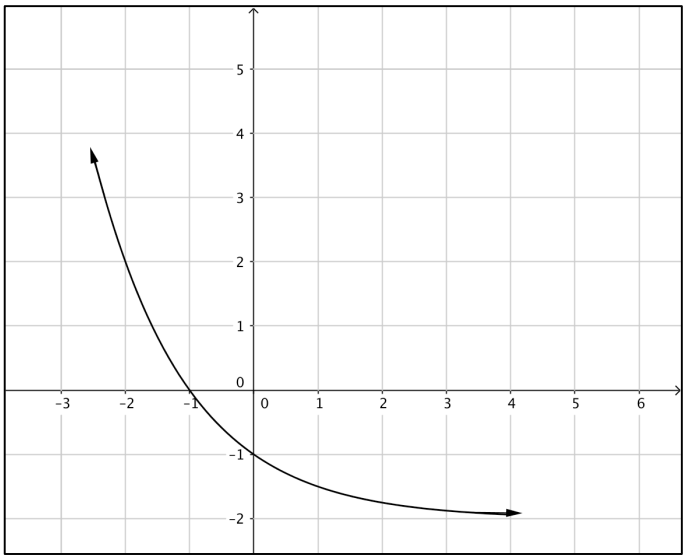
c. Where is the graph increasing?

d. Where is the graph decreasing?

e. Identify any relative maximums.

f. Identify any relative minimums.

3. Consider the following graph of an exponential function.



a. Define the domain.

b. Define the range.

c. Where is the graph increasing?

d. Where is the graph decreasing?

e. Identify any relative maximums.

f. Identify any relative minimums.

Name _____ Date _____

Introduction to Functions
Transformations of Functions
Independent Practice

1. Label the following as transformations on the independent variable or the dependent variable and describe the transformation.

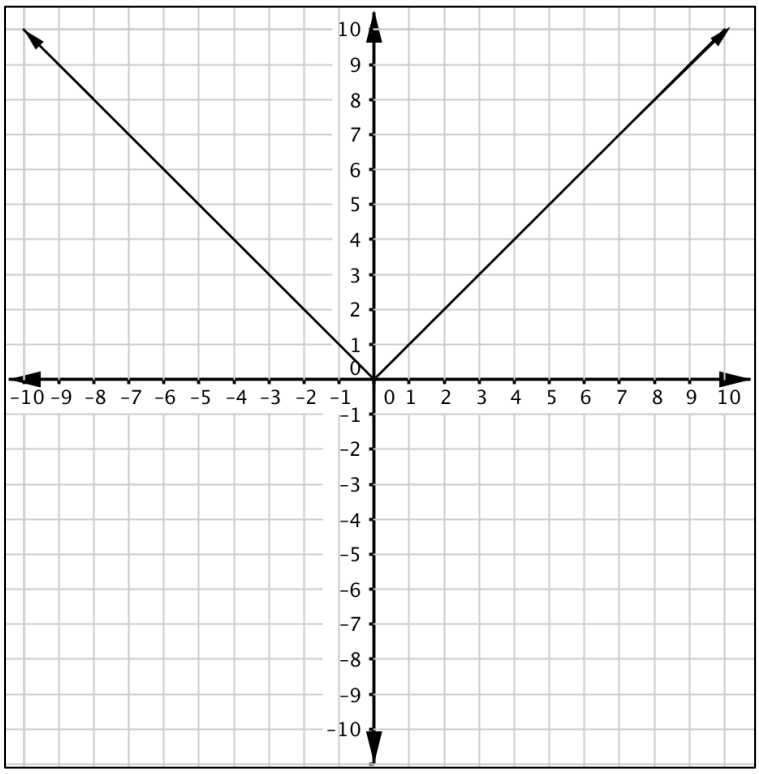
		Description
a. $f(x)+3$	○ Independent Variable ○ Dependent Variable	
b. $f(x)-3$	○ Independent Variable ○ Dependent Variable	
c. $f(x+3)$	○ Independent Variable ○ Dependent Variable	
d. $f(x-3)$	○ Independent Variable ○ Dependent Variable	

2. The following table represents the function $h(x)$. Complete the table for $g(x)$, given $g(x)=\frac{1}{2}h(x)$.

x	$h(x)$
-4	256
-2	16
0	0
3	81
6	1296

x	$g(x)$

3. The following graph represents the function $f(x)$. Sketch and label the following functions on the same coordinate plane.
   a. $f(x+2)$
   b. $f(x-5)$
   c. $f(x)+2$
   d. $f(x)-5$



4. The following table represents the function $h(x)$. Complete the table for $g(x)$, given $g(x) = h\left(\frac{1}{4}x\right)$. The first two have been done for you!

x	$h(x)$
-2	3.25
-1	3.5
0	4
1	5
2	7
3	11
4	19

x	$h\left(\frac{1}{4}x\right)$	$g(x)$
-8	$h\left(\frac{1}{4}\cdot -8\right) = h(-2)$	3.25
-4	$h\left(\frac{1}{4}\cdot -4\right) = h(-1)$	3.5

5. Consider the following table of values.

x	$f(x)$	$g(x)$	$h(x)$	$m(x)$
-5	25	23	-25	32
-3	9	7	-9	16
0	0	-2	0	7
3	9	7	-9	16
5	25	23	-25	32

   a. Write $g(x)$ as a transformation of $f(x)$.

   b. Write $h(x)$ as a transformation of $f(x)$.

   c. Write $m(x)$ as a transformation of $f(x)$.

6. Consider the following table of values.

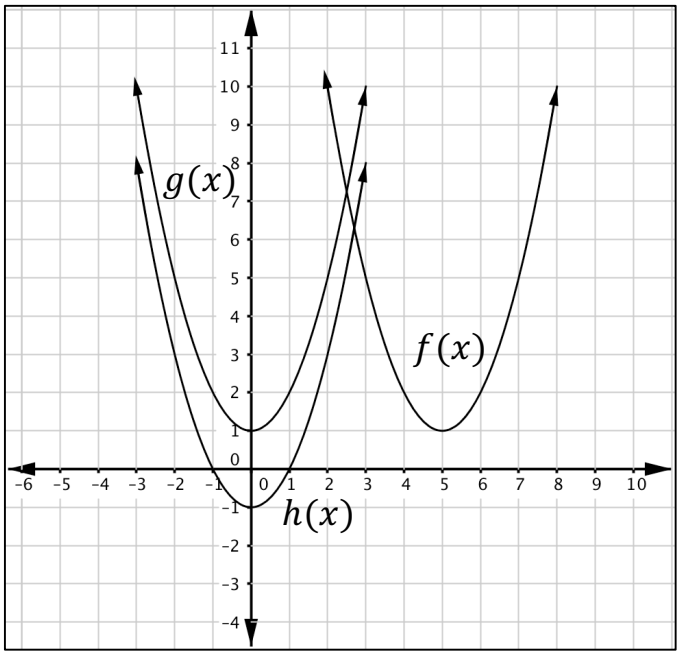
x	$f(x)$
-5	25
-3	9
0	0
3	9
5	25

x	$m(x)$
-7	25
-5	9
-2	0
1	9
3	25

   a. Write $m(x)$ as a transformation of $f(x)$.

   b. Write $f(x)$ as a transformation of$m(x)$.

7. Consider the following graph.



   a. Write $h(x)$ as a transformation of $g(x)$.

   b. Write $g(x)$ as a transformation of $f(x)$.

   c. Write $h(x)$ as a transformation of $f(x)$.

8. Consider the following Algebra 1 standard that deals with transformations.

   MAFS.912.F-BF.2.3: Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $kf(x)$, $f(kx)$, and $f(x + k)$ for specific values of k (both positive and negative); find the value of k given the graphs.

   a. Circle the expressions that describe a transformation on the independent variable.

   b. Underline the expressions that describe a transformation on the dependent variable.

Section 3: Introduction to Functions

Section 3 – Topic 1
Input and Output Values

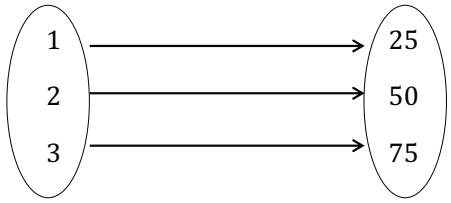
A function is a relationship between input and output.

- ***Domain*** is the set of values of x used for the _____ of the function.
- ***Range*** is the set of values of y calculated from the domain for the _____ of the function.

In a function, every x corresponds to only one y.

- y can also be written as $f(x)$.

Consider the following function.



For every x (input, domain) there is a unique y (output, range).

We also refer to the variables as independent and dependent. The dependent variable _____ ____ the independent variable.

Refer to the mapping diagram on the previous page.

Which variable is independent?

Which variable is dependent?

Consider a square whose perimeter depends on the length of its sides.

What is the independent variable?

What is the dependent variable?

How can you represent this situation using function notation?

STUDY EDGE TIP

We can choose any letter to represent a function, such as $f(x)$ or $g(x)$, where x is the input value. By using different letters, we show that we are talking about different functions.

Let's Practice!

1. You earn $\$10.00$ per hour babysitting. Your total earnings depend on the number of hours you spend babysitting.

   a. What is the independent variable?

   b. What is the dependent variable?

   c. How would you represent this situation using function notation?

2. The table below represents a relation.

x	y
-3	5
0	4
2	6
-3	8

   a. Is the relation also a function? Justify your answer.

   b. If the relation is not a function, what number could be changed to make it a function?

Try It!

3. Mrs. Krabappel is buying composition books for her classroom. Each composition book costs $\$1.25$.

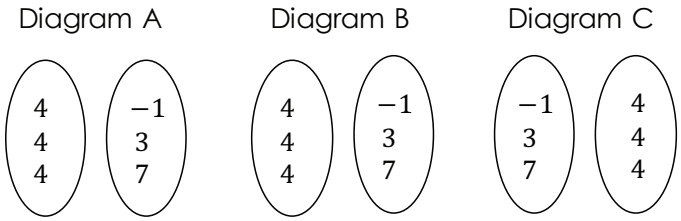
   a. What does her total cost depend upon?

   b. What are the input and output?

   c. Write a function to describe the situation.

   d. If Mrs. Krabappel buys 24 composition books, they will cost her $\$30.00$. Write this function using function notation.

4. Consider the following incomplete mapping diagrams.



a. Complete Diagram A so that it is a function.

b. Complete Diagram B so that it is NOT a function.

c. Is it possible to complete the mapping diagram for Diagram C so it represents a function? If so, complete the diagram to show a function. If not, justify your reasoning.

BEAT THE TEST!

1. Isaac Messi is disorganized. To encourage Isaac to be more organized, his father promised to give him three dollars for every day that his room is clean and his schoolwork is organized.

   Part A: Define the input and output for the given scenario.

   Input:

   Output:

   Part B: Write a function to represent this situation.

2. The cost to manufacture x pairs of shoes can be represented by the function $C(x) = 63x$. Complete the statement about the function.

If $C(6) = 378$, then [0 / 6 / 63 / 378] pairs of shoes cost [\$6. / \$189. / \$378. / \$2,268.]

3. Which of the following relations is not a function?

Ⓐ $\{(0,5),(2,3),(5,8),(3,8)\}$
Ⓑ $\{(4,2),(-4,5),(0,0)\}$
Ⓒ $\{(6,5),(4,1),(-3,2),(4,2)\}$
Ⓓ $\{(-3,-3),(2,1),(5,-2)\}$

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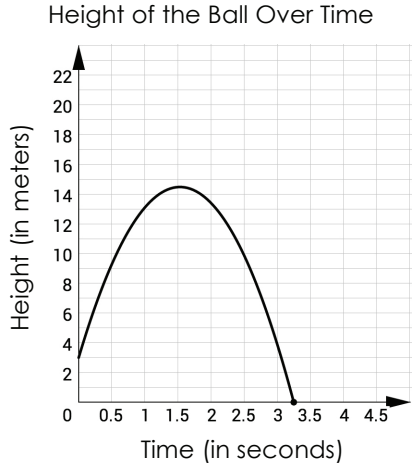
Section 3 – Topic 2
Representing, Naming, and Evaluating Functions

A ball is thrown into the air with an initial velocity of 15 meters per second. The quadratic function $h(t) = -4.9t^2 + 15t + 3$ represents the height of the ball above the ground, in meters, with respect to time t, in seconds.

Determine $h(2)$ and explain what it represents.

Is -3 a reasonable input for the function?

The graph below represents the height of the ball with respect to time.



What is a reasonable domain for the function?

What is a reasonable range for the function?

Let's Practice!

1. On the moon, the time, in seconds, it takes for an object to fall a distance, d, in feet, is given by the function $f(d) = 1.11\sqrt{d}$.

   a. Determine $f(5)$ and explain what it represents.

   b. The South Pole-Aitken basin on the moon is $42{,}768$ feet deep. Determine a reasonable domain for a rock dropped from the rim of the basin.

2. Floyd drinks two Mountain Dew sodas in the morning. The function that represents the amount of caffeine, in milligrams, remaining in his body after drinking the sodas is given by $f(t) = 110(0.8855)^t$ where t is time in hours. Floyd says that in two days the caffeine is completely out of his system. Do you agree? Justify your answer.

Try It!

3. Medical professionals say that $98.6°\text{F}$ is the normal body temperature of an average person. Healthy individuals' temperatures should not vary more than $0.5°\text{F}$ from that temperature.

   a. Write an absolute value function $f(t)$ to describe an individual's variance from normal body temperature, where t is the individual's current temperature.

   b. Determine $f(101.5)$ and describe what that tells you about the individual.

   c. What is a reasonable domain for a healthy individual?

BEAT THE TEST!

1. The length of a shipping box is two inches longer than the width and four times the height.

   Part A: Write a function $V(w)$ that models the volume of the box, where w is the width, in inches.

   Part B: Evaluate $V(10)$. Describe what this tells you about the box.

Algebra Wall

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Section 3 – Topic 3
Adding and Subtracting Functions

Let $h(x) = 2x^2 + x - 5$ and $g(x) = -3x^2 + 4x + 1$.

Find $h(x) + g(x)$.

Find $h(x) - g(x)$.

Let's Practice!

1. Consider the following functions.

$$f(x) = 3x^2 + x + 2$$
$$g(x) = 4x^2 + 2(3x - 4)$$
$$h(x) = 5(x^2 - 1)$$

   a. Find $f(x) - g(x)$.

   b. Find $g(x) - h(x)$.

Try It!

2. Recall the functions we used earlier.

$$f(x) = 3x^2 + x + 2$$
$$g(x) = 4x^2 + 2(3x - 4)$$
$$h(x) = 5(x^2 - 1)$$

   a. Let $m(x)$ be $f(x) + g(x)$. Find $m(x)$.

   b. Find $h(x) - m(x)$.

BEAT THE TEST!

1. Consider the functions below.

$$f(x) = 2x^2 + 3x - 5$$
$$g(x) = 5x^2 + 4x - 1$$

Which of the following is the resulting polynomial when $f(x)$ is subtracted from $g(x)$?

Ⓐ $-3x^2 - x - 4$
Ⓑ $-3x^2 + 7x - 6$
Ⓒ $3x^2 + x + 4$
Ⓓ $3x^2 + 7x - 6$

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Section 3 – Topic 4
Multiplying Functions

Use the distributive property and modeling to perform the following function operations.

Let $f(x) = 3x^2 + 4x + 2$ and $g(x) = 2x + 3$.

Find $f(x) \cdot g(x)$.

Let $m(y) = 3y^5 - 2y^2 + 8$ and $p(y) = y^2 - 2$.

Find $m(y) \cdot p(y)$.

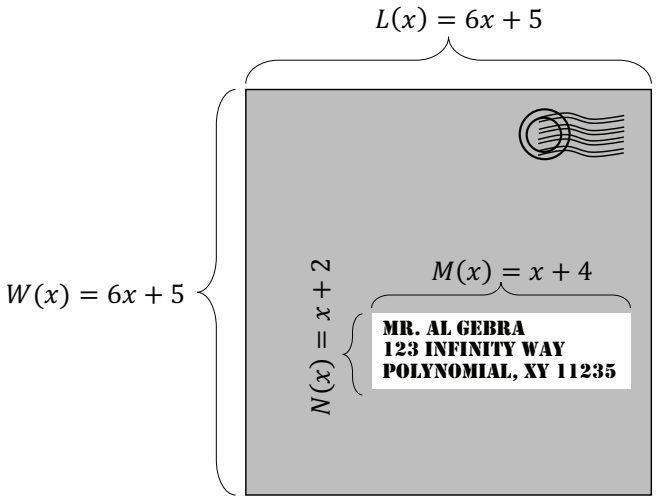
Let's Practice!

1. Let $h(x) = x - 1$ and $g(x) = x^3 + 6x^2 - 5$.

   Find $h(x) \cdot g(x)$.

Try It!

2. The envelope below has a mailing label.



a. Let $A(x) = L(x) \cdot W(x) - M(x) \cdot N(x)$. Find $A(x)$.

b. What does the function $A(x)$ represent in this problem?

BEAT THE TEST!

1. The length of the sides of a square are s inches long. A rectangle is six inches shorter and eight inches wider than the square.

   Part A: Express both the length and the width of the rectangle as a function of a side of the square.

   Part B: Write a function to represent the area of the rectangle in terms of the sides of the square.

2. Felicia needs to find the area of a rectangular field in her backyard. The length is represented by the function $L(x) = 4x^4 - 3x^2 + 6$ and the width is represented by the function $W(x) = x + 1$. Which of the following statements is correct about the area, $A(x)$, of the rectangular field in Felicia's backyard? Select all that apply.

   - ☐ $A(x) = 2[L(x) + W(x)]$
   - ☐ The resulting expression for $A(x)$ is a fifth-degree polynomial.
   - ☐ The resulting expression for $A(x)$ is a polynomial with a leading coefficient of 5.
   - ☐ The resulting expression for $A(x)$ is a binomial with a constant of 6.
   - ☐ $W(x) = \frac{A(x)}{L(x)}$

Section 3 – Topic 5
Closure Property

When we add two integers, what type of number is the sum?

When we multiply two irrational numbers, what type of numbers could the resulting product be?

A set is _____ for a specific operation if and only if the operation on two elements of the set ***always*** produces an element of the same set.

Are integers closed under addition? Justify your answer.

Are irrational numbers closed under multiplication? Justify your answer.

Let's apply the closure property to polynomials.

Are the following statements true or false? If false, give a counterexample.

Polynomials are closed under addition.

Polynomials are closed under subtraction.

Polynomials are closed under multiplication.

Let's Practice!

1. Check the boxes for the following sets that are closed under the given operations.

Set	+	−	×
$\{0, 1, 2, 3, 4, \dots\}$	☐	☐	☐
$\{\dots, -4, -3, -2, -1\}$	☐	☐	☐
$\{\dots, -3, -2, -1, 0, 1, 2, 3, \dots\}$	☐	☐	☐
{rational numbers}	☐	☐	☐
{polynomials}	☐	☐	☐

Try It!

2. Ms. Sanabria claims that the closure properties for polynomials are analogous to the closure properties for integers. Mr. Roberts claims that the closure properties for polynomials are analogous to the closure properties for whole numbers. Who is correct? Explain your answer.

BEAT THE TEST!

1. Choose from the following words and expressions to complete the statement below.

$2x^5 + (3y)^{-2} - 2$	$(5y)^2 + 4x + 3y^3$	$5y^{-1} + 7x^2 + 8y^2$

integers	variables	whole numbers
coefficients	rational numbers	exponents

The product of $5x^4 - 3x^2 + 2$ and _____

illustrates the closure property because the

_____ of the product are _____ ,

and the product is a polynomial.

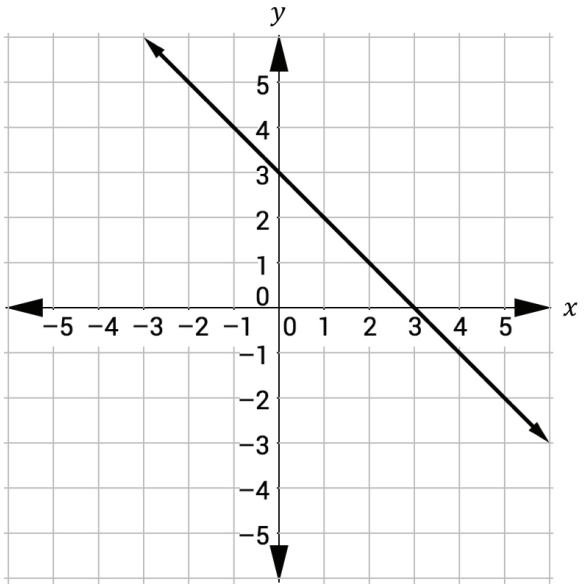
Want some help? You can always ask questions on the Algebra Wall and receive help from other students, teachers, and Study Experts. You can also help others on the Algebra Wall and earn Karma Points for doing so. Go to AlgebraNation.com to learn more and get started!

Section 3 – Topic 6
Key Features of Graphs of Functions – Part 1

Let's review the definition of a function.

Every input value (x) corresponds to _____ _____ output value (y).

Consider the following graph.



How can a vertical line help us quickly determine if a graph represents a function?

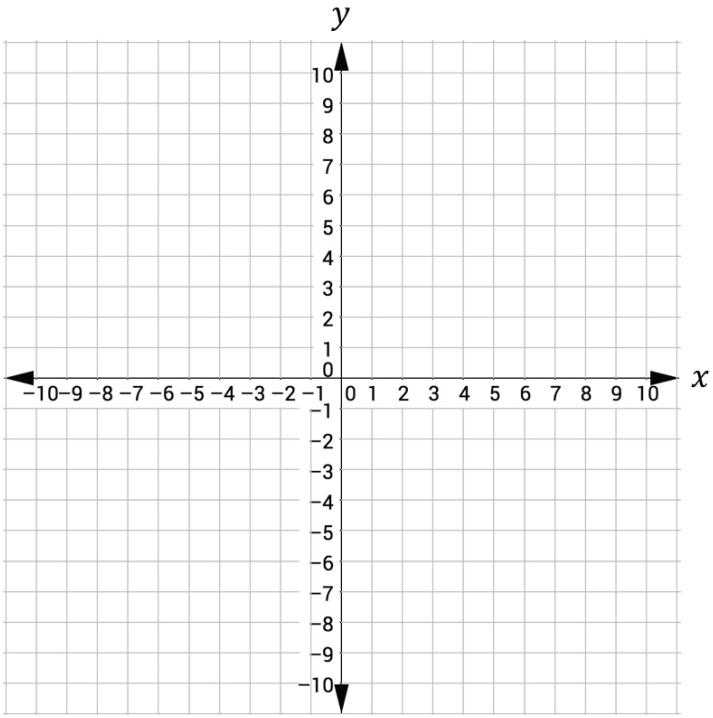
We call this the ***vertical line test***. Use the vertical line test to determine if the graph above represents a function.

Important facts:

- Graphs of lines are not always functions. Can you describe a graph of a line that is not a function?

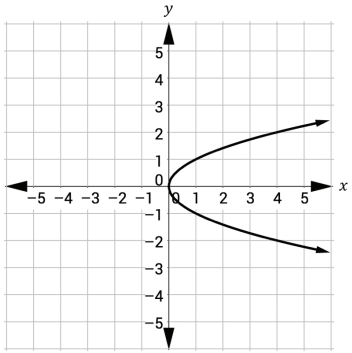
- Functions are not always linear.

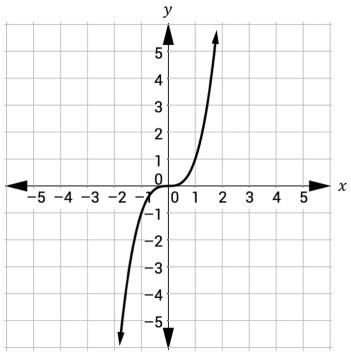
Sketch a graph of a function that is not linear.



Let's Practice!

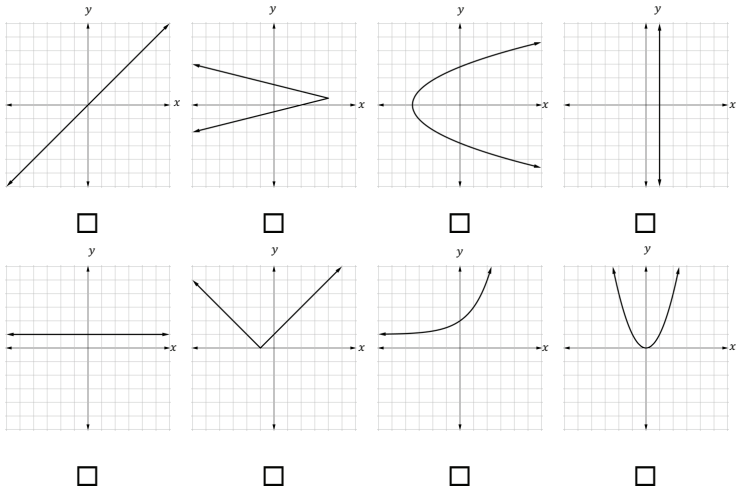
1. Use the vertical line test to determine if the following graphs are functions.





Try It!

2. Which of the following graphs represent functions? Select all that apply.



☐ ☐ ☐ ☐

☐ ☐ ☐ ☐

3. Consider the following scenarios. Determine if each one represents a function or not.

   a. An analyst takes a survey of people about their heights (in inches) and their ages. She then relates their heights to their ages (in years).

   b. A geometry student is dilating a circle and analyzes the area of the circle as it relates to the radius.

   c. A teacher has a roster of 32 students and relates the students' letter grades to the percent of points earned.

   d. A boy throws a tennis ball in the air and lets it fall to the ground. The boy relates the time passed to the height of the ball.

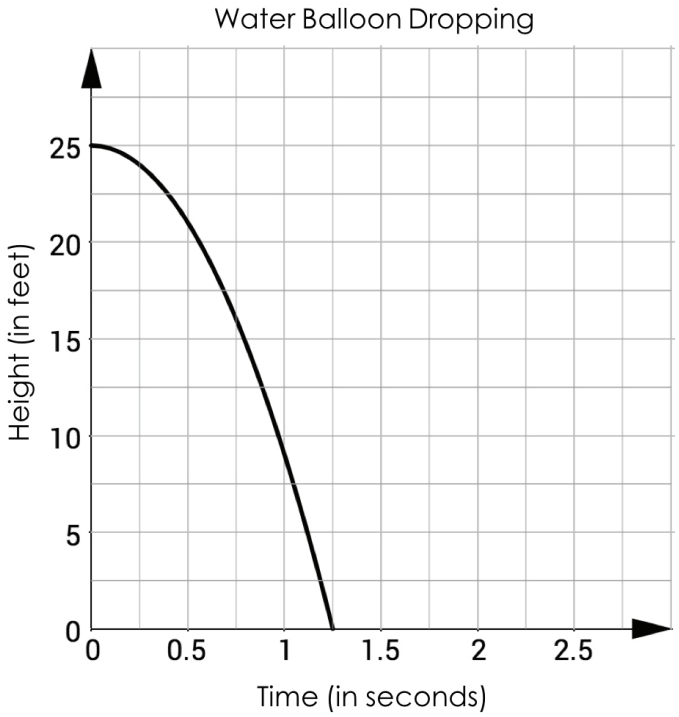
It's important to understand key features of graphs.

- An ***x-intercept*** of a graph is the location where the graph crosses the _____.
- The y-coordinate of the x-intercept is always _____.
- The ***y-intercept*** of a graph is the location where the graph crosses the _____.
- The x-coordinate of the y-intercept is always _____.
- The x-intercept is the _____ to $f(x) = 0$.

All of these features are very helpful in understanding real-world context.

Let's Practice!

4. Consider the following graph that represents the height, in feet, of a water balloon dropped from a 2nd story window after a given number of seconds.



   a. What is the x-intercept?

   b. What is the y-intercept?

   c. Label the intercepts on the graph.

Try It!

5. Refer to the previous problem for the following questions.

   a. What does the y-intercept represent in this real-world context?

   b. What does the x-intercept represent in this real-world context?

   c. What is the solution to this situation?

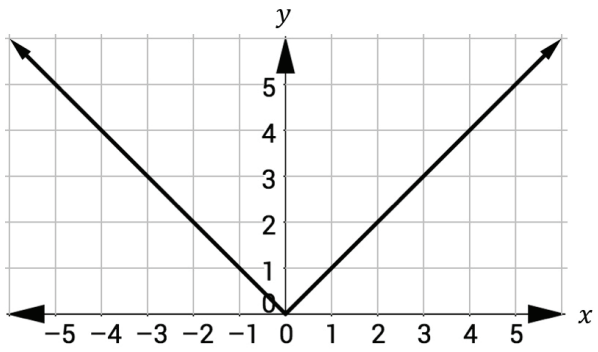
Section 3 – Topic 7
Key Features of Graphs of Functions – Part 2

Let's discuss other key features of graphs of functions.

- ***Domain***: the input or the _____ values.
- ***Range***: the _____ or the y-values.
- The domain and range of a function can be expressed in ***set notation*** or ***interval notation.***
- ***Increasing intervals***: as the x-values _____, the y-values _____.
- ***Decreasing intervals***: as the x-values _____, the y-values _____.
- ***Relative maximum***: the point on a graph where the interval changes from _____ to _____.
- ***Relative minimum***: the point on a graph where the interval changes from _____ to _____.
- ***Positive intervals***: intervals of a function $f(x)$ over which _____.
- ***Negative intervals***: intervals of a function $f(x)$ over which _____.

Let's Practice!

1. Use the following graph of an ***absolute value function*** to answer the questions below.



   a. Define the domain using set notation.

   b. Define the range using interval notation.

   c. Where is the graph increasing?

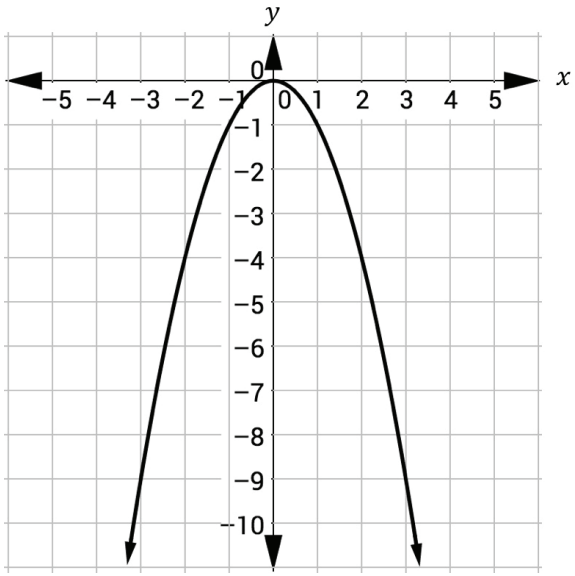
   d. Where is the graph positive?

   e. Identify any relative maximums.

   f. Identify any relative minimums.

Try It!

2. Use the graph of the following ***quadratic function*** to answer the questions below. Use set notation to express all answers.



a. Define the domain.

b. Define the range.

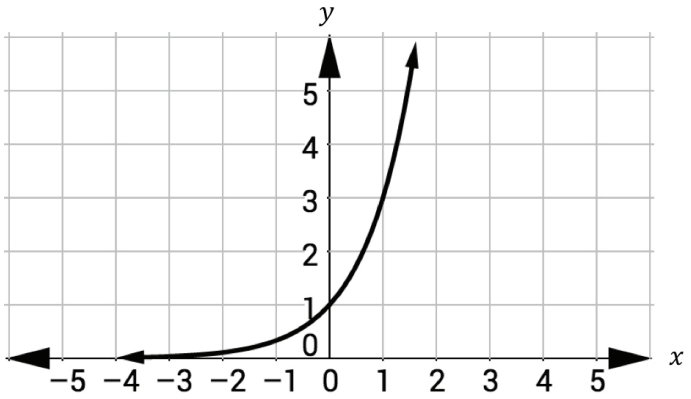
c. Where is the graph decreasing?

d. Where is the graph negative?

e. Identify any relative maximums.

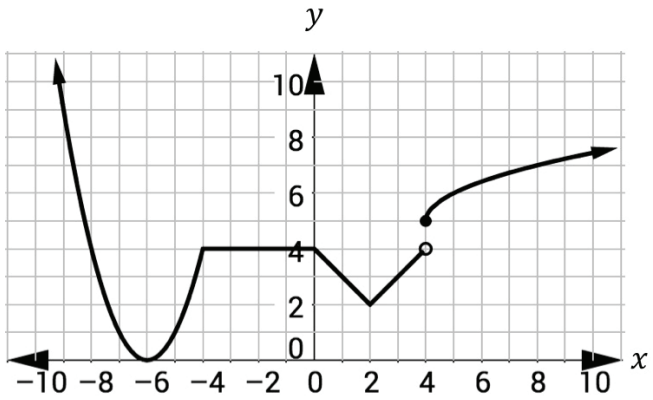
f. Identify any relative minimums.

3. Describe everything you know about the key features of the following graph of an ***exponential function***. Use interval notation to express all answers.



BEAT THE TEST!

1. The following graph is a ***piecewise function***.

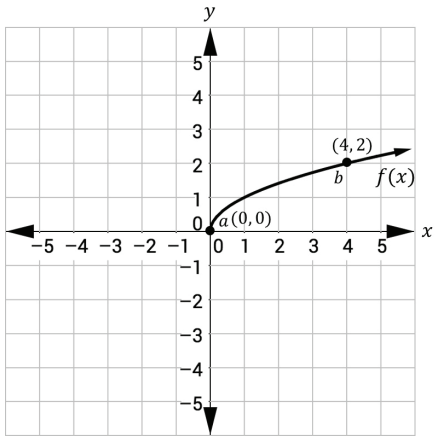


Which of the following statements are true about the graph? Select all that apply.

- ☐ The graph is increasing when the domain is $-6 < x < -4$.
- ☐ The graph has exactly one relative minimum.
- ☐ The graph is increasing when $x \geq -4$.
- ☐ The graph is positive when $x > 4$.
- ☐ The graph has no negative intervals.
- ☐ The range is $\{y | 0 \leq y < 4 \cup y \geq 5\}$.
- ☐ There is a relative minimum at $(2, 2)$.

Section 3 – Topic 8
Average Rate of Change Over an Interval

Consider the following graph of the square root function $f(x) = \sqrt{x}$.



Draw a line connecting a and b.

Determine the slope of the line between the interval $[a, b]$.

For every two points x_1 and x_2, where $x_1 \neq x_2$, (x_1, y_1) and (x_2, y_2) form a straight line and create a _____ _____.

To determine the average rate of change for *any* function $f(x)$ over an interval, we can use two points $(x_1, \_\_\_\_\_)$ and $(x_2, \_\_\_\_\_)$ that lie on that interval.

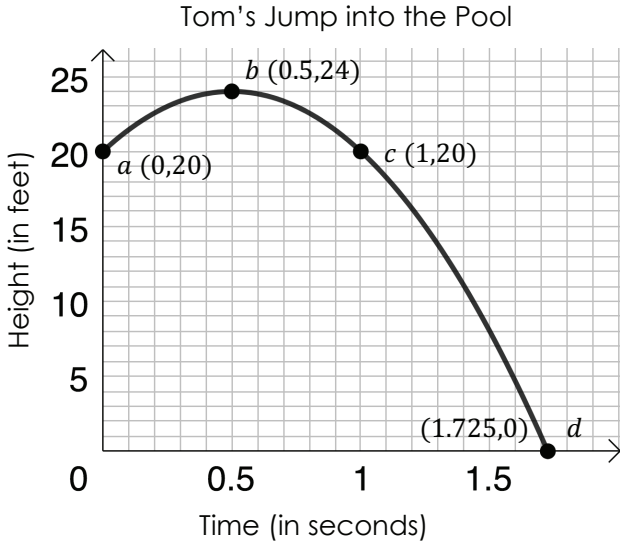
The process to find the slope of a linear function is:

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

We can also use the slope formula to find the average rate of change over an interval $[a, b]$, where $x_1 = a$ and $x_2 = b$.

Let's Practice!

1. Tom is jumping off the diving board at the city pool. His height is modeled by the quadratic function $h(t) = -16t^2 + 16t + 20$, where $h(t)$ represents height above water (in feet), and t represents time after jumping (in seconds).



   a. Determine the average rate of change for the following intervals.

      $[a, b]$

      $[b, c]$

      $[c, d]$

   b. Compare Tom's average rate of change over the interval $[a, b]$ with his average rate of change over the interval $[b, c]$. What does this represent in real life?

Try It!

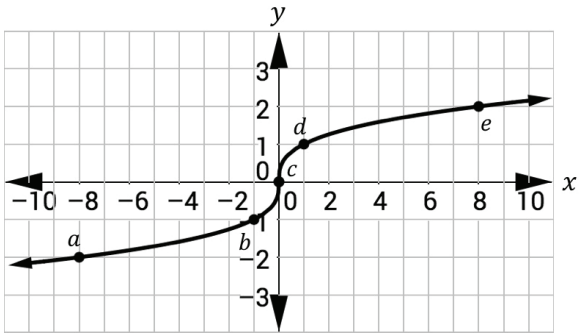
2. Consider the table for the exponential function, $p(x) = 3^x$, shown below.

Point	x	$p(x)$
M	0	1
N	1	3
R	2	9
T	3	27

   a. Determine the average rate of change over the interval $[N, T]$.

   b. Compare the average rate of change over the interval $[M, N]$ with the average rate of change over the interval $[R, T]$.

3. Determine the intervals that have the same average rate of change in the graph $j(x) = \sqrt[3]{x}$ below.



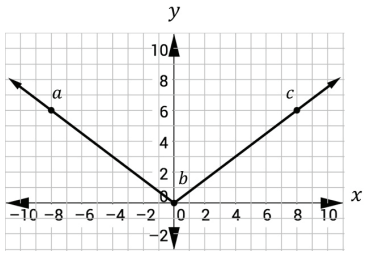
BEAT THE TEST!

1. Suppose that the cost of producing r radios is defined by $c(r) = 300 + 15r - 0.3r^2$. Determine which of the following intervals has the greatest average rate of change for the cost to produce a radio.

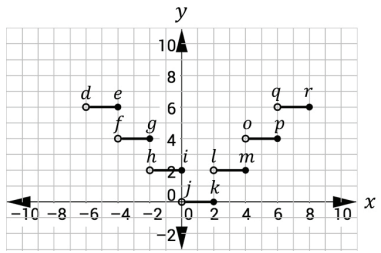
   Ⓐ Between 20 and 25 radios.
   Ⓑ Between 60 and 65 radios.
   Ⓒ Between 5 and 10 radios.
   Ⓓ Between 30 and 35 radios.

2. Consider the absolute value function $f(x)$ and the step function $g(x)$ in the graphs below.

$f(x)$



$g(x)$



Which of the following is true about the rate of change of the graphs?

Ⓐ The average rate of change for $f(x)$ over the interval $[b, c]$ is greater than the average rate of change for $g(x)$ over the interval $[j, k]$.

Ⓑ The average rate of change for $f(x)$ over the interval $[a, c]$ is greater than the average rate of change for $g(x)$ over the interval $[d, r]$.

Ⓒ The average rate of change for $f(x)$ over the interval $[a, b]$ is $-\frac{1}{2}$.

Ⓓ The average rate of change for $g(x)$ over the interval $[d, j]$ is $-\frac{1}{2}$.

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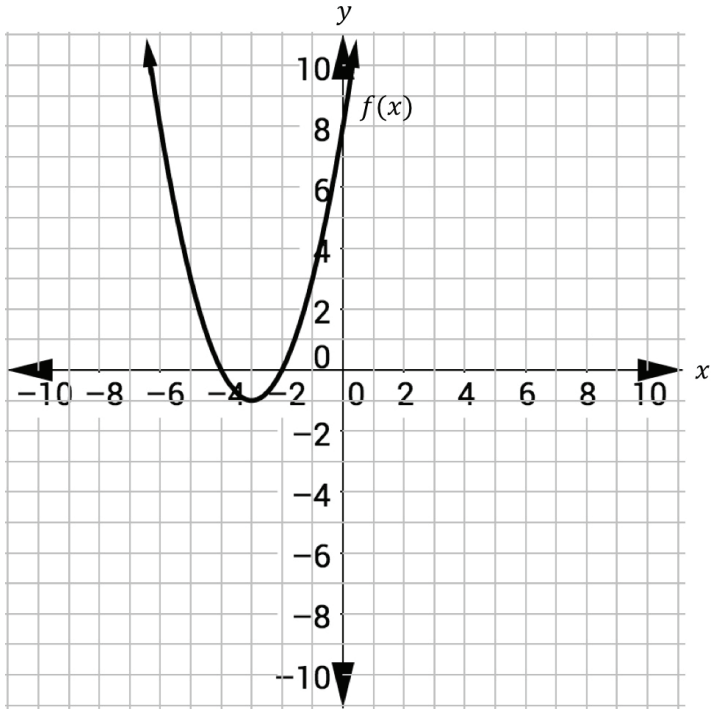
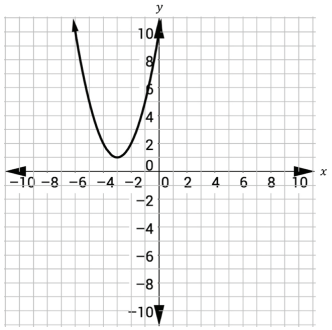
Section 3 – Topic 9
Transformations of Functions

The graph of $f(x)$ is shown below.

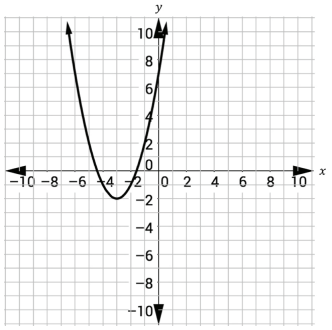


The following graphs are transformations of $f(x)$. Describe what happened in each graph.

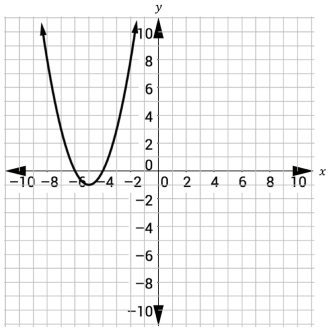
$f(x)+2$



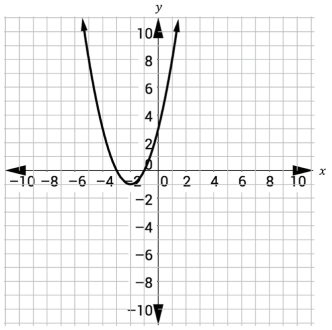
$f(x)-1$



$f(x+2)$



$f(x-1)$



Which graphs transformed the independent variable?

Which graphs transformed the dependent variable?

Let's Practice!

1. For the following functions, state whether the independent or dependent variable is being transformed and describe the transformation (assume $k > 0$).

   a. $f(x)+k$

   b. $f(x)-k$

   c. $f(x+k)$

   d. $f(x-k)$

2. The following table represents the function $g(x)$.

x	$g(x)$
-2	0.25
-1	0.5
0	1
1	2
2	4

The function $h(x) = g(2x)$. Complete the table for $h(x)$.

x	$g(2x)$	$h(x)$
-1	$g(2(-1))$	
-0.5	$g(2(-0.5))$	
0		
0.5		
1		

Try It!

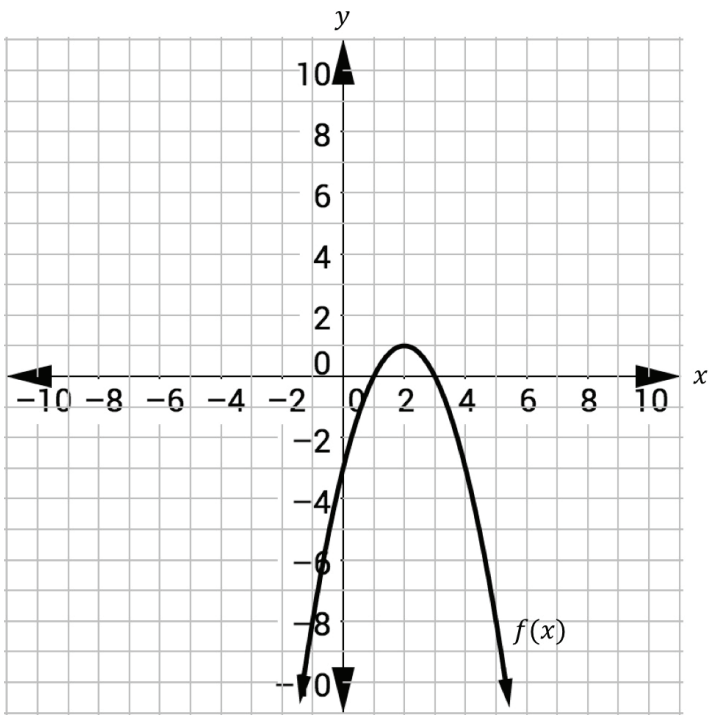
3. The table below shows the values for the function $f(x)$.

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

Complete the table for the function $-\frac{1}{2}f(x)$.

x	$-\frac{1}{2}f(x)$
-2	
-1	
0	
1	
2	

4. The graph of $f(x)$ is shown below.

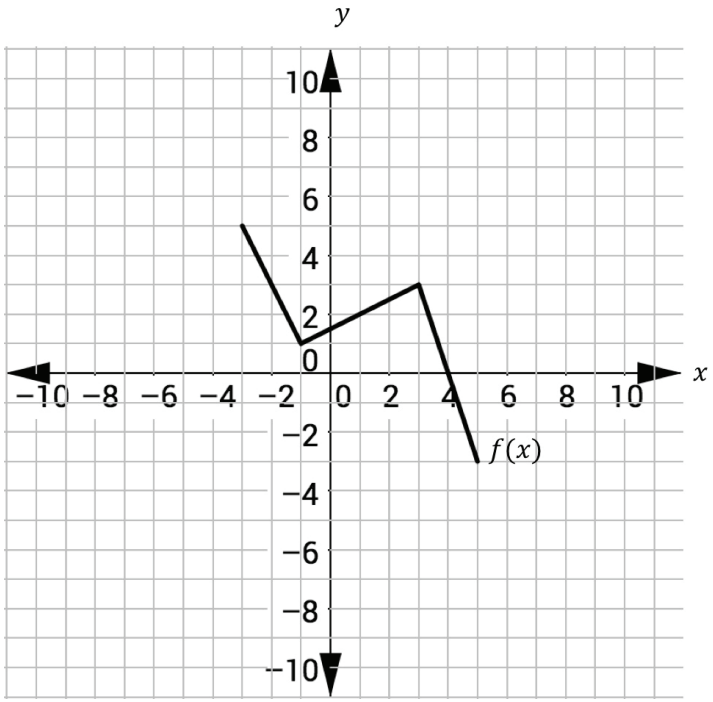


Let $g(x) = f(x + 3) - 2$.

Graph $g(x)$ on the coordinate plane with $f(x)$.

BEAT THE TEST!

1. The graph of $f(x)$ is shown below.



Let $g(x) = f(x - 3)$ and $h(x) = f(x) - 3$.

Graph $g(x)$ and $h(x)$ on the coordinate plane with $f(x)$.

2. The table below shows the values for the function $p(x)$.

x	-4	-1	0	2	3
$p(x)$	12	6	4	8	10

Complete the table for the function $\frac{1}{2}p(x) - 3$.

x	$\frac{1}{2}p(x) - 3$

Test Yourself! Practice Tool

Great job! You have reached the end of this section. Now it's time to try the "Test Yourself! Practice Tool," where you can practice all the skills and concepts you learned in this section. Log in to Algebra Nation and try out the "Test Yourself! Practice Tool" so you can see how well you know these topics!

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