Algebra 1

Unit 6

Functions and Function Transformations

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

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# Objectives

By the end of this unit I will be able to…

1. Understand the concept of a function and use function notation.
2. Use functions to model a relationship between two quantities.
3. Identify and interpret key features of functions from graphs, tables, equations, and verbal descriptions.
4. Identify and create transformations of parent functions given graphs, tables, and equations.

# Progress

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| --- | --- | --- | --- | --- |
| Objective | Limited Command | Moderate Command | Strong Command | Distinguished Command |
| 1 | Is this a function? | Is this a function? Why/ why not?   |  |  | | --- | --- | | 2 | -1 | | 4 | 2 | | 2 | 5 | | Find f(4) in f(x) = 4x -5 | Find x when f(x) = 3 when f(x) = 4x – 5 |
| 2 | Time vs. Distance which is the independent and which is the dependent variable?  Define what are independent and dependent variables. | A bunch of bananas cost $0.89 per pound, what is the total cost for 3lbs? what are the independent/dependent variables? |  | Come up with a situation that relates two variables as a function and identify which is the independent/dependent |
| 3 | State the domain and range of:  2 -3  4 7  7 10  What values are the domain values?  What values are the range values?  Sketch the graph of the square root parent function.  Write the equation of the quadratic parent function. | State the domain and range of:  Graph f(x) = Ix – 3I + 2 |  | State where this is increasing and decreasing:  Graph g(x) = -3(x)² - 1 |
| 4 |  |  |  |  |

# Vocabulary

|  |  |  |
| --- | --- | --- |
| Word | Definition | Example / Picture |
| Absolute Value Function |  |  |
| Algebraically |  |  |
| Average Rate of Change |  |  |
| Axis |  |  |
| Continuous |  |  |
| Coordinate Plane |  |  |
| Discrete |  |  |
| Domain |  |  |
| End Behavior |  |  |
| Vertical Line Test |  |  |
| Interval |  |  |
| Maximum |  |  |
| Minimum |  |  |
| Parent Functions |  |  |
| Range |  |  |

# Lesson 1 – Functions

Objective:

I can identify and justify if two variables (a domain (x-values) and range (y-values)) create a function.

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| Functions and Secret Codes | The table below shows that the letter A is coded into letter Q, the letter B is coded into R, and so on. It also shows that the letter U is coded into the letter K.  This code is an example of a letter-shift code. Can you see why? How would you use the code to write a message?    Use the table to decode this word: CGJX  Use the table to write your favorite movie in the secret code. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  Trade with a neighbor and decode their word. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  You can also represent the code with a grid. Note that the input letters (domain) run across (horizontally). To code a letter, look for the colored square directly above it. Then find the coded output by looking across to the letters that run up (range) (vertically).    Use the grid to encode your favorite color. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  Trade with your neighbor and decode their favorite color. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| Relations vs. Functions | Step 1: Use the grid to the right to send your favorite  TV show to your partner.  Step 2: Exchange and decode each other's messages.  Step 3: Did your partner successfully decode your message?  Why or why not?  Step 4: How is the last grid different from the first grid?  Code the word FUNCTION using both grids.   |  |  | | --- | --- | | 1st Grid | Newest Grid | |  |  |   What do you discover? Which grid is easier to use to decode with?  What has to happen in order for a relation to be a function? |
| Relations vs. Functions | Decide if each relation is a function or not. Explain why? Write the domain and range.   |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  | |  |  | | --- | --- | | Grid 1 | | | Function? | Yes / No | | Why? |  | | Domain: |  | | Range: |  | | |  | |  |  | | --- | --- | | Grid 2 | | | Function? | Yes / No | | Why? |  | | Domain: |  | | Range: |  | | |  | |  |  | | --- | --- | | Table A | | | Function? | Yes / No | | Why? |  | | Domain: |  | | Range: |  | | |  | |  |  | | --- | --- | | Table B | | | Function? | Yes / No | | Why? |  | | Domain: |  | | Range: |  | | |  | |  |  | | --- | --- | | Table C | | | Function? | Yes / No | | Why? |  | | Domain: |  | | Range: |  | | |

# Lesson 2 – Vertical Line Test

Objective:

I can use the vertical line test to identify and justify if two variables create a function.

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| Reasoning about Functions | Each table represents a relation. Based on the tables, which relations are functions and which are not? Give reasons for your answers.   |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  | |  |  | | --- | --- | | Table 1 | | | Function? | Yes / No | | Why? |  | | Domain: |  | | Range: |  | | |  | |  |  | | --- | --- | | Table 2 | | | Function? | Yes / No | | Why? |  | | Domain: |  | | Range: |  | | |  | |  |  | | --- | --- | | Table 3 | | | Function? | Yes / No | | Why? |  | | Domain: |  | | Range: |  | | |  | |  |  | | --- | --- | | Table 4 | | | Function? | Yes / No | | Why? |  | | Domain: |  | | Range: |  | | |
| Vertical Line Test | Each graph below represents a relation. Move a vertical line, such as the edge of a rule, from side to side on the graph. Based on the graph and your vertical line, which relations are functions and which are not? Give reasons for your answers.     |  |  |  | | --- | --- | --- | |  | Graph 1 | Graph 2 | | Function? | Yes / No | Yes / No | | Why? |  |  | |  | Graph 3 | Graph 4 | | Function? | Yes / No | Yes / No | | Why? |  |  |   Write a rule for the Vertical Line Test:  Class’s rule for the Vertical Line Test: |

# Lesson 3 – Modeling Situations

Objective:

I can interpret graphs that model real-world situations and write descriptions using the terms, linear, nonlinear, increasing, decreasing, rate of change, continuous, domain, range, independent variable and dependent variable.



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| Linear vs. Nonlinear | What does the word LINEAR mean to you? What do you think a LINEAR graph would look like?  What does the word NONLINEAR mean to you? What do you think a NONLINEAR graph would look like? |
| Increasing Functions | Step 1: These are graphs of ***increasing functions***.    What do the three graphs have in common?  How would you describe the rate of change in each? |
| Decreasing Functions | Step 2: These are graphs of ***decreasing functions***.    What do the three graphs have in common?  How are they different from the graphs in Step 1?  How would you describe the rate of change in each? |
| Describing Situations | Step 3: For each situation below, identify the independent and dependent variables, then describe what the graph of each situation will look like.  Situation A: During the first few years, the number of deer on the island increased by a steady percentage. As food became less plentiful, the growth rate started slowing down. Now, the number of births and deaths is about the same.   |  |  | | --- | --- | | Independent Variable: | Dependent Variable: | | Description of Graph: | |   Situation B; In the Northern Hemisphere the amount of daylight increases slowly from January through February, faster until mid-May, and then slowly until the maximum in June. Then it decreases slowly through July, faster from August until mid-November, and then slowly until the year's end.   |  |  | | --- | --- | | Independent Variable: | Dependent Variable: | | Description of Graph: | |   Situation C: If you have a fixed amount of fencing, the width of your rectangular garden determines its area. If the width is very short, the garden won't have much area. As the width increases, the area also increases. The area increases more slowly until it reaches a maximum. As the width continues to increase, the area becomes smaller more quickly until it is zero.   |  |  | | --- | --- | | Independent Variable: | Dependent Variable: | | Description of Graph: | |   Situation D; Your cup of tea is very hot. The difference between the tea temperature and the room temperature decreases quickly at first as the tea starts to cool to room temperature. But when the two temperatures are close together, the cooling rate slows down. It actually takes a long time for the tea to finally reach room temperature   |  |  | | --- | --- | | Independent Variable: | Dependent Variable: | | Description of Graph: | | |
| Modeling Situations w/ Graphs | Step 4: Match each graph to the situation that it models from the situations above (two graphs won’t be matched).  Step 5: Label the independent and dependent variable on the appropriate axis for each matched graph.   |  |  |  | | --- | --- | --- | | Situation: \_\_\_\_ | Situation: \_\_\_\_ | Situation: \_\_\_\_ | | Situation: \_\_\_\_ | Situation: \_\_\_\_ | Situation: \_\_\_\_ | |
| Domain & Range | When we write the domain and range of a **graph**, we don't list every number.  This is because there are an **infinite** number of domain and range values.  We write the domain, range, increasing, and decreasing sections as **intervals**.  For each graph, write the domain, range, and where the function is increasing or decreasing.   |  |  | | --- | --- | |  | Domain:  Range:  Increasing:  Decreasing: | |  | Domain:  Range:  Increasing:  Decreasing: | |  | Domain:  Range:  Increasing:  Decreasing: | |  | Domain:  Range:  Increasing:  Decreasing: | |

# Lesson 4 – Functions and Function Notation

Objective:

I can deepen my understanding of functions and understand and apply the special notation used when working with functions.

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| Functions  Function Notation  Examples of Functions  Investigation | Every function defines a relationship between an input (independent variable, domain) and an output (dependent variable, range).  **Function Notation** uses parenthesis to name the input, or independent, variable for a function.  For example, the function  **y = f(x)** is read as **“y equals f of x”** which means that **“y is a function of x”** or **“y depends on x”**.  An equation that is also a function can be written using this notation. Here are 3 examples of equations written with function notation.  Equation Written with function notation (the letters f,g,h are commonly used)   1. y = 2x + 4 f(x) = 2x + 4 2. y = x2  g(x) = x2 3. y = 5(2x) h(x) = 5(2x)   The notation f(3) tells you to substitute 3 in for x into the equation y = 2x + 4. So f(3) = 2(3) + 4 and therefore f(3) = 10.  Find g(5) Find h(4) Find f(-3)    Not all functions are equations, sometimes we see them as graphs and there is no rule to follow. For example the following graph is represented by the function f(x) = y    If given the point x = 4, then the coordinate would be (4,1) or (4, f(4)). This means that f(4) = 1.  Using the graph above, find the following values.   1. f(2)   b. f(6)  c. find x if f(x) = 3  Complete the following problems using the graph below.    Step 1: Describe the Domain and Range for this function.   |  |  | | --- | --- | | Domain | Range |   Step 2: Use the graph to find each function value and complete any given operations.    Step 3: Use the rules for the order of operations to evaluate these expressions that involve function notation. Complete any operations in parenthesis first, and then use the graph to find the function values and do any remaining operations. |
| Additional Practice | You can use the function f(x) = 9/5 x + 32 to find the temperature f(x) in degrees Fahrenheit for any given temperature x in degrees Celsius. Find each given value and label in degrees Fahrenheit or degrees Celsius. .   1. f(15)   b. f(-10)  c. x when f(x) = 41  d. x when f(x) = -4 |
| Distance  Definition  Your Definition  Practice and Examples  Variables and the Absolute Value Function  Practice  Graphs of Absolute Value Functions    Connections to Prior Learning  Practice  Graphs of a Quadratic Function Investigation | **Lesson 5: Absolute Value Functions**  Objective:  Investigate, analyze and interpret absolute value functions.    Distance is never negative but is sometimes found by subtracting (which can lead to a negative result). Because of this, there is a **Function** that is used to turn any number into the same positive  **The** **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of a number is its size or magnitude regardless if the number is positive or negative. The notation to represent Absolute Value are vertical lines on either side of the number or expression. |-3.2|=3.2 and |3.2| = 3.2**  In the space provided, write your own definition of an **absolute value** of a number. Use examples and the vocabulary (opposite, positive, negative)  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  **Evaluate each expression (Always use order of operations)**   1. |4|=\_\_\_\_\_\_ b) |-5|= \_\_\_\_\_\_ c) |3-7|=\_\_\_\_\_\_     d) |-6| - |-6|=\_\_\_\_\_\_\_ e) -|9|=\_\_\_\_\_ f) 2|-7| + 9 = \_\_\_\_\_\_  When solving for a variable in an absolute value, the result will be both the positive and negative value of the number. In other words, you will have two solutions.  For example:  |x| + 7 = 12  -7 -7  |x| = 5 so,  x = 5 or -5  Solve the following two equations with absolute values (Hint: Each will have 2 solutions)   1. |x - 2| + 7 = 12 b. 2|x| + 8 = 20   Complete the following steps to graph the function **f(x) = |x|**  Step 1: Complete the table of values for the function f(x) = |x|   |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | x | -6 | -4 | -2 | 0 | 2 | 4 | 6 | 7 | | f(x) |  |  |  |  |  |  |  |  |   Plot the points on the graph below. This is a **continuous** function so make sure to connect the coordinates.    In the space below, describe any distinguishing features of the graph.  **Lesson 6: Quadratics: Squares, Squaring and Parabolas**  Objective:  Evaluate expressions and solve for variables using absolute value, squaring and square root. Graph quadratic functions to describe the characteristics of a parabola.  Functions that involve **Squaring** are similar to **Absolute Value Functions** because in most cases, both functions will result in two solutions.  For example:  |x| = 4, x = +4 and -4 x2 = 4, x = 2 and -2.  The opposite of squaring a number is taking a **Square Root.** The symbol for a **Square Root is**  Just like subtraction “undoes” addition, taking a **square root** “undoes” **squaring.**  Solve the following equations, show your work and check your solutions.   1. x2 = 81 b. 7r2 = 700 c. 4n2 - 1 = 399   In this investigation you will explore the graph of the relationship y = x2. Pay attention to patterns, characteristics and any noticing’s that you have about this relationship and its graph.  Step 1: Complete the table below for the values of x from -6 to 6   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | x | -6 | -5 | -4 | -3 | -2 | -1 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | | x2 |  |  |  |  |  |  |  |  |  |  |  |  |  |   Step 2: How do the squares of numbers and their opposites compare? What is the relationship between the positive numbers and their squares? Between the negative numbers and their squares?     |  | | --- | |  |     Step 3: Graph the relationship y = x2 on the axis below using the values from your table.    Step 4: What relationship does this graph show? Is it a function? If so, describe the domain and range.   |  | | --- | | Relationship: Linear Exponential Absolute Value Quadratic  (circle one)  Is this a function? yes no  (circle one)  If yes, describe how you know: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  What is the domain and range for this function? (see your notes on domain and range for a reminder) |   The graph of *y = x2*  is called a **parabola**. In later sections you will learn how to create other **parabolas** based on variations of this basic equation.  Step 5: What quadrants to the points for the graph of y = x2 fall in?   |  | | --- | |  |   Step 6: What makes the point (0,0) on your graph unique? Where is this point on the parabola?   |  | | --- | |  |     Step 7: Compare your graph with the graph of the absolute value function (lesson 5). Describe any similarities and differences that you notice.   |  |  | | --- | --- | | Similarities | Differences | |
|  |  |

# Lesson 7 – Translations of Graphs

Objective:

I will investigate how a graph is translated, moved, on a coordinate plane.

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| Investigation on Translating a Graph | What do you think the word **translation** means to a figure on a coordinate plane?  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_   |  |  | | --- | --- | |  |  |   Step 1: On the given graph, plot the points (2, 1), (2, 4) and (6, 1). Connect the points to create a shape.    Step 2: Using the points from step 1, keep the same x-values and create new y-values by subtracting 3 from the previous y-values. Graph your new points in a new color and connect the three new points.  Step 3: Using the points from step 1, keep the same x-values and create new y-values by adding 2 to the original y-vales. Graph your new points in a new color and connect the three new points.  Step 4: What happens to your graph when you do steps 2 and 3?  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  Step 5: On the new graph, plot the points (-3, -1), (-2, 1), (1, 2) and (-2, -2). Connect the points to create a shape.    Step 6: Using the points from step 5, keep the same y-values and create new x values by subtracting 3 from the previous x-values. Graph the new points in a new color and connect the points.  Step 7: Using the points from step 5, keep the same y-values and create new x-values by adding 2 to the original x-values. Graph your new points in a new color and connect the new points.  Step 8: What happens to your graph when you do steps 6 and 7?  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  Step 9: Using the points from step 5, subtract 1 from your original x-values and add 3 to your original y-values, plot your new points.  What happens to your graph when you do this?  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| Practice |  |

# Lesson 8 – Translations of Parent Functions

Objective:

I will translate parent functions to create a family of functions.

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| The Parent Functions | The most common **parent functions** are:  f(x) = IxI  f(x) = x²  f(x) = |
| Translating the Absolute Value Function | Graph the **absolute value function** f(x) = IxI by making a table of values      Now make a table of values for the function f(x) = IxI + 2, then graph it on the same graph as the parent function in a different color. What happened?  Make a new table of values for the function f(x) = Ix + 3I. Graph is on the same graph as the parent function in a different color. What happened?  Lastly, make a table of values for the function f(x) = Ix – 2I – 5. Graph this function on the graph with the parent function in a different color. What do you notice?  How do we move a graph up or down?  How do we move a graph left or right? |
| Translating the Quadratic and Square Root Functions | What do you think the graph of g(x) = x² + 1 would look like? Make a quick sketch.  Below graph the parent function for the quadratic family, then make a table of values for the translation g(x) = x² + 1. Graph your results below in a different color. Was your prediction correct?    What do you think you can say about moving the quadratic function up or down?  Graph the function g(x) = (x – 4)² on the graph above in a different color.  How can we move the quadratic function left or right?  Describe in words how the following graphs would be transformed from their parent functions.  1). h(x) = 2). k(x) = (x – 2)² + 3 |

# Lesson 9 – Reflections of Parent Functions

Objective:

I will investigate when a function reflects over either the x or y-axes.

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| Reflecting Functions |  |
| Reflecting the Parent Functions | In writing decribe what the differences are between the three functions below  f(x) = (parent function) f(x) = -f(x) =  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  Make tables of values for all three functions above and graph them on the graph in three different colors.    How does that relate to other functions?  g(x) = I-xI would reflect over the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  -g(x) = IxI would reflect over the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  -k(x) = x² would reflect over the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  In words decribe the transformations that are happening  1). j(x) = (-x – 4) + 6 2). –r(x) = IxI - 2 |

# Lesson 10 – Stretches and Shrinks

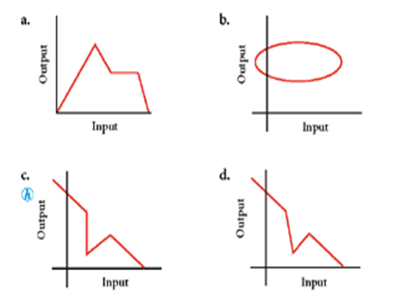
Objective:

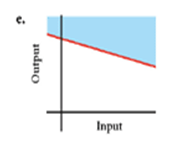
I will observe what happens when a graph stretches or shrinks.

|  |  |
| --- | --- |
| Stretching and Shrinking Graphs | Imagine what happens to a picture that is drawn on a rubber sheet as you **stretch** the sheet vertically.    Another way to change a shape of a picture is by making it **shrink** vertically. The picture will appear to be flattened. |
| Investigation | |  | | --- | | Step 1: Graph the following points on your graph (-3,0), (2,-1), (1,3), (-2,2).  Step 2: Use the following values *a*: 2,3,0.5,-2 to change the shape of your graph by multiplying the y-values by each *a* value. Graph each new shape and write your observation for each new shape.  a = 2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  a = 3 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  a = 0.5\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  a = -2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |     Step 3: Predict the location of each vertext if the value of a is 1.5. Describe how you think the overall appearance of the quadrilateral will change.  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  Step 4: Write a statement about what would happen to your graph when your y-values are multiplied by a number greater than 1.  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  A number between -1 and 1  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  And a number less than -1  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  How does that relate to parent functions?  g(x) =6 IxI would \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  g(x) = 0.8IxI would \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  k(x) =-2 x² would \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  In words decribe the transformations that are happening  1). j(x) = 5(-x + 4) + 6 2). –r(x) = 0.5IxI - 2 |

Week 1 Homework Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1). Circle the graphs below that are functions and write a brief statement why the graphs that are not functions, are not functions.





The following graphs \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ are not functions because, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2). Does each relationship in the form (input, output) represent a function? If the relationship does not represent a function, find an example of one input that has two or more outputs. (this is called a counterexample)

a). (city, ZIP Code) yes/no a function, if no, write a counterexample

b). (person, birth date) yes/no a function, if no, write a counterexample

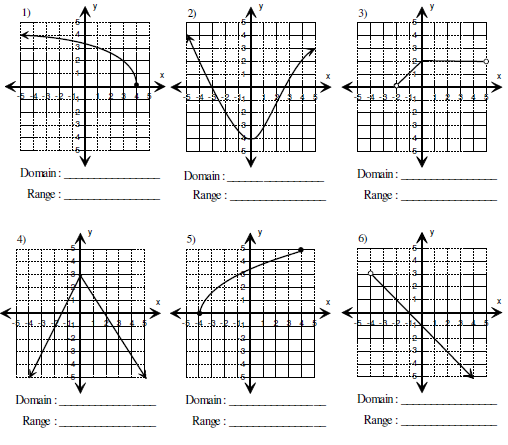
c). (last name, first name) yes/no a function, if no, write a counterexample

d). (state, capital) yes/no a function, if no, write a counterexample

3). Create your own table relationship of x and y-values that would be a function. You must have at least 6 x and y-values.

4). Create a table of x and y-values that is a relation but not a function and describe why it is not a function. You must have at least 6 x and y-values.

5). Find the domain and Range for the following graphs.



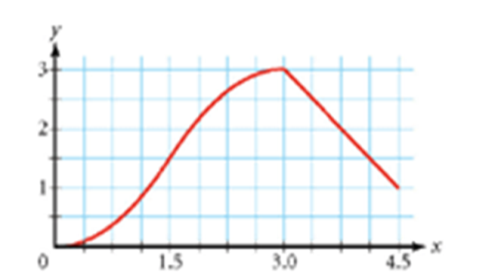
Week 2 Homework Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Describe what is happening in this graph. Also give the domain and range of the graph and where it is increasing and decreasing.

Description and increasing/decreasing \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Domain: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Range: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



1. Draw a graph that has a dependent variable that is increasing as the independent variable is also increasing. Include scales so you can also state your domain and range.

Graph: Domain \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Range \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Draw a graph that decreases at a steady rate, then increases quickly, then decreases again slowly. State the intervals the graph is decreasing and increasing.

Graph: Decreasing \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Increasing \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Using the following equations, find the given values

F(x) = -4x + 5 G(x) = x² - 10 H(x) =

* 1. F(-10) g. F(x) = 25
  2. G(12) h. G(x) = 71
  3. H(11) i. H(x) = -20

* 1. 4\*H(6) j. H(x) = 13
  2. F(8) + 5 k. F(x) = -35
  3. G(-3) l. G(x) = -11

1. Use the following graph to find the given values .
   1. f(4) b. f(x) = 6 c. f(5) – 2 d. f(x) = 1, find x

Week 3 Homework Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Week 4 Homework Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Part One: Parent Functions

Please identify the two major parent functions we have investigated this chapter. Write their equations and sketch a graph of them.

1. f(x)= 2. f(x)=

Part two: Given the function, graph it.

1. f(x) = (x – 2)² 4. h(x) = -6 Ix + 2I – 4
2. g(x) = -IxI + 5 5. k(x) = -(x)²+ 6
3. v(x) = ½ (x + 4)² – 5 6. r(x) =2 Ix – 2I + 3

Part Three: Given the function and the graph, please write what is wrong with the graph, then on the same graph please draw the right function and give the equation of the wrong graph.

1. f(x) = -(x + 1)² What is wrong with the graph? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Equation of wrong graph \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. g(x) = Ix + 2I – 4 What is wrong with the graph? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Equation of wrong graph \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. j(x) = ½ (x – 2)² + 4 What is wrong with the graph? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Equation of wrong graph \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Part four: Find the indicated function value given that

f(x) = x² + 2 g(x) = (x – 2) ² + 1 h(x) = Ix – 7I

1. f(-5) 3. h(1) 5. f(4) 7. g(8)

1. g(4) 4. h(-9) 6. f(-11) 8. g(-7)