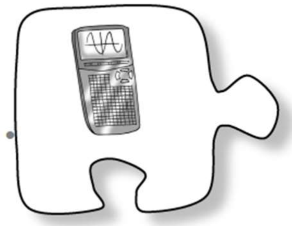
0.3 Which values are possible?



Domain and Range

In Lesson 0.2 you worked with your graphing calculator to see complete graphs of functions and to determine what information was useful to describe those functions completely. In this lesson you will look at more functions, this time thinking about what input and output values are possible. You will also learn about additional tools on your graphing calculator that allow you to see a complete graph. As you work with your team, remember to ask each other questions such as:

What values are possible?

Can we see the complete graph?

What other information can we use to describe the function?

1. Jerrod and Sonia were working with their team on problem 2 from Lesson 0.1 to put the function machines in order. These functions are reprinted for you below.

$$f(x) = \sqrt{x} \qquad g(x) = -(x-2)^2$$

$$h(x) = 2^x - 7 \qquad k(x) = -\frac{x}{2} - 1$$

   a. Jerrod first put an input of 6 into the function g(x) and got an output of −16. He wanted to try f(x) as his next function in the order, but he thinks there might be a problem using −16 as an input. Is there a problem? Discuss with your team.
   b. Because it is not possible to take the square root of −16, it can be said that −16 is not in the **domain** of the function f(x). The **domain** of a function is the collection of numbers that are possible inputs for that function. With your team, find two other numbers that are *not* part of the domain of f(x). Then describe the domain. In other words, what are all of the numbers that *can* be used as inputs for the function f(x)? Write this in your notebook.
   c. Sonia claimed that g(x) could not possibly be the last function in the order for problem 2. She justified her thinking by saying, *"Our final output has to be 11, which is a positive number. The function* g(x) *will always make its output negative, so it can't come last in the order."* Discuss this with your team. Does Sonia's logic make sense? How did she know that the output of g(x) would never be positive?
   d. Because the outputs of the function g(x) do not include certain numbers, it can be said that positive numbers are not part of the **range** of the function g(x). The **range** of a function is the set of all of the possible values that can be outputs. With your team, describe the range of the function g(x). In other words what are all of the values that *can* be outputs of the function? Write this in your notebook.

2. Use your graphing calculator to help you see a complete graph of $y = (x + 1)(x - 9)$.
   a. Describe the graph completely.
   b. What window settings allow you to see the complete graph?
   c. How are the settings related to domain and range?

3. Use your graphing calculator to see a complete graph of $y = (x - 12)^2 + 11$.
   a. What happens when you use the standard window? (Remember: standard window is ZOOM 6)
   b. What window settings did you use to see enough of the graph to help you visualize a complete graph?
   c. What are the domain and range of the function? Write this in your notebook.

4. How can a graphing calculator help you find the solution to a system of equations? Consider this system:

   $5x - y = 35$
   $3x + y = -3$

   a. First graph the system in a standard window. Can you see the solution on your screen?
   b. To find the solution you will need to change the window on your calculator. Discuss with your team what maximum value, minimum value, and scale you should use for the $x-$ and $y-$axes in order to see the intersection. After you have decided, check your conclusion on the graphing calculator.
   c. Use a "trace" function on your calculator to find the solution from the graphs. Then solve the system algebraically.
   d. Discuss the two methods with your team. Explain which one your team prefers and why.

METHODS AND MEANINGS

MATH NOTES

Domain and Range

The set of possible values for the input of a function is called the **domain** of the function. This set consists of every input value for x for which the function is defined.

The **range** of a function is the set of possible values of the output. This set contains every y-value that the function can generate.

Domain and **range** are often written with **inequality notation** as shown in the examples below.

The symbols $-\infty$ and ∞ represents positive and negative **infinity**. They mean that the domain goes on without ending in the positive or negative direction. Infinity is not a number; it is a concept.

If the domain is any number between and including –2 and 7:	$-2 \le x \le 7$
If the range is any number greater than but excluding 4:	$y > 4$ or $4 < y < \infty$
If the domain is all real numbers except for –3:	$x \ne -3$
If the domain is all real numbers:	$-\infty < x < \infty$