Introductions to Functions

In order to understand functions we first look at a **relation**.

A **relation** is a set of ordered pairs. Example:

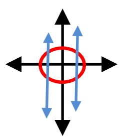
{ (2, 3), (4, 5), (8, 20) }

The set of x-coordinates is called the **domain** and the set of y-coordinates is called the **range**. In the relation: { (2, 3), (4, 5), (8, 20) }, the domain would be {2, 4, 8} and the range would be {3, 5, 20}.

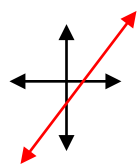
A **function** is a relation that assigns each x-value to exactly one y-value. This means that if you given a x-value like 10, it can only have one y-value. The equations we have done in this class for lines and parabolas are functions. If you recall whenever we substituted a x-value into an equation, we obtained just one y-value.

If you have a graph, you can tell if it is a function by the vertical line test.

Vertical Line Test: If a vertical line can be drawn so that it intersects a graph more than once, the graph is **not** a function.



Not a function because a vertical line intersected the graph more than once.



Is a function because a vertical line will not intersect the graph more than one once.

There is new notation to show a function. It usually uses the letter f, but it can also use g or h. We have been writing equations like $y = 3x + 4$ and in function notation it is written as:

$f(x) = 3x + 4$.

It is important to realize that $f(x)$ does not mean **f** times $\boldsymbol{x}$. It means the "function of x" or "f of x". To evaluate a function you simply substitute in a value. Example:

Evaluate $f(2)$ for $f(x) = 3x + 4$.

$$\begin{aligned} f(2) &= 3(2) + 4 \\ &= 6 + 4 \\ &= 10 \end{aligned}$$

Make sure you substitute the 2 into the $f(x)$ on the left side of the equation as well as the right side.

The function we just used, $f(x) = 3x + 4$, is called a function in symbolic representation. Functions can also be described in the following representations:

- Graphical
- Numerical
- Verbal
- Diagrammatical

The next page has problems in graphical and numerical form. Numerical form uses a table of values.

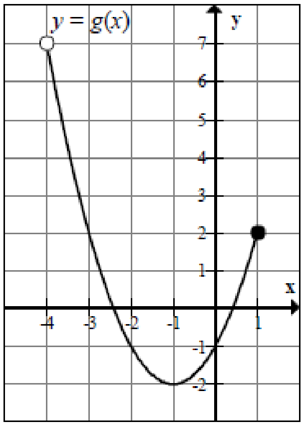


Figure 1.

x	$y = h(x)$
-7	-3
0	64
1	64
-5	-4
17	0
20	3

Figure 2.

Steps to Evaluate a Function for a Value

1. W.O.P.

2. If the function is given in symbolic form, that is, an equation is given, then substitute in the value for x and simplify. For example:

   Evaluate $f(6)$ for $f(x) = 3x + 4$.

   $f(6) = 3(6) + 4$

   $= 18 + 4$

   $= 22$

3. If a graph is given, the value in the ( ) is the x coordinate and find the corresponding y coordinate. For example, find $g(-3)$ using Figure 1.. The x coordinate will be -3 and the y coordinate on the graph is 2. Thus $g(-3) = 2$.

4. If a table is given the value in the ( ) is the x value to be found in the x column and find the corresponding y value in the other column. For example, find $h(20)$ using Figure 2. The x value is 20 and the value of 3 is found in the other column. Thus
   $h(20) = 3$.

Steps to Solve a Function Given an Output of the Function

1. W.O.P.

2. If the function is given in symbolic form, that is, an equation is given, then substitute the function definition for $f(x)$ and solve for x. For example, solve $f(x) = 10$, given $f(x) = 3x + 4$.

Details for Solving	Notes
$f(x)=10$ $(3x+4)=10$ $3x+4=10$ $3x+4-4=10-4$ $3x=6$ $\frac{3x}{3}=\frac{6}{3}$ $x=2$	Substitute in $3x + 4$ for $f(x)$ and solve.

The solution set is {2}.

3. If a graph is given, then the output value is the *y* coordinate; find the corresponding *x* coordinate. For example, solve $g(x) = 2$ using Figure 1. You will notice that the *y* coordinate of 2 appears twice at (-3, 2) and (1, 2) and there will be two *x* values. The solution is {-3, 1}.

4. If a table is given, then the output value is the *y* value. Find the corresponding *x* value. For example, solve $h(x) = -4$ using Figure 2. Find -4 in the right column and the corresponding *x* value is -7. The solution is {-7}.