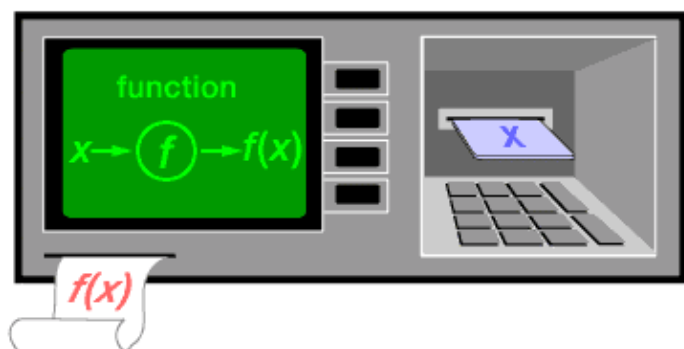**Unit:** The Basics                    **Module:** Precalculus Review

## Functions

**key concepts:**

● A **function** pairs one object with another. A function will produce only one object for any pairing.

● A function can be represented by an equation. To evaluate the function for a particular value, substitute that value into the equation and solve.

● You can evaluate a function for an expression as well as for a number. Substitute the entire expression into the equation of the function. Be careful to include parentheses where needed.

### A function as a machine



function
$x \rightarrow (f) \rightarrow f(x)$

$f(x)$

A **function** is a mathematical machine that takes one value and produces another one. In the example of an ATM machine, each account number matches up to exactly one balance.

Here the function machine is called $f$. $f$ takes a value $x$ and returns another value $f(x)$.

| | | |
|---|---|---|
| $y = x^2$ ← the machine | | Find what $y$ equals when $x$ equals 5. |
| $f(x) = x^2$ | $f$ is a function of $x$ that produces $x$-squared. | Find $f(5)$. |

$f(5) = 5^2$

$= 25$

This notation is an improvement over $y$-notation. It allows you to write $f(5)$ to mean "the value of the function when $x$ equals 5."

The symbol $f(5)$ is read as "$f$ of 5."

### Putting strange things into functions

Consider the function $f(x) = 3x^2 - 2x + 35$.

$f(a) = 3(a)^2 - 2(a) + 35$

$f(a + b) \neq 3a + b^2 - 2a + b + 35$          missing parentheses

$f(a + b) = 3(a + b)^2 - 2(a + b) + 35$

$= 3(a^2 + 2ab + b^2) - (2a + 2b) + 35$

Note:

$(a + b)^2 \neq a^2 + b^2$

$= 3a^2 + 6ab + 3b^2 - 2a - 2b + 35$

If you have a function whose inputs are numbers, then you can also use variables to represent those numbers.

For example, $f(a)$ produces the value of the function $f$ when the value of $a$ is used as the input.

You can even evaluate a function for a number that is represented by an expression such as $a + b$. In this example, make sure to replace every appearance of $x$ with the expression $a + b$. If $x$ is squared, you must square the entire expression. If $x$ is multiplied by 2, you must multiply the entire expression by 2. Use parentheses to help you keep track.

| | |
|---|---|
| $f(x) = 3x^2 - 2x + 35$ | This is a function named $f$. |
| $g(t) = t^2$ | This is a function named $g$. |

The most common name for a function is $f$, but sometimes it makes sense to name a function $g$, $p$, $v$, or even something else.