FUNctions – Introduction

MATH by Wilson
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Basic FUNction Idea/Concept – Allowable Input $\Rightarrow$ Unique Output

Definition: A **function** **f** from a set $\mathbf{X} \subseteq \mathbb{R}_x$ unto a set $\mathbf{Y} \subseteq \mathbb{R}_y$ is a correspondence that associates with each $\mathbf{x} \in \mathbf{X}$ one and only one $\mathbf{y} \in \mathbf{Y}$

$\mathbf{X} \subseteq \mathbb{R}_x$ is called the **domain**: $\mathbf{Dom\ f} = \mathbf{Domain\ f}$
Note: The domain of **f** is a subset of all the real numbers on the horizontal number line.

As we will see in more detail soon, the **domain** of **f** may be defined two (2) ways:

1. **Explicitly** – the domain is given
2. **Implicitly** – the domain is defined by $\mathbf{Dom\ f} = \{\mathbf{x} \in \mathbb{R}_x \,|\, \mathbf{f(x)} \in \mathbb{R}_y\}$

$\mathbf{Y} \subseteq \mathbb{R}_y$ is called the **range**: $\mathbf{Rng\ f} = \mathbf{Range\ f}$
Note: The range of **f** is a subset of all the real numbers on the vertical number line.

College Algebra Assumption: We consider **real-valued functions**, that is, functions that take real #'s to real #'s

What do we *officially* need to specify a function?

1. Name: **Identity, Square, Absolute Value, Exponential, …**
2. Symbol: $\mathbf{f}, \mathbf{g}, \mathbf{h}, \ldots$
3. Domain: $\mathbf{Dom\ f}$
4. Correspondence (rule, formula, table, …): $\mathbf{f(x)}, \mathbf{g(x)}, \mathbf{h(x)}, \ldots$
5. Range: $\mathbf{Range\ f}$

We usually are NOT given all these five (5) items when a function is defined. We have certain rules to follow to find what is not given.

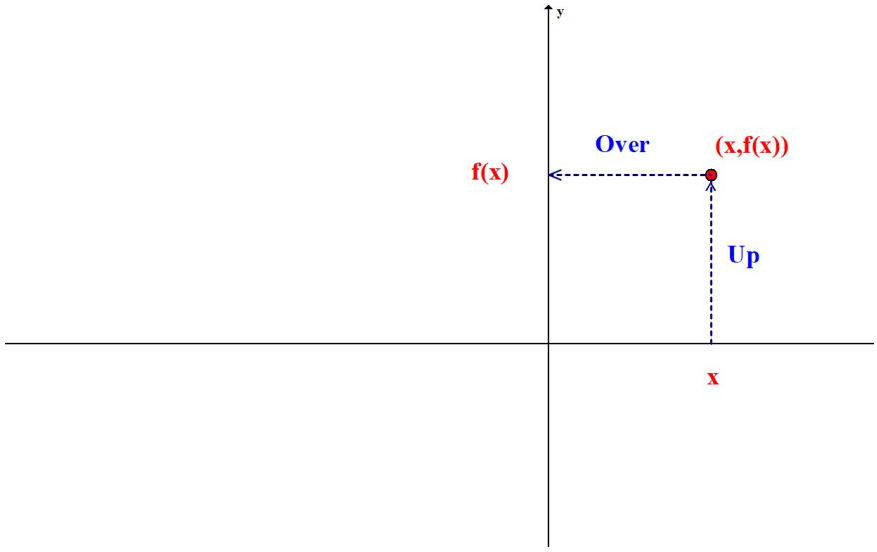
We frequently construct two (2) dimensional representations of our functions with what is called their **graph**:

Definition: The **graph** of a function **f** is a set of ordered pairs:

$$\{(\mathbf{x},\mathbf{f}(\mathbf{x}))|\mathbf{x} \in \mathbf{Dom\ f}\}$$

It is constructed (drawn) in the x-y Number Plane (Rectangular Coordinate System, Cartesian Coordinate System).

Note: The correspondence is seen by starting with an x in the domain on the x-axis, going up (or down) to the graph, and then projecting this point onto the y-axis.



Note: The domain can be *any* subset of the x-axis and the range can be *any* subset of the y-axis.

Note: Geometrically, the domain is the *projection* of the graph onto the x-axis and the range is the *projection* of the graph onto the y-axis.