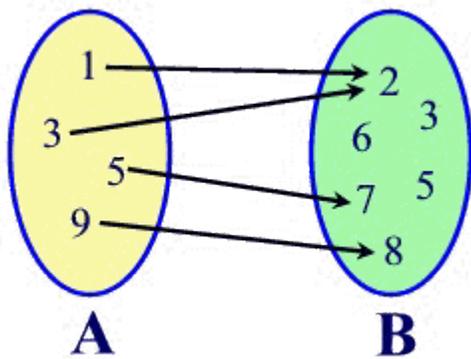


# Definition of a Relation and a Function

**Relation:** A relation is simply a set of ordered pairs.

The first elements in the ordered pairs (the  $x$ -values), form the **domain**. The second elements in the ordered pairs (the  $y$ -values), form the **range**. Only the elements "used" by the relation constitute the range.

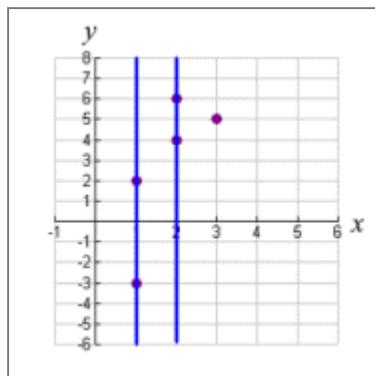


This mapping shows a **relation** from set A into set B.

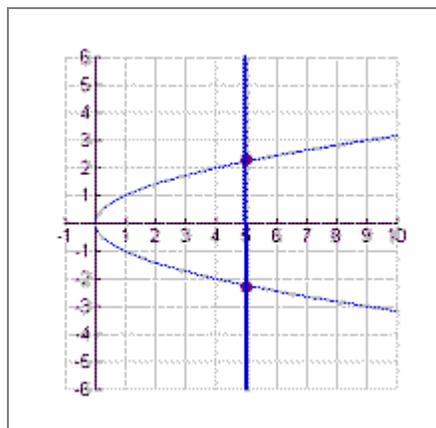
This relation consists of the ordered pairs (1,2), (3,2), (5,7), and (9,8).

- The **domain** is the set {1, 3, 5, 9}.
- The **range** is the set {2, 7, 8}.  
(Notice that 3, 5 and 6 are not part of the range.)
- The range is the dependent variable.

The following are examples of relations. Notice that a vertical line may intersect a relation in more than one location.



This set of 5 points is a relation.  
 $\{(1,2), (2, 4), (3, 5), (2, 6), (1, -3)\}$   
Notice that vertical lines may intersect more than one point at a time.



This parabola is also a relation.  
Notice that a vertical line can intersect this graph twice.

If we impose the following rule on a relation, it becomes a function.

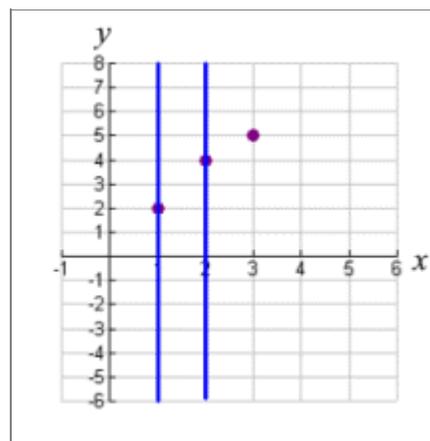
**Function:** A function is a set of ordered pairs in which each  $x$ -element has only ONE  $y$ -element associated with it.

The relations shown above are NOT functions because certain  $x$ -elements are paired with more than one unique  $y$ -element.

The first relation shown above can be altered to become a function by removing the ordered pairs where the  $x$ -coordinate is repeated. It will not matter which "repeat" is removed.

**function:  $\{(1,2), (2,4), (3,5)\}$**

The graph at the right shows that a vertical line now intersects only ONE point in our new function.



**Vertical line test:** each vertical line drawn through the graph will intersect a **function** in only one location.

