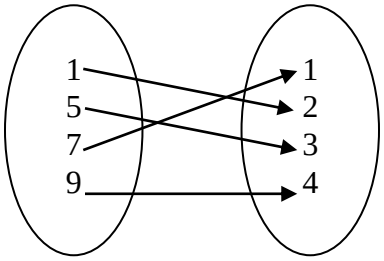
4.2: The Characteristics of a Function

A **relation** is a set of **ordered pairs**. These can be represented in various ways.

Examples of Relations:

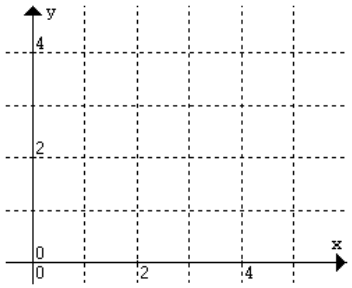
a) { (1,2), (5,3), (9,4), (7,1) }
…as a **mapping** diagram



b) { (1,3), (4,2), (3,2), (6,5) }
… as a **table of values**

x	y
1	3
3	2
4	2
6	5

c) { (1,4), (3,2), (5,4), (3,1) }
… as a **scatter plot**



The **DOMAIN** is the set of first elements of the ordered pairs (the set of distinct **x values**)

The **RANGE** is the set of second elements of the ordered pairs (the set of distinct **y values**)
(see pg 7 of the textbook for alternate definitions)

For each example above we can write the Domain and Range using **SET NOTATION**…

Example a) has…**Domain = {** **}** and **Range = {** **}**

Example b) has…**Domain = {** **}** and **Range = {** **}**

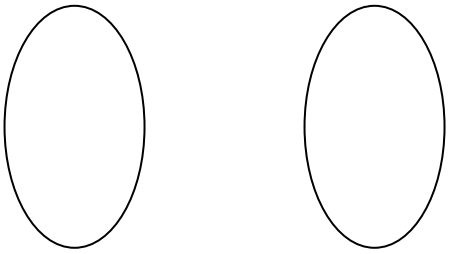
Example c) has…**Domain = {** **}** and **Range = {** **}**

A **FUNCTION** is a relation in which each value in the *domain* corresponds to exactly **ONE** element of *range*. It can also be thought of as a **rule** that associates each *x* value with only **ONE** *y*-value.
Note: More than one *x*-value can correspond to the same *y*-value.

A relation is **NOT** a function if *one x value has 2 different y-values associated* with it.

In the examples above, example a) and b) **are functions**.

Example c) is **not** a function since the *x*-value 3 is associated with ***two*** *y*-values… $y = 1$ and $y = 2$
To visualize this, complete a **MAPPING** diagram for example c)



One other thing… since we are dealing with functions, but not all equations represent functions, we're going to use a special type of notation when using functions. It's called **FUNCTION NOTATION**!

Equation	Function Notation
$y = 3x + 1$	$f(x) = 3x + 1$
$y = 3t^2 - 2t + 1$	$g(t) = 3t^2 - 2t + 1$
$y = x^3 - 2x^2 + 1$	$h(x) = x^3 - 2x^2 + 1$
$y = t^2 - 21$	$v(t) = t^2 - 21$

"*f(x)*" is read "*f of x*" or "*f at x*". It represents the value of the function at the given independent variable.

Using **function notation** is similar to using equations involving ***x*** and ***y*** values. To find a ***y***-value given an ***x***-value simply requires ***substitution***. Thus, we can write ordered pairs (*x, f(x)*) which are the same as (*x, y*).

Example 1: Find *f(2)* if $f(x) = x^2 - 2x + 1$. (Here, we are looking for the "*y*-value" when *x* = 2.)

Example 2: Given the function $g(x) = 4x - 5$, find…

a) $2g(-1)$ b) $g(a + 2)$