Summer MA 15200 Lesson 15 Section 2.1, Section 2.2 (part 1)

A relation is any set of ordered pairs. The set of all first components of the ordered pairs is called the **domain**. The set of all second components is called the **range.**

Relations can be represented by tables, sets, equations of two variables, or graphs.

Name	% of all Names
Smith	1.006%
Johnson	0.810%
Williams	0.699%
Brown	0.621%
Jones	0.621%

The table at the left would represent a relation where the ordered pairs are of the form (name, %). An example would be (Williams, 0.699%). The domain would be {Smith, Johnson, Williams, Brown, Jones} and the range is {1.006%, 0.810%, 0.699%, 0.621%}.

Ex 1: Find the domain and range of each relation.

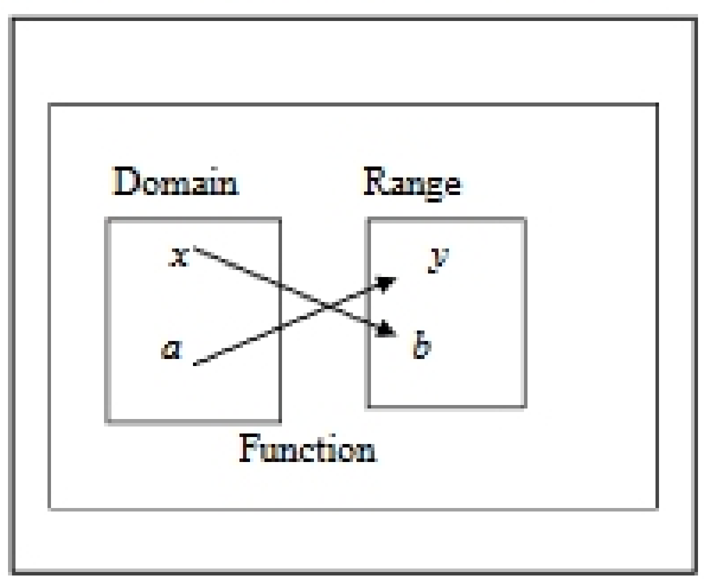
a) $\{(2,-3),(3,-4),(4,-5),(5,-5),(2,-6)\}$

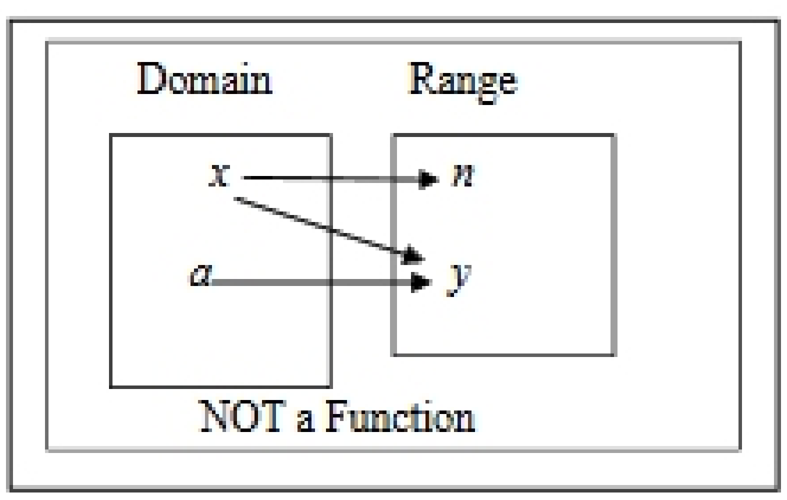
A relation in which each member of the domain corresponds to exactly one member of the range is a **function**. The table above that pairs a last name with a percent of all names is a function because each last name is paired to exactly one percent. Another way to identify a function is the following, it is a **relation in which no two ordered pairs have the same first component and different second components.**

Definition of a Function
A **function** is a correspondence from a first set, called the **domain**, to a second set, called the **range**, such that each element in the domain corresponds to ***exactly one*** element in the range.

If the table was changed as below, the relation is not a function. The percent 0.621% would be paired with both Brown and Jones.

% of all Names	Name
1.006%	Smith
0.810%	Johnson
0.699%	Williams
0.621%	Brown
0.621%	Jones





I Determining Whether a Relation is a Function

Ex 2: Determine if each relation is a function.

a)

x	y
0	1
1	0
-1	0
2	-3
-3	-8
-2	-3
4	-15

b) $\{(2,-3),(3,-4),(4,-5),(5,-5),(2,-6)\}$

II Determining Whether an Equation Represents a Function

Many functions are written as equations of two variables. For example, $R = -0.6x + 94$, where *R* represents the average number of meals per person Americans ordered from restaurants and *x* represents the number of years after 1984. The *x* is called the **independent variable**, because any number of years after 1984 can be selected. The *y* is called the **dependent variable,** because its value depends upon the value of *x*.

Not all equations represent functions. If an equation is solved for *y* and more than one value of *y* can be obtained for a given *x*, then the equation does not define a function.

Ex 3: Determine if each equation is a function or not. Find the domain in interval notation.

a) $y = x^2 + 2$

b) $y = \sqrt{x-3}$

c) $x = y^2 + 2$

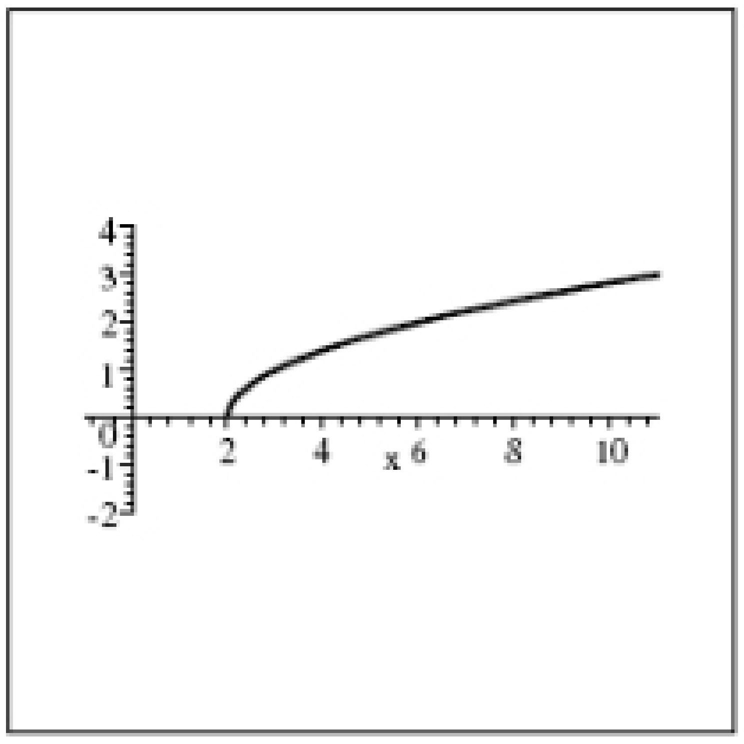
d) $xy - y = -1$

e) $y = \dfrac{2x}{x-5}$

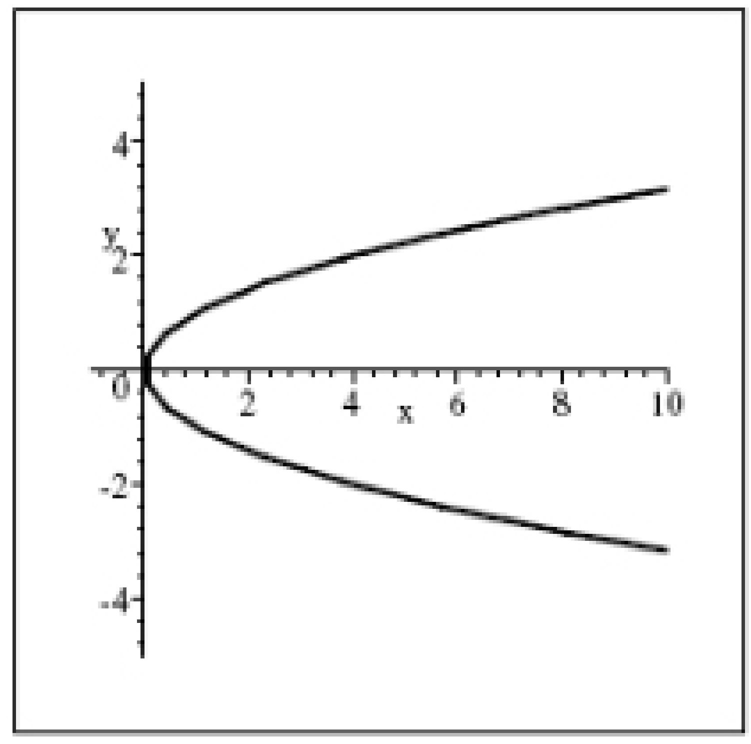
III Determining if a Graph Represents a Function

Graphs of Functions: A function can be graphed by determining the set of all ordered pairs (points) where x is in the domain and y is in the range. Because each x can only be paired to one y, the **vertical line test** can be used to determine if a graph represents a function. If every possible vertical line would intersect the graph only once, then the graph represents a function.

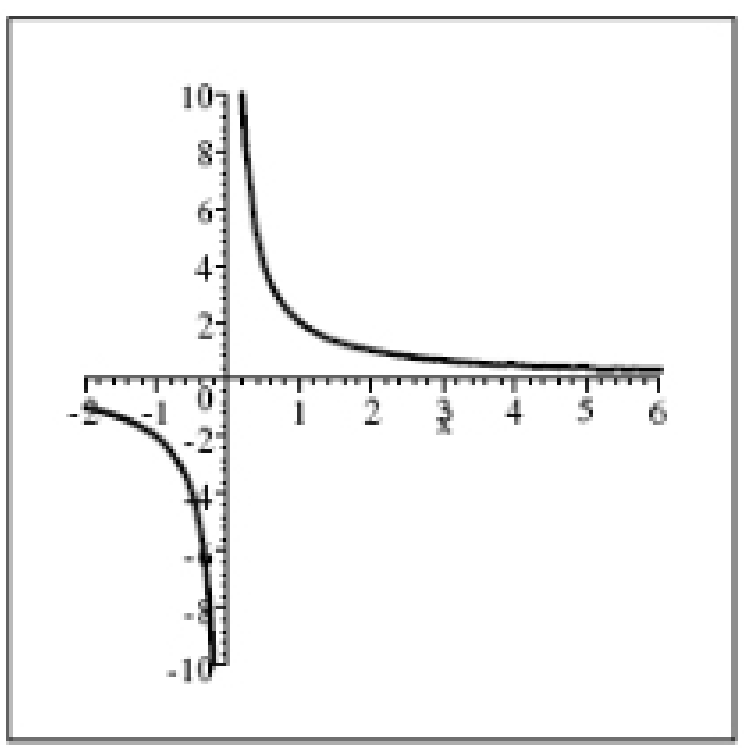
Ex 2: Determine which graphs are functions.

a) 

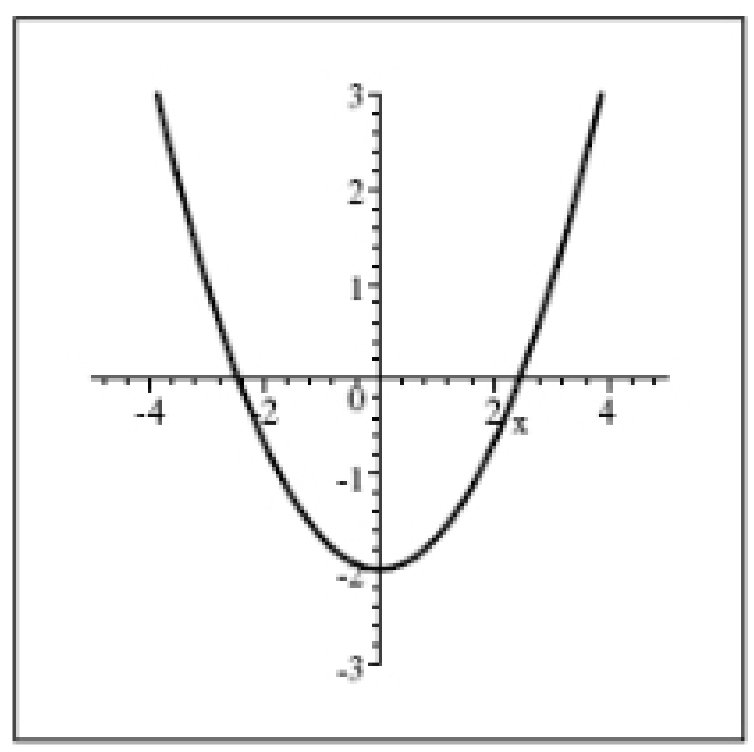
$y = \sqrt{x-2}$

b) 

$y^2 = x$

c) 

$y = \frac{2}{x}$

d) 

$y = \frac{1}{3}x^2 - 2$

The Vertical Line Test for Functions
If any vertical line intersects a graph in more than one point, the graph does not define y as a function of x.