

MA 15200 Lesson 20 Section 2.1

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

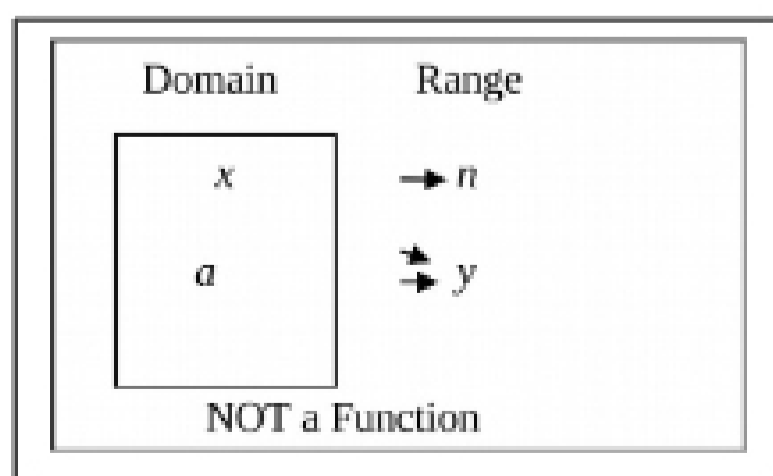
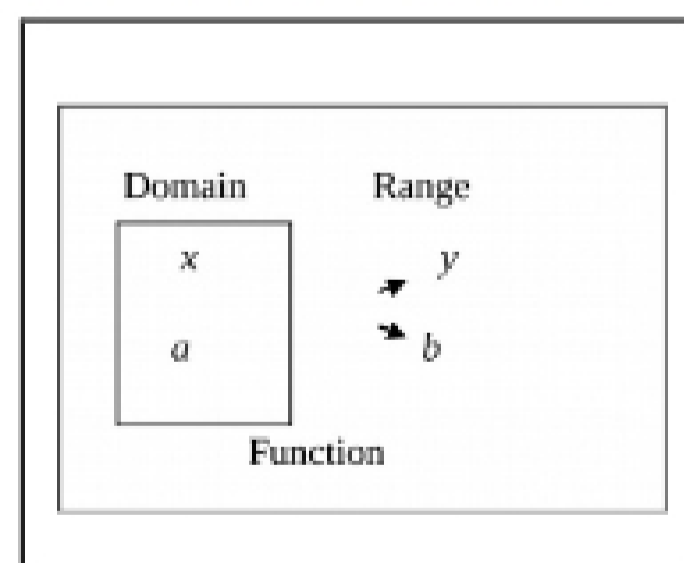
A relation in which each member of the domain corresponds to exactly one member of the range is a **function**. The table above that pairs a last name with a percent of all names is a function because each last name is paired to exactly one percent. Another way to identify a function is the following, 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)  $y = x^2 + 2$

c)  $x = y^2 + 2$

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

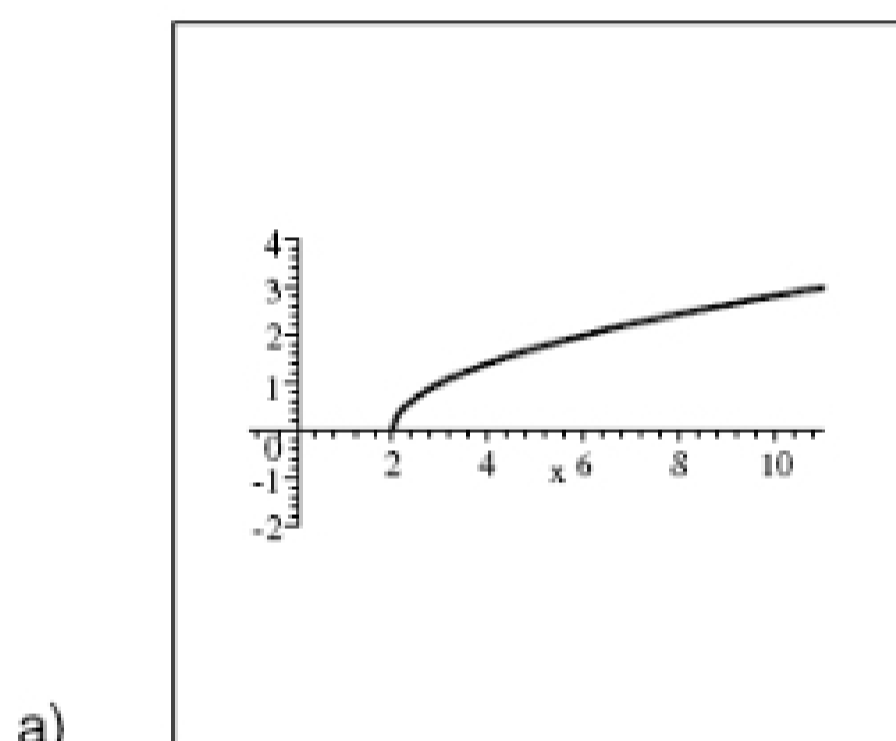
d)  $xy - y = -1$

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

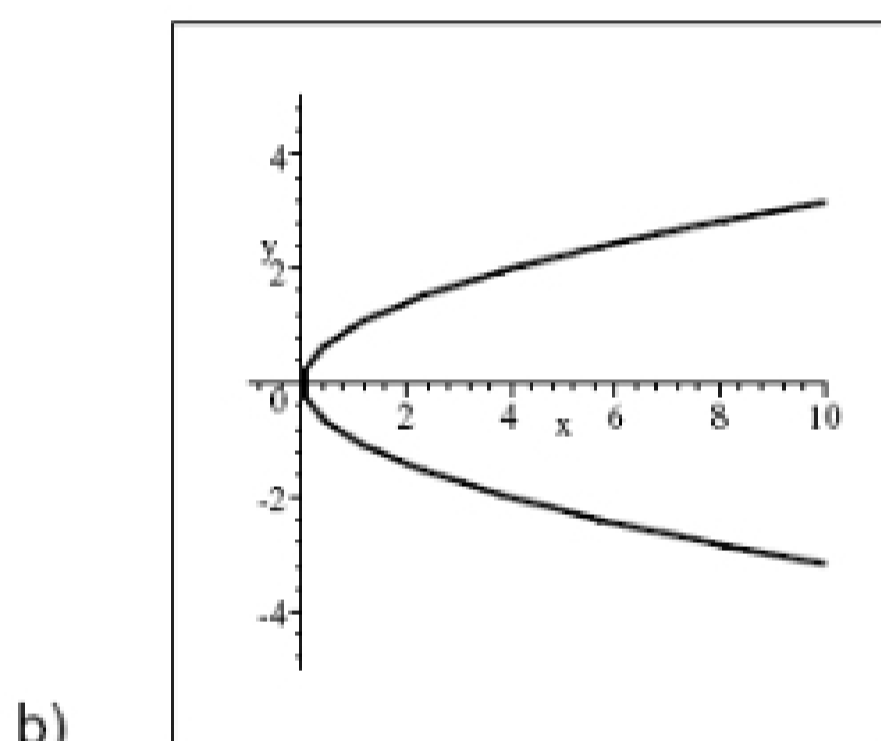
### III Determining if a Graph Represents a Function

**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.

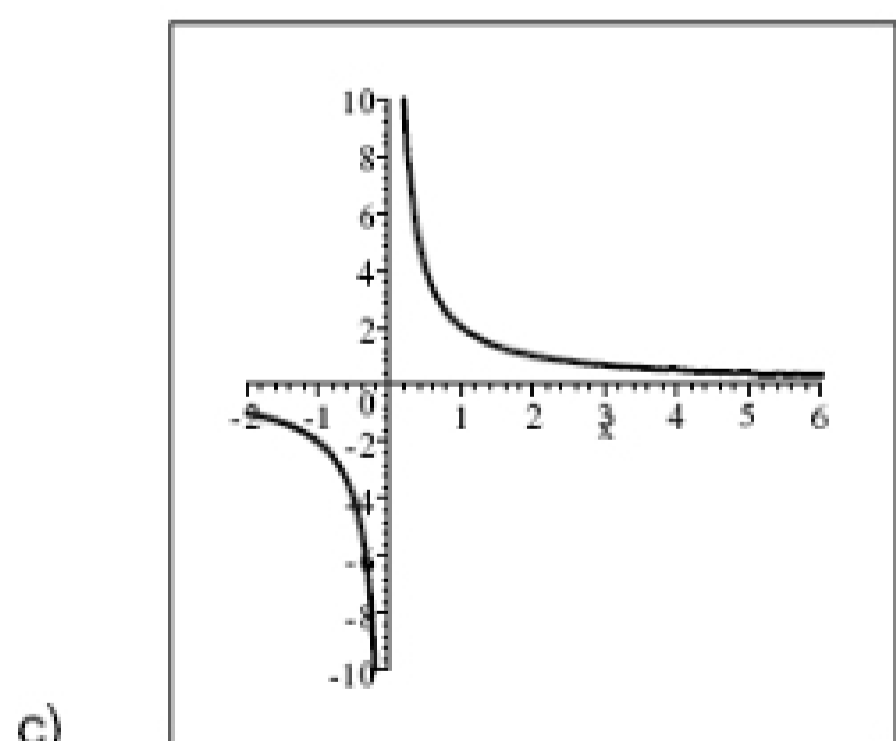
Ex 2: Determine which graphs are functions.



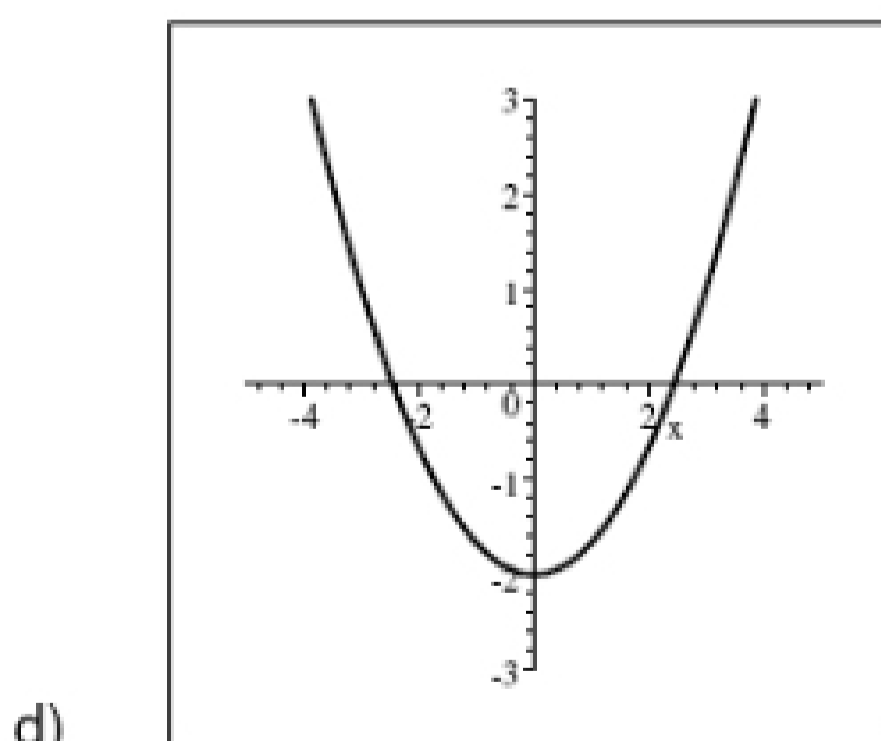
$$y = \sqrt{x-2}$$



$$y^2 = x$$



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



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