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# MATH 11010: Functions

## Section 1.2

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- **Function:** A function is a rule or correspondence that assigns to each element of one set, called the domain, exactly one element of a second set, called the range. A function may be defined by a set of ordered pairs, a table, a graph, or an equation.
- **Domain:** The domain of a function is the set of all inputs. If  $x$  is any element in the domain, then  $x$  is called the **independent variable**.
- **Range:** The range of a function is the set of all outputs. If  $y$  represents an output of the function  $f$  from an input  $x$ , then  $y$  is called the **dependent variable** and is denoted by  $f(x)$ .

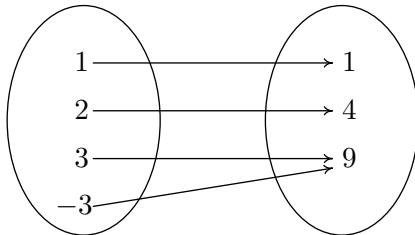
**Example 1:** Determine which of the following are examples of functions. For each function, determine the domain and range.

(a)  $\{(1, 2), (3, 6), (6, 8), (9, 2), (12, 5)\}$

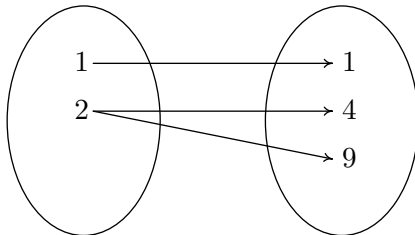
(b) 

$x$	1	2	-5	2	-4
$y$	-1	4	6	7	9

(c)

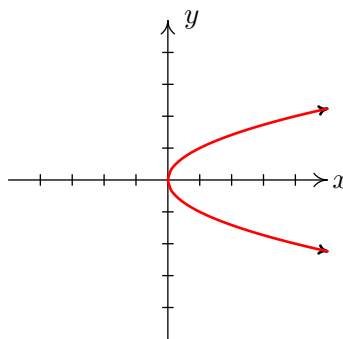
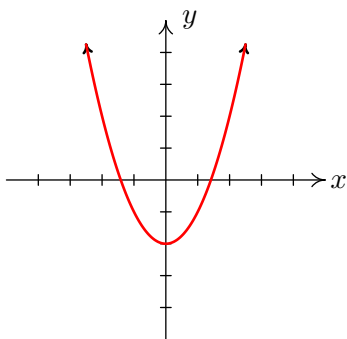


(d)



- The **graph of a function** is a set of points  $(x, y)$  in the  $xy$ -plane such that  $y = f(x)$ .
- **The Vertical Line Test:** A set of points in the  $xy$ -plane is the graph of a function if and only if no vertical line intersects the set of points more than once.

**Example 2:** Determine if each of following curves is the graph of a function.



**Evaluating Functions:** In our definition of a function  $y = f(x)$ , the independent variable  $x$  serves as a placeholder for all input values. Therefore, to evaluate a function at a number, we substitute the number for the placeholder.

**Example 3:** Consider the function  $f(x) = 3x^2 - 2x - 8$ . Find

(a)  $f(-1)$

(c)  $f\left(\frac{1}{2}\right)$

(b)  $f(2)$

(d)  $f(x + h)$

**Finding the Domain of a function:** The domain of a function is the set of all inputs for which the expression is defined as a real number. Examples of values that are **not** in the domain of a function are:

- values that result in a denominator of zero
- values that result in an even root of a negative number

**Example 4:** For each of the following functions determine the domain.

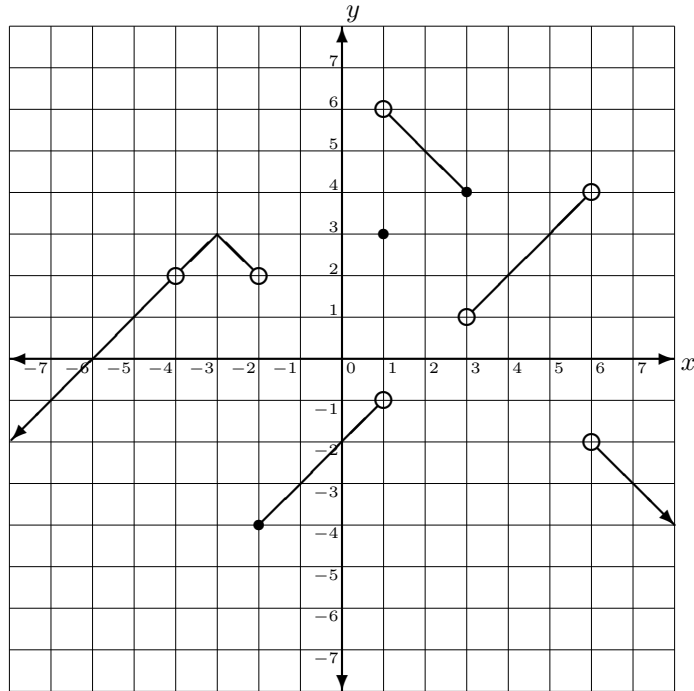
(a)  $f(x) = \frac{x-3}{x+7}$

(b)  $g(x) = \frac{x}{15x^2 + 2x - 8}$

(c)  $h(x) = \sqrt{x-7}$

(d)  $k(x) = \frac{\sqrt{2x-5}}{x^2 - 12x + 35}$

**Example 5:** For the function  $f$  graphed below, find the following:



- |                  |             |
|------------------|-------------|
| 1. Domain of $f$ | 5. $f(1) =$ |
| 2. Range of $f$  | 6. $f(3) =$ |
| 3. $f(-5)$       | 7. $f(5) =$ |
| 4. $f(-4) =$     | 8. $f(6) =$ |

**Homework:** pp 84–88; 1–41 every other odd (eoo), 43–61 odd