Math 1111 – Basic Functions and Their Graphs

Objectives:

1. Find the domain and range of a relation

2. Determine if a relation is a function

3. Determine if an equation represents a function

4. Evaluate a function

5. Graph functions by plotting points

6. Use the vertical line test

7. Obtain information from its graph

8. Identify the domain and range from its graph

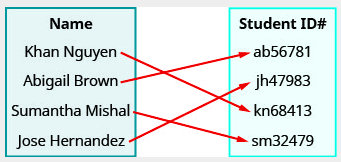
9. Identify intercepts from a graph

**Objective 1:** Find the domain and range of the relation.

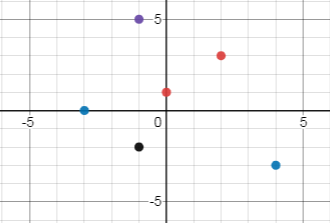
A relation is any set of ordered pairs (x, y). All the x-values in the ordered pairs together make up the domain. All the y-values in the ordered pairs together make up the range. The domain is also known as the input value or the independent variable. The range is also known as the output value or the dependent variable.

A relation can also be represented by a map or a graph.

When using a map, the arrows show the pairing of the elements of the domain with the elements of the range. When using a graph, the set of ordered pairs that are plotted represent the relation.



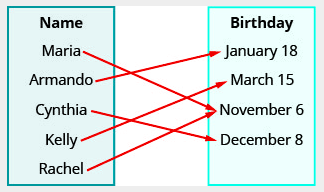
MAPPING



GRAPH

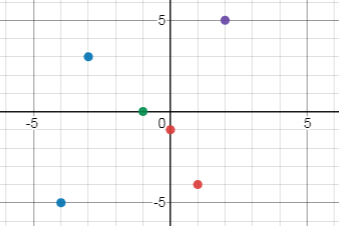
Example #1: Determine the domain and range of each relation. If the relation is a map or graph, write the ordered pairs.

A. {(1, 3), (2, 6), (3, 9), (4, 12), (5, 15)}



B.

C.



**Objective 2:** Determine if a relation is a function.

A function is a relation in which each possible input value leads to exactly one output value. We say “the output is a function of the input.” In other words, no x-values are repeated.

The following figure compares relations that are functions and relations that are not functions.

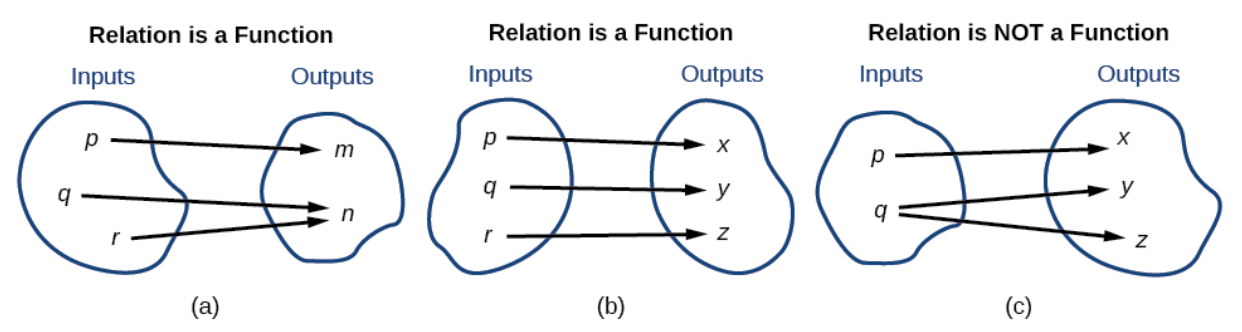


Figure a: This relationship is a function because each input is associated with a single output, even though q and r have the same output, n.

Figure b: This relationship is a function because each input is associated with a single output.

Figure c: This relationship is not a function because input q is associated with two different outputs, y and z.

To determine if a relation is a function:

1. Identify the input values.

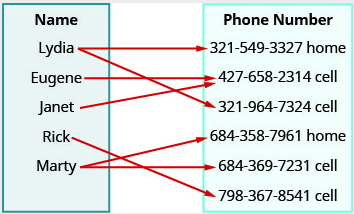
2. Identify the output values.

3. If each input value leads to only one output value, classify the relationship as a function. If any input value leads to two or more outputs, do not classify the relationship as a function.

Example #2: Determine if each relation is a function. Explain why or why not it is a function.

A. {(-3, -6), (-2, -4), (-1, -2), (0, 0), (1, 2), (2, 4), (3, 6)}

B. {(8, -4), (4, -2), (2, -1), (0, 0), (2, 1), (4, 2), (8, 4)}

C.

**Objective 3:** Determine if an equation represents a function.

Many times, in algebra, functions will be represented by an equation. To determine if the equation represents a function, we must solve for y. If each value of x results in only one value of y, then the equation defines a function.

Example #3: Determine if the equation represents a function.

A. 2x + y = 7

B. y = x2 + 1

C. x + y2 = 7

**Objective 4:** Evaluating a function.

In any function, for each *x*-value from the domain we get a corresponding *y*-value in the range. For the function *f*, we write this range value *y* as *f(x)*. This is called function notation and is read *f* of *x* or the value of *f* at *x*.

Function Notation: For the function *y = f(x)*

*f* is the name of the function

*x* is the domain value

*f(x)* is the range value *y* corresponding to the value *x*

We read *f(x)* as *f* of *x* or the value of *f* at *x*.

Also,

*x* is the independent variable as it can be any value in the domain

*y* is the dependent variable as its value depends on *x*

Example #4: Evaluate the following functions.

A. *f(x)* = 3x2 – 2x + 4, for *f*(-2), *f*(3), *f*(x + 1), *f*(-x), *-f*(x)

B. The number of unread emails in Anthony’s account is 110. This number grows by 25 unread emails a day. The function *N(t)* = 110 + 25*t* represents the relation between the number of emails, *N*, and the time, *t*, measured in days.

Determine the independent and dependent variable.

Find *N*(14). Explain what this means.

**Objective 5:** Graph functions by plotting points.

To graph a function by plotting points, we need to find some ordered pairs (*x*, *f(x)*), where *y* = *f(x)*.

*f* is the name of the function

*x* is the *x*-coordinate of the ordered pair

*f(x)* is the *y*-coordinate of the ordered pair

Example #5: Graph the functions by plotting points using the given values.

 A. *f(x)* = 3x – 2

|  |  |  |
| --- | --- | --- |
| *f(x)* = 3x + 2 | | |
| *x* | *f(x)* | (*x*, *f(x)*) |
| -2 |  |  |
| -1 |  |  |
| 0 |  |  |
| 1 |  |  |
| 2 |  |  |

.



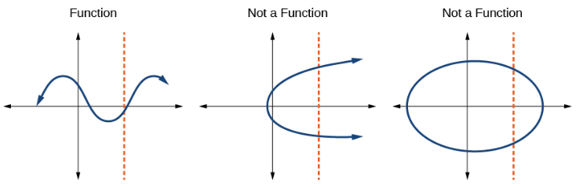
B. *f(x)* = x2 - 3

|  |  |  |
| --- | --- | --- |
| *f(x)* = x2 - 3 | | |
| *x* | *f(x)* | (*x*, *f(x)*) |
| -2 |  |  |
| -1 |  |  |
| 0 |  |  |
| 1 |  |  |
| 2 |  |  |

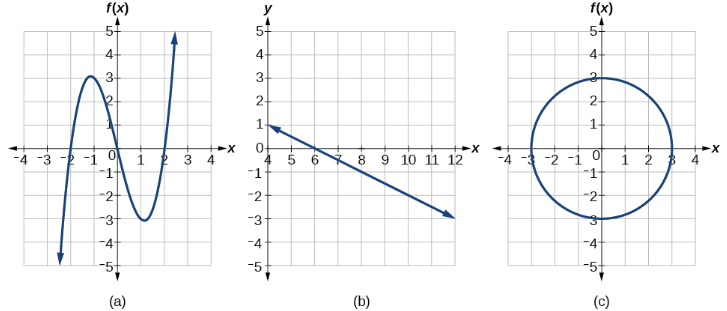
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**Objective 6:** Use the vertical line test.

When we are given a graph, we can determine if it is a function by using the vertical line test. If we can draw any vertical line that intersects a graph more than once, then the graph does not define a function because a function has only one output value for each input value.



Example #6: Circle the graphs which represent a function.



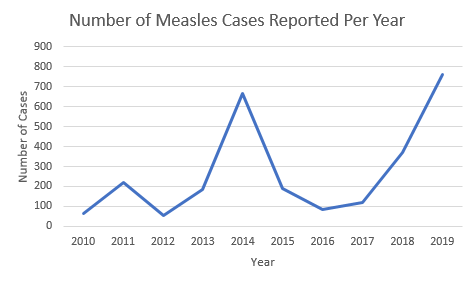
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**Objective 7:** Obtain information from its graph.

In the sciences and business, data is often collected and then graphed. The information obtained from the graph is analyzed and many times, predictions are made from the data.

Example #7: Using the graph below, analyze the graph and report the answers.

Below is a graph from the CDC showing the number of measles outbreaks in the US since 2010.



A. Is this a function?

B. Find and interpret *f*(2015).

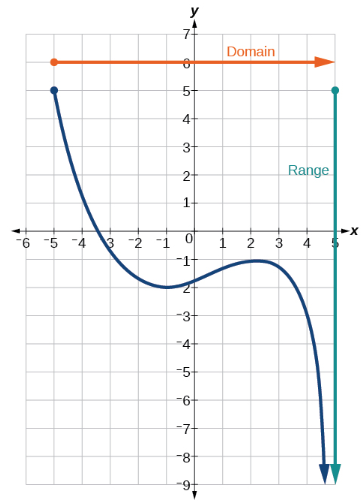
C. For what value of x is f(x) = 372?

D. Describe the trend of this graph.

<https://www.cdc.gov/measles/cases-outbreaks.html>

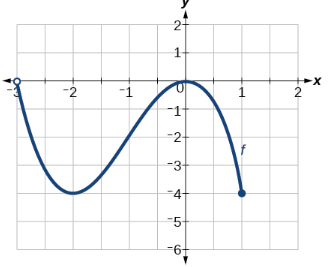
**Objective 8:** Identify the domain and range of a function from its graph.

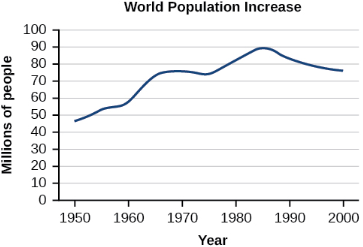
Another way to identify the domain and range of functions is by using graphs. Because the domain refers to the set of possible input values, the domain of a graph consists of all the input values shown on the x-axis. The range is the set of possible output values, which are shown on the y-axis. Keep in mind that if the graph continues beyond the portion of the graph we can see, the domain and range may be greater than the visible values.



We can observe that the graph extends horizontally from −5 to the right without bound, so the domain is [−5, ∞).  The vertical extent of the graph is all range values 5 and below, so the range is (−∞, 5].  Note: the domain and range are always written from **smaller to larger values**, or from left to right for domain, and from the bottom of the graph to the top of the graph for range.

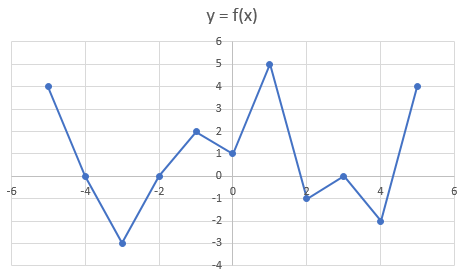
Example #8: Using the graphs below, identify the domain and range of each function.

 A.

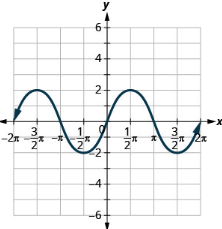
 B.

**Objective 9:** Identify intercepts from a graph.

To find the intercepts of a graph, we look for where the graph crosses the x- and y-axis. In the graph below, we have 3 x-intercepts (-4, 0), (-2, 0), and (3, 0). Notice that the y-values are zero. In the same graph we have 1 y-intercept which is (0, 1). Notice that the x-value is zero.



Example #9: Using the graph below, identify the following.



A. Find *f* (0)

B. Find *f* ()

C. Find *f* ()

D. Find the values for *x* when *f(x)* = 0

E. Find the *x*-intercepts

F. Find the *y*-intercepts

G. Find the domain. Write it in interval notation.

H. Find the range. Write it in interval notation.

OpenStax, Intermediate Algebra. OpenStax CNX. Jun 11, 2019 http://cnx.org/contents/02776133-d49d-49cb-bfaa-67c7f61b25a1@8.1.

OpenStax College Algebra, College Algebra. OpenStax CNX. Aug 2, 2019 http://cnx.org/contents/9b08c294-057f-4201-9f48-5d6ad992740d@11.1.