

Lesson 6.3 Domain and Range

. Demonstrate an understanding of relations and functions.

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When comparing two quantities, the words **domain** and **range** are used.

Domain

- the set of all possible values for the independent (x) variable in a relation

Range

- the set of all possible values for the dependent (y) variable as the independent variable takes on all possible values of the domain

In a set of ordered pairs, values for the domain are the first element of each pair. Values for the range are the second element.

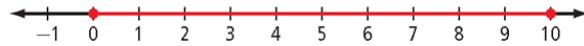
On a graph, values of the domain are plotted along the horizontal axis. Values of the range are plotted along the vertical axis.

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There are a variety of ways to express the domain and range of a relation.

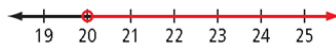
- **Words** can be used to describe the values that are allowed. For example, the domain is the set of all real numbers between 0 and 10, inclusive. The range is the set of all real numbers greater than 20.
- **Number lines** give a picture of the values that are allowed.

For example, this number line represents all numbers between 0 and 10, inclusive.



The solid circles at 0 and 10 indicate that these points are included

This number line represents all numbers greater than 20.



The open circle at 20 indicates that the value 20 is not included. The arrow pointing to the right indicates that there is no upper limit.

This number line represents the discrete list of numbers -2, 0, 4, 8, and 10.



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A **list** is a useful way to give the domain and range for discrete data when there are not many numbers in the set. For the relation (0, 0), (1, 5), (3, 7), (5, 7), the domain is {0, 1, 3, 5} and the range is {0, 5, 7}.

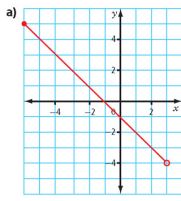
Set notation is a formal mathematical way to give the values of the domain and range.

Set Notation	What It Means
The domain: $\{x \mid x \leq 10, x \in \mathbb{R}\}$	$\{ \}$ is the type of brackets used for a set. \in means "is an element of". $ $ means "such that". The statement is read as follows: x is an element of the real numbers such that x is less than or equal to 10.
The range: $\{y \mid y > 20, y \in \mathbb{R}\}$	The statement is read as follows: y is an element of the real numbers such that y is greater than 20.

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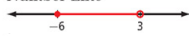

Example 1 Determine the Domain and Range From a Graph

For each graph, give the domain and range. Use words, a number line, and set notation

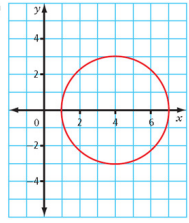
a) 

Solution



a) From looking at the graph, you can see that the smallest value for x is -6 . The largest value for x is up to, but not including, 3 . The smallest value for y is down to, but not including, -4 . The largest value for y is 5 .

Domain	Range
<p><i>Words</i> All real numbers between -6 and 3, including -6 but not including 3</p> <p><i>Number Line</i> </p> <p><i>Set Notation</i> $\{x \mid -6 \leq x < 3, x \in \mathbb{R}\}$ In this class, you will be expected to read the formal set notation and to at least write set notation informally $-6 \leq x < 3$</p>	<p><i>Words</i> All real numbers between -4 and 5, not including -4 but including 5</p> <p><i>Number Line</i> </p> <p><i>Set Notation</i> $\{y \mid -4 < y \leq 5, y \in \mathbb{R}\}$ $-4 < y \leq 5$</p>

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b) 


b) From looking at the graph, you can see that the smallest value for x is 1 . The largest value for x is 7 . The smallest value for y is -3 . The largest value for y is 3 .

Domain	Range
<p><i>Words</i> All real numbers between 1 and 7, inclusive</p> <p><i>Number Line</i> </p> <p><i>Set Notation</i> $\{x \mid 1 \leq x \leq 7, x \in \mathbb{R}\}$</p>	<p><i>Words</i> All real numbers between -3 and 3, inclusive</p> <p><i>Number Line</i> </p> <p><i>Set Notation</i> $\{y \mid -3 \leq y \leq 3, y \in \mathbb{R}\}$</p>

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Chapter
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Domain and Range

Choose a graph by clicking **Select a Graph**. Then, represent its domain and range by using the number line. Drag the endpoint symbols to the number line, then connect the symbols with the line. Click **Check** to check your answer.



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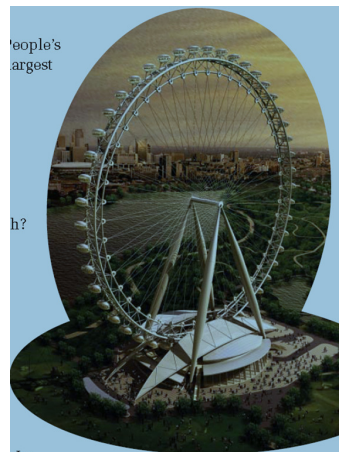
Example 2 Domain and Range for a Situation

The Great Wheel is being built in Beijing in the People's Republic of China. When finished, it will be the largest Ferris wheel in the world. The wheel will have a diameter of 193 m and will reach a maximum height of 208 m.

The graph shows a rider's height relative to the ground for a 20-min ride through one rotation.

a) What are the values of points A, B, C, and D, and what do they represent?

b) What are the domain and the range of the graph?



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Example 2 Domain and Range for a Situation

The Great Wheel is being built in Beijing in the People's Republic of China. When finished, it will be the largest Ferris wheel in the world. The wheel will have a diameter of 193 m and will reach a maximum height of 208 m. The graph shows a rider's height relative to the ground for a 20-min ride through one rotation.

a) What are the values of points A, B, C, and D, and what do they represent?

Solution

a) Point A is the highest point on the graph, so it must represent the highest point on the ride. Its value is 208 m.

Point B is the lowest point on the graph. It represents the location where a rider boards the Ferris wheel. Since the diameter of the wheel is 193 m, this point is 193 m below point A. By subtraction, the value of B is 15 m.

Point C is the origin, (0, 0). It represents ground level on the vertical axis and the starting time on the horizontal axis.

Point D represents the time it takes to complete one revolution. Its value therefore is 20 min.

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b) What are the domain and the range of the graph?

Solution

b) The domain and range can be described in several ways.

Words:
 Domain: All times are between 0 min and 20 min, inclusive.
 Range: A rider's height above the ground is between 15 m and 208 m, inclusive.

Number Line:
 Domain: Ride time, in minutes
 Range: Height above the ground, in metres

Set Notation:
 Domain: Ride time, in minutes: $\{t \mid 0 \leq t \leq 20, t \in \mathbb{R}\}$
 Range: Height above the ground, in metres: $\{h \mid 15 \leq h \leq 208, h \in \mathbb{R}\}$

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Example 3 Domain and Range for Discrete Data

Caitlin is marking time for some music by clapping on the first beat of every bar. The table of values and the set of ordered pairs show the relationship between the total number of beats and her total number of claps. Give the domain and range of the relation using words and a list

Number of Beats	Number of Claps
1	1
5	2
9	3
13	4
17	5
21	6
25	7
29	8

Ordered Pairs (Beats, Claps)
{(1, 1), (5, 2), (9, 3), (13, 4), (17, 5), (21, 6), (25, 7), (29, 8)}

Solution

Words:

Domain: The total number of beats is given by the numbers 1, 5, 9, 13, 17, 21, 25, and 29.

Range: The total number of claps is given by the whole numbers between 1 and 8, inclusive.

List:

Domain: {1, 5, 9, 13, 17, 21, 25, 29}

Range: {1, 2, 3, 4, 5, 6, 7, 8}


Handwritten: $\{c \mid 1 \leq c \leq 8, c \in \mathbb{W}\}$

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Chapter 6

Set Notation


Match each set notation to its graph.



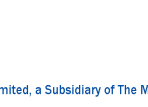
Domain: $\{x \mid x \geq -4, x \in \mathbb{R}\}$
 Range: $\{y \mid y \leq 0, y \in \mathbb{R}\}$




Domain: $\{x \mid x \geq -4, x \in \mathbb{R}\}$
 Range: $\{y \mid y \leq 0, y \in \mathbb{R}\}$




Domain: $\{x \mid -1 \leq x \leq 3, x \in \mathbb{R}\}$
 Range: $\{y \mid 0 \leq y \leq 4, y \in \mathbb{R}\}$



Domain: $\{x \mid -1 \leq x \leq 3, x \in \mathbb{R}\}$
 Range: $\{y \mid 0 \leq y \leq 4, y \in \mathbb{R}\}$



Domain: $\{x \mid x > -3, x \in \mathbb{R}\}$
 Range: $\{y \mid y < 3, y \in \mathbb{R}\}$



Domain: $\{x \mid x > -3, x \in \mathbb{R}\}$
 Range: $\{y \mid y < 3, y \in \mathbb{R}\}$

[Click here for the answer](#)

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Homework Page 301 #1-6 omit 4b, 8, 9

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