

Domain and Range of a Function

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CONCEPT

1

Domain and Range of a Function

The set of all possible input values for the independent variable is called the **domain**. The domain can be expressed in words, as a set, or as an inequality. The values resulting from the substitution of the domain represent the **range** of a function.

Example A

A tennis ball is bounced from a height and bounces back to 75% of its previous height. Write the function for this scenario and determine its domain and range.

Solution: The function representing this situation is $h(b) = 0.75b$, where b represents the previous bounce height.

Domain: The previous bounce height can be any positive number, so $b \geq 0$.

Range: The new height is 75% of the previous height, and therefore will also be any positive number (decimal or whole number), so the range is **all positive real numbers**.

Example B

Find the range of $f(x) = 2x - 3$ when the domain is 0, 1, 2, 3.

Solution:

Since the range is the output, we plug in the values in the domain to see what values we will get out.

$$f(0) = 2(0) - 3 = -3$$

$$f(1) = 2(1) - 3 = -1$$

$$f(2) = 2(2) - 3 = 1$$

$$f(3) = 2(3) - 3 = 3$$

The range for the given domain is $-3, -1, 1, 3$.

Notice that we used function notation to keep track of which input value gave us which output value. This will be useful later.

Vocabulary

Domain: The **domain** of a function is the set of all possible input values for that function.

Range: The **range** of the function is the set of all possible output values for that function.

Guided Practice

Eli makes \$20 an hour tutoring math.

- Write a function expressing the amount of money she earns.
- What are the domain and range of this function?

c. Suppose Eli will only work for either 1, 1.5 or 2 hours. Express this domain and the corresponding range in a table.

Solutions:

a. Let $M(h)$ represent money earned for h hours. Then the function is $M(h) = 20h$.

b. Since hours worked can only be zero or positive, $h \geq 0$ is the domain. If Eli works for zero hours, she will earn zero dollars. She could also earn any positive amount of money, so the range is also all non-negative real numbers. That is, $M \geq 0$.

c. First we plug the domain into our function:

$$M(1) = 20(1) = 20$$

$$M(1.5) = 20(1.5) = 30$$

$$M(2) = 20(2) = 40.$$

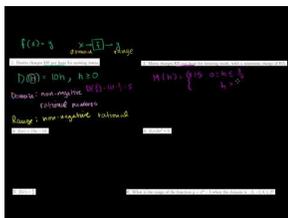
Putting this into a table, we get:

TABLE 1.1:

h	$M(h)$
1	20
1.5	30
2	40

Practice

Sample explanations for some of the practice exercises below are available by viewing the following video. Note that there is not always a match between the number of the practice exercise in the video and the number of the practice exercise listed in the following exercise set. However, the practice exercise is the same in both.



MEDIA

10900

1. Define domain.
2. True or false?
3. Generate a table from $-5 \leq x \leq 5$ for $f(x) = -(x)^2 - 2$.

In 4-8, identify the domain and range of the function.

1. Dustin charges \$10 per hour for mowing lawns.
2. Maria charges \$25 per hour for math tutoring, with a minimum charge of \$15.
3. $f(x) = 15x - 12$
4. $f(x) = 2x^2 + 5$
5. $f(x) = \frac{1}{x}$

1. Make up a situation in which the domain is all real numbers but the range is all whole numbers.
2. What is the range of the function $y = x^2 - 5$ when the domain is $-2, -1, 0, 1, 2$?

3. What is the range of the function $y = 2x - \frac{3}{4}$ when the domain is $-2.5, 1.5, 5$?
4. Angie makes \$6.50 per hour working as a cashier at the grocery store. Make a table of values that shows her earnings for the input values 5, 10, 15, 20, 25, 30.
5. The area of a triangle is given by: $A = \frac{1}{2}bh$. If the base of the triangle is 8 centimeters, make a table of values that shows the area of the triangle for heights 1, 2, 3, 4, 5, and 6 centimeters.
6. Make a table of values for the function $f(x) = \sqrt{2x+3}$ for the input values $-1, 0, 1, 2, 3, 4, 5$.