FUNCTIONS 1.2.1 through 1.2.3

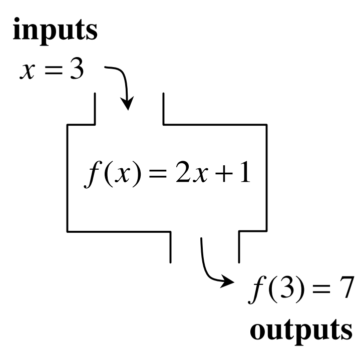
A relationship between the input values (usually x) and the output values (usually y) is called a function if for each input value, there is no more than one output value. Functions can be represented with an illustration of a "function (input–output) machine", as shown in Lesson 1.2.3 of the textbook and in the diagram in Example 1 below. Note: $f(x) = 2x + 1$ is equivalent to $y = 2x + 1$.

The set of all possible inputs is called the **domain**, while the set of all possible outputs is called the **range**.

For additional information about functions, function notation, and domain and range, see the Math Notes box in Lesson 1.2.3.

Example 1

The inputs of a function are "x"s and the outputs are "$f(x)$"s. Numbers are input into the function machine labeled f one at a time, and then the function performs the indicated operation on each input to determine its corresponding output. For example, when $x = 3$ is put into the function machine f at right, the function multiplies the 3 by 2 and then adds 1 to get the corresponding output, which is 7. The notation $f(3) = 7$ shows that the function named f connects the input 3 with the corresponding output 7. This also means the point (3, 7) lies on the graph of the function.



Example 2

a. If $f(x) = \sqrt{x-2}$ then $f(11) = ?$

$$f(11) = \sqrt{11-2}$$
$$f(11) = \sqrt{9}$$
$$f(11) = 3$$

b. If $g(x) = 3 - x^2$ then $g(5) = ?$

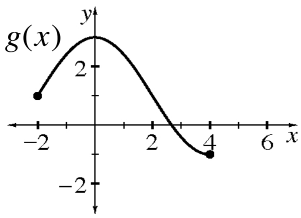
$$g(5) = 3 - (5)^2$$
$$g(5) = 3 - 25$$
$$g(5) = -22$$

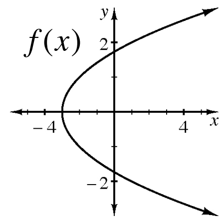
c. If $f(x) = \frac{x+3}{2x-5}$ then $f(2) = ?$

$$f(2) = \frac{2+3}{2 \cdot 2 - 5}$$
$$f(2) = \frac{5}{-1}$$
$$f(2) = -5$$

Example 3

A relationship in which each input has only one output is called a **function**.





$g(x)$ is a function; each input (x) has only one output (y).
$g(-2)=1$, $g(0)=3$, $g(4)=-1$, and so on.

$f(x)$ is not a function: each input greater than –3 has two y-values associated with it. $f(1)=2$ and $f(1)=-2$.

Example 4

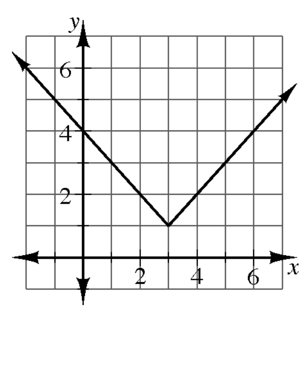
The set of all possible inputs is called the **domain**, while the set of all possible outputs of is called the **range**.

In Example 3 above, the domain of $g(x)$ is $-2 \le x \le 4$, or "all numbers between –2 and 4". The range of $g(x)$ is $-1 \le g(x) \le 3$ or "all numbers between –1 and 3".

The domain of $f(x)$ in Example 3 above is $x \ge -3$ or "any real number greater than or equal to 3," since the graph starts at $x = -3$ and continues forever to the right. Since the graph of $f(x)$ extends in both the positive and negative y (vertical) directions forever, the range is "all real numbers".

Example 5

For the graph at right, since the graph extends forever horizontally in both directions, the domain is "all real numbers". The y-values start at $y = 1$ and increase, so the range is $y \ge 1$ or "all numbers greater or equal to 1".



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Function Review

Problems

Determine the outputs for the following function machines and the given inputs.

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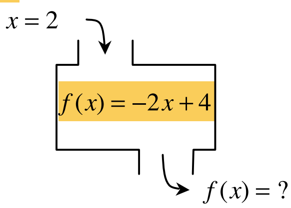

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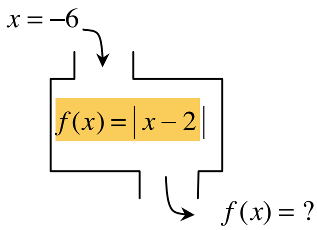

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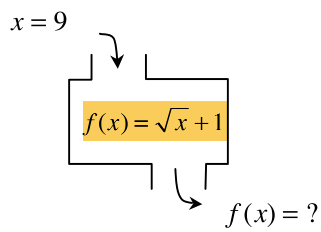


4. $f(x) = (5 - x)^2$
$f(8) = ?$

5. $g(x) = x^2 - 5$
$g(-3) = ?$

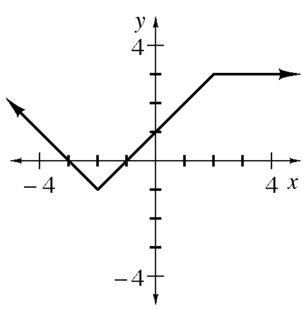
6. $f(x) = \frac{2x+7}{x^2-9}$
$f(3) = ?$

7. $h(x) = 5 - \sqrt{x}$
$h(9) = ?$

8. $h(x) = \sqrt{5 - x}$
$h(9) = ?$

9. $f(x) = -x^2$
$f(4) = ?$

Determine if each graph below represents a function. Then state its domain and range.

10.


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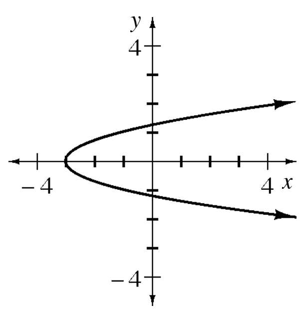

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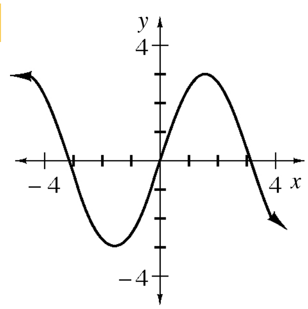

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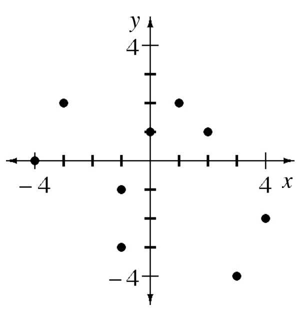

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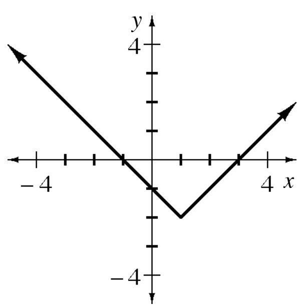

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