

Lesson 2: Function Notation - Part One

Friday, August 31, 2018 2:40 AM

Functions Lesson #2: Function Notation - Part One

Mapping Notation

In the previous lesson we discovered some ways in which functions can be represented:

- in words
- a table of values
- a set of ordered pairs
- a mapping (or arrow) diagram
- an equation
- a graph
- function notation (this unit)

A **function** was defined in mapping notation as follows:

“A function from a set D , the domain, to a set R , the range, is a relation in which each element of D is related to exactly one element of R .

If the function f maps an element x in the domain to an element y in the range, we write $f: x \rightarrow y$.”

Consider the function $f: x \rightarrow 2x + 3$ defined on the set of real numbers.

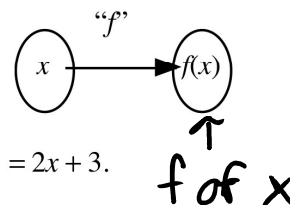
Under this function we know that $5 \rightarrow 2(5) + 3$ ie $5 \rightarrow 13$.

We say that under the function f , the **image** of 5 is 13.

We also say that the **value of the function** is 13 when $x = 5$.

Function Notation

In most math courses, function notation is used to replace the mapping notation $f: x \rightarrow 2x+3$. Under a function f , the image of an element x in the domain is denoted by $f(x)$, which is read “ f of x ”.



In the example above, the function f can be defined by the formula $f(x) = 2x + 3$.

The notation $f(x) = 2x + 3$ is called **function notation**.

We showed above, that, under the function f , the image of 5 is 13. We write $f(5) = 13$.

mapping notation

$$f: x \rightarrow 2x+3$$

$$f: 5 \rightarrow 2(5)+3$$

$$f: 5 \rightarrow 13$$

function notation

$$f(x) = 2x + 3$$

$$f(5) = 2(5) + 3$$

$$f(5) = 13$$

equation of graph of function

$$y = 2x + 3$$

$$y = 2(5) + 3$$

$$y = 13$$

The symbol $f(x)$ is read as “ f at x ” or “ f of x ”.

$f(x)$ provides a formula for the function f , and also represents the value of the function for a given value of x .



In function notation:

- $f(x)$ does not mean f times x .
- Values of the independent variable represent the **inputs** of a function and are shown on the **horizontal axis**. X
- The “name” of the function is f .
- Values of the dependent variable represent the **outputs** of a function and are shown on the **vertical axis**. y

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Consider the function $f(x) = x^2 + 5$ and $g(x) = 4 - x$. Evaluate:

a) $f(3)$
 $f(3) = 3^2 + 5$
 $f(3) = 9 + 5 = 14$

b) $g(1)$
 $g(1) = 4 - 1$
 $= 3$

c) $f(-2)$
 $f(-2) = (-2)^2 + 5$
 $= 4 + 5$
 $= 9$

d) $g(-2)$
 $g(-2) = 4 - (-2)$
 $= 4 + 2$
 $= 6$

e) $f(0) - g(0)$
 $(0^2 + 5) - (4 - 0)$
 $5 - 4 = 1$

$(-2, 9)$



Consider the function f defined by $f(x) = 5x^3 - 2x, x \in R$. Determine:

a) $f(-3)$
 $f(-3) = 5(-3)^3 - 2(-3)$
 $= 5(-27) + 6$
 $= -135 + 6 = -129$

b) the value of f when $x = 2$
 $f(2) = 5(2)^3 - 2(2)$
 $= 5 \cdot 8 - 4$
 $= 40 - 4 = 36$

c) ~~the image of 7 under f~~
 $f(7)$

e) an expression for $f(a)$
 $f(a) = 5a^3 - 2a$

f) an expression for $f(2x)$
 $f(2x) = 5(2x)^3 - 2(2x)$
 $= 5(8x^3) - 4x$
 $= 40x^3 - 4x$



If $P(x) = 4x^2 - 6x + 1$, determine a simplified expression for $P(x-3)$.

$P(x-3) = 4(x-3)^2 - 6(x-3) + 1$
 $= 4(x-3)(x-3) - 6x + 18 + 1$
 $= 4(x^2 - 3x - 3x + 9) - 6x + 19$
 $= 4(x^2 - 6x + 9) - 6x + 19$
 $= 4x^2 - 24x + 36 - 6x + 19$
 $= 4x^2 - 30x + 55$

Complete Assignment Questions #1 - #7



Consider the function $f(x) = 10x - 3, x \in R$.

a) Determine the value of x if $f(x) = 47$.
 $f(5) = 47$
 $47 = 10x - 3$ *solve for x
 $50 = 10x$
 $\frac{50}{10} = \frac{10x}{10}$
 $5 = x$

b) Solve the equation $f(x) = -23$.
 $-23 = 10x - 3$
 $-20 = 10x$
 $\frac{-20}{10} = \frac{10x}{10}$
 $-2 = x$
 $f(-2) = -23$



Consider the function $f(x) = x^2 - 5, x \in R$.

a) Evaluate $f(4)$.

$$\begin{aligned} f(4) &= 4^2 - 5 \\ &= 16 - 5 \\ &= 11 \end{aligned}$$

b) Solve the equation $f(x) = 4$.

$$\begin{aligned} 4 &= x^2 - 5 \\ +5 & \quad +5 \\ \hline 9 &= x^2 \\ \sqrt{\quad} & \quad \sqrt{\quad} \\ \sqrt{9} &= \sqrt{x^2} \\ x &= \pm 3 \end{aligned}$$

$$\begin{aligned} \sqrt{3^2} &= \sqrt{9} \\ \sqrt{3^2} &= \sqrt{9} \end{aligned}$$

c) Solve the equation $f(t) = 75$, where $t > 0$. Answer as an exact value and as a decimal to the nearest hundredth.

$$\begin{aligned} f(t) &= t^2 - 5 \\ 75 &= t^2 - 5 \\ +5 & \quad +5 \\ \hline &= t^2 \end{aligned}$$

$$\begin{aligned} \sqrt{80} &= \sqrt{t^2} \\ t &= \sqrt{80} = 8.94 \end{aligned}$$

↑ exact value

Complete Assignment Questions #8 - #13

#1, (2-6)b, 8 17

Assignment

1. Each statement refers to the function f whose graph has equation $y = f(x)$. Circle the correct choice.

- a) f is the *name / value* of the function.
- b) The values of x represent the *inputs / outputs* of the function.
- c) The values of $f(x)$ represent the *inputs / outputs* of the function.
- d) The values of y represent the *inputs / outputs* of the function.
- e) x represents the *independent / dependent* variable of the function.
- f) $f(x)$ represents the *independent / dependent* variable of the function.
- g) y represents the *independent / dependent* variable of the function.

2. If $f(x) = 5x - 7$, determine:

- a) $f(2)$
 $f(2) = 5(2) - 7$
 $f(2) =$
- b) $f(-3)$
- c) $f(0)$

3. Function g is defined by $g(x) = 6 - x^2$. Evaluate
a) $g(4)$ b) $g(-6)$ c) $g(\sqrt{3})$
4. A function f is defined by the formula $f(x) = x^3 + 1$. Find
a) the image of 2 under f b) the value of f at -7 . c) an expression for $f(a)$
5. If $f(x) = x^3 - 2x^2 - x - 5$, evaluate
a) $f(5)$ b) $f(-3)$
6. Consider the function f defined by $f(x) = 8 - 2x$, $x \in R$. Determine
a) $f(4)$ b) the value of f when $x = -4$ c) the image of 0.5 under f

d) an expression for $f(2t)$ e) an expression for $f(a + 3)$
7. If $F(x) = 3x^2 - 2x - 9$, determine a simplified expression for
a) $F(-x)$ b) $F(x - 5)$

- 8.** a) If $f(x) = 5x - 7$, then determine the value of x if $f(x) = 43$.
- b) If $g(x) = 6x + 3$, then determine the value of x if $g(x) = -24$.
- c) If $g(t) = 56 - 3t$, then determine the value of t if $g(t) = 11$.
- d) If $h(x) = -3x + 1$, then determine the value of x if $h(x) = 22$.
- e) If $P(x) = 50 - 3x^2$, then determine the values of x if $P(x) = -25$.
- 9.** Consider the function f defined by $f(x) = 6x - 15$. Find
- a) $f(0)$ b) an expression for $f(2x + 1)$ c) the solution to the equation $f(x) = 27$
- 10.** A function C is defined by $C(x) = \sqrt{x}$ where $x \geq 0$.
- a) Evaluate
- i) $C(16)$ ii) $C\left(\frac{1}{36}\right)$ iii) $\frac{C(100)}{C(4)}$
- b) If $C(x) = 9$, find x .

11. A function g is defined by the formula $g(t) = t + 12$.
 a) Calculate the value of $g(4) + g(-2)$. b) If $g(a^2) = 48$, determine all possible values of a .

Multiple Choice

12. If $f(x) = 3x - 1$ and $f(t) = 8$, then $t =$
 A. $\frac{7}{3}$
 B. 3
 C. $\frac{11}{3}$
 D. 23

Numerical Response

13. A function f is defined by the formula $f(x) = 8\sqrt{x}$, $x \in R$.
 The value of $f(144)$ is _____.

(Record your answer in the numerical response box from left to right)

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Further assignment questions on Function Notation - Part One will appear in the assignment of the next lesson, Function Notation - Part Two.

Answer Key

1. a) name b) inputs c) outputs d) outputs
 e) independent f) dependent g) dependent
2. a) 3 b) -22 c) -7 3. a) -10 b) -30 c) 3
4. a) 9 b) -342 c) $a^3 + 1$ 5. a) 65 b) -47
6. a) 0 b) 16 c) 7 d) $8 - 4t$ e) $2 - 2a$
7. a) $3x^2 + 2x - 9$ b) $3x^2 - 32x + 76$
8. a) 10 b) $-\frac{9}{2}$ c) 15 d) -7 e) ± 5
9. a) -15 b) $12x - 9$ c) $x = 7$ 10. a) i) 4 ii) $\frac{1}{6}$ iii) 5 b) 81
11. a) 26 b) ± 6 12. B 13.

9	6		
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