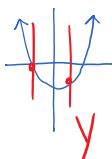

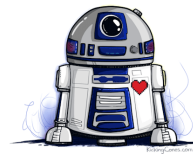


# Lesson 2: Function Notation - Part One

Friday, August 31, 2018 2:40 AM

Review: ①  ②  ③ (0,2) (2,3) (4,1) (0,5)

Functions? **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.

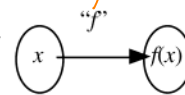
We also say that the **value of the function** is 13 when  $x = 5$ .

**Note:**

① another way to express  $x \rightarrow y$  (image of  $x$  is  $y$ )  
 ② another way when  $x = \square$ , value of function is  $y$ .

## 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

$$\begin{aligned} f: x &\rightarrow 2x+3 \\ f: 5 &\rightarrow 2(5)+3 \\ f: 5 &\rightarrow 13 \end{aligned}$$

### function notation

$$\begin{aligned} f(x) &= 2x + 3 \\ f(5) &= 2(5) + 3 \\ f(5) &= 13 \end{aligned}$$

### equation of graph of function

$$\begin{aligned} y &= 2x + 3 \\ y &= 2(5) + 3 \\ y &= 13 \end{aligned}$$

**most common in senior math classes**

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

- The “name” of the function is  $f$ .  
 ... can be diff letter  $g, h, b...$

- Values of the dependent variable represent the **outputs** of a function and are shown on the **vertical axis**.

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

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

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

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

d)  $g(-2)$

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

so ordered pair

so ordered pair  
(3, 14)

d)  $g(-2)$

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



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

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

b) the value of  $f$  when  $x = 2$

c) the image of 7 under  $f$   
 $f(7) = 5x^3 - 2x$   
 $= 5(7)^3 - 2(7)$   
 $= 1701$  ✓

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



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

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

**Complete Assignment Questions #1 - #7**



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

a) Determine the value of  $x$  if  $f(x) = 47$ .  
 $y = 47$

b) Solve the equation  $f(x) = -23$ .  
 $y = -23$

Note!!!  $f(x)$  is another way of writing  $Y$   
 whole term

A)  $f(x) = 10x - 3$   
 $47 = 10x - 3$   
 $50 = 10x$   
 $5 = x$  ✓

B)  $f(x) = 10x - 3$   
 $-23 = 10x - 3$   
 $-20 = 10x$   
 $-2 = x$  ✓

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

a) Evaluate  $f(4)$ .  
 $= x^2 - 5$   
 $= (4)^2 - 5$   
 $= 11$

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

$f(x) = x^2 - 5$   
 $4 = x^2 - 5$   
 $9 = x^2$   
 $\pm 3 = x$   
(-3, 4)  
(+3, 4)

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

**Complete Assignment Questions #8 - #13**

Assignment # 1: 2-4 (A, C); 5 (A); 6 (A, B, E); 7 (A); 8 (A, D); 9 (C)

**Assignment** # 1; 2-4 (A, C); 5 (A); 6 (A, B, E); 7 (A); 8 (A, D); 9 (C)

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)  $\pm 5$
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)  $\pm 6$                       12. B                      13. 

9	6		
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