

## Functions

Recall that a set of ordered pairs,  $\{(x, y)\}$ , defines  $y$  as a function of  $x$  if and only if no two ordered pairs in the set have the same  $x$ -coordinate. If the set is a function named  $f$  and the ordered pair  $(a, b)$  is in the set, then we write  $f(a) = b$  and we say that the function value at  $a$  is  $b$ .

### Example 1

Fill in the missing information about a function called  $g$ .

Point on $g$	Function Notation	What we say
$(2, -3)$		
	$g(7) = 12$	
		The function value at 8 is 22.
$(0, 51)$		
		The function value at 1 is $-14$ .

### Example 2

Translate each statement into the appropriate symbols.

The value of  $f$  at 9 is 62

$f$  at  $x$  is less than 20

$k$  defines  $y$  as a function of  $x$

12 is the value of  $k$  at  $-4$

$g$  of  $t$  is equal to 17

**Example 3**

Answer each question about the function  $w$ .

What ordered pair is in  $w$  if the value of  $w$  at 8 is 22?

What ordered pair is in  $w$  if 94 is the function value at 55?

What ordered pair is in  $w$  if the function value at  $-19$  is 7?

What ordered pair is in  $w$  if 82 is the value of  $w$  at  $-3$ ?

What function value do you know if the ordered pair  $(7,10)$  is in  $w$ ?

**Example 4**

Answer each of the following questions about the function  $f$  whose graph is shown in Figure 1.

What is the function value at 4?

Write an equation that states the function value at 4.

What is the function value at  $-3$ ?

Write an equation that states the function value at  $-3$ .

At what values of  $x$  is the function value equal to 0? These values are called **the zeros of  $f$** .

What are the solutions to the equation  $f(x) = 0$ ?

At what values of  $x$  is the function value equal to 0?

What are the solutions to the equation  $f(x) = 2$ ?

What is the value of  $f$  at 2?

Between what two values of  $x$  is the function value always positive?

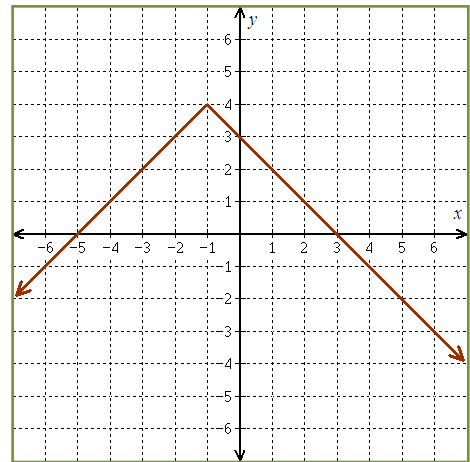


Figure 1:  $y = f(x)$

**Example 5**

Fill in each blank about the function  $k$  in Figure 2.

$$k(\underline{\hspace{2cm}}) = 3 \quad k(3) = \underline{\hspace{2cm}} \quad k(-1) = \underline{\hspace{2cm}} \quad k(\underline{\hspace{2cm}}) = -1$$

The value of  $k$  is 4 at  $\underline{\hspace{2cm}}$ .

The function value at 4 is  $\underline{\hspace{2cm}}$ .

The function value at 0 is  $\underline{\hspace{2cm}}$ .

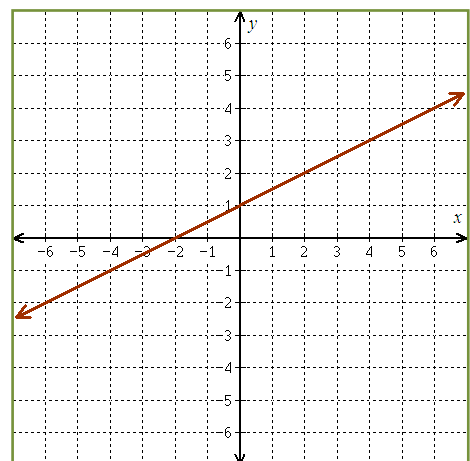
The zero of  $k$  is  $\underline{\hspace{2cm}}$ .

The slope of the line is  $\underline{\hspace{2cm}}$ .

The y-intercept of the line is  $\underline{\hspace{2cm}}$ .

**Example 6**

What is the formula for the function  $k$  in Figure 2? Use that formula to find the function value at  $-1$ ,  $0$ ,  $3$ , and  $4$ .



**Figure2:**  $y = k(x)$

**Example 7**

Determine each of the following about the function  $g(x) = x^2 - 4x - 5$ .

What is the value of  $g$  at  $-1$ ?

What is the value of  $g(0)$ .

What is the function value at  $0$ ?

What are the zeros of  $g$ ?

What are the solutions to the equation  $g(x) = -9$ ?

**Example 8**

Find  $f(3)$ ,  $f(-5)$ ,  $f(x)$ ,  $f(x+4)$ , and  $f(x)+4$  if  $f(t) = t^2 + 6$ .

**Example 9**

Find  $g(-2)$ ,  $g(17)$ ,  $g(t)$ ,  $g(t)-7$ , and  $g(t-7)$  if  $g(x) = 4 - 3x$ .

**Example 10**

Find  $f(3)$ ,  $f(-1)$ ,  $f(x) + 9$ , and  $f(x + 9)$  if  $f(x) = x^2 + x$ .

**Example 11**

Find  $w(0)$ ,  $w(19)$ ,  $w(t - 2)$ , and  $w(t) - 2$  if  $w(t) = 3t - 20$ .

**Example 12**

Find the formula for the linear function  $j$  if you know that  $j(-2)=1$  and  $j(1)=-8$ . (Use  $x$  as the independent variable.)

**Example 13**

Find the value of  $h$  at 7 where  $h$  is the linear function with  $h(9)=19$  and  $h(-1)=4$ . (Use  $x$  as the independent variable.)



**Example 14**

Determine where the value of the linear function  $f$  is 12 if  $f(3)=1$  and  $f(-14)=18$ . (Use  $t$  as the independent variable.)

**Example 15**

Find the value of  $g$  at 11 where  $g$  is the linear function with  $g(5)=6$  and  $g(1)=6$ . (Use  $t$  as the independent variable.)

**Example 16**

Dieter made 50 slingshots that he is selling from a booth he set up on his front lawn. The amount of profit Dieter makes if he sells  $x$  slingshots is given by the function  $P(x) = 3x - 18$ . Answer each of the following questions about Dieter's profit function.

What is the contextual domain of the function?

What is the function value at 15 and what does it tell you in the context of the problem?

What is the horizontal intercept of the profit function and what does it tell you in the context of the problem?

What is the vertical intercept of the profit function and what does it tell you in the context of the problem?

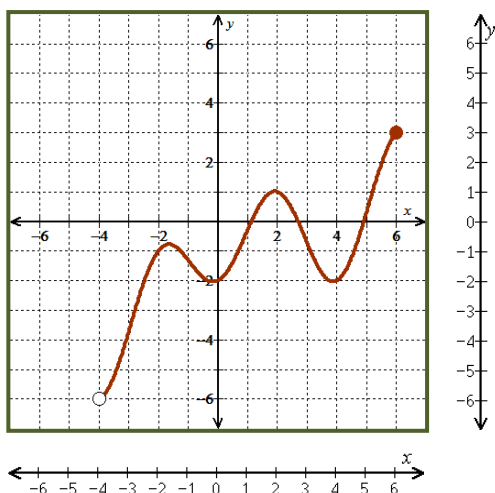
What is the slope of the profit function and what does it tell you in the context of the problem?

**Domain and Range**

If the set of ordered pairs,  $\{(x, y)\}$  is a function, then the set of all of the  $x$ -coordinates is called **the domain** of the function and the set of all of the  $y$ -coordinates is called **the range** of the function.

**Example 17**

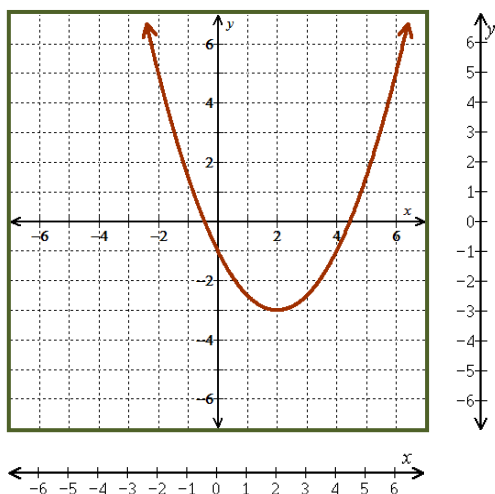
Consider the set of points on each of the following curves. For each relation, indicate whether or not the relation is also a function. Also state the domain and range of each relation using interval notation



Function? \_\_\_\_\_

Domain \_\_\_\_\_

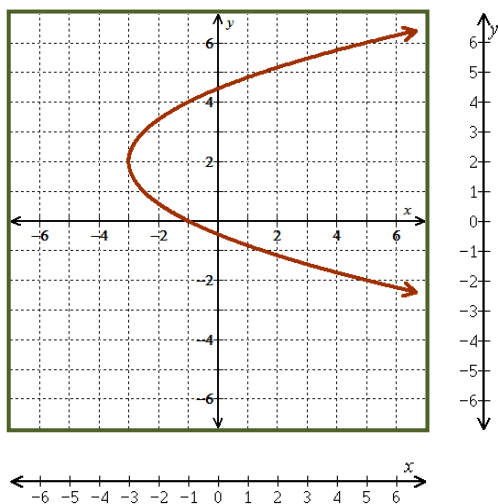
Range \_\_\_\_\_



Function? \_\_\_\_\_

Domain \_\_\_\_\_

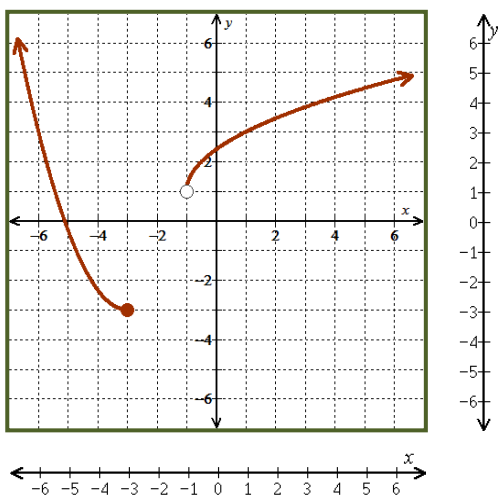
Range \_\_\_\_\_



Function? \_\_\_\_\_

Domain \_\_\_\_\_

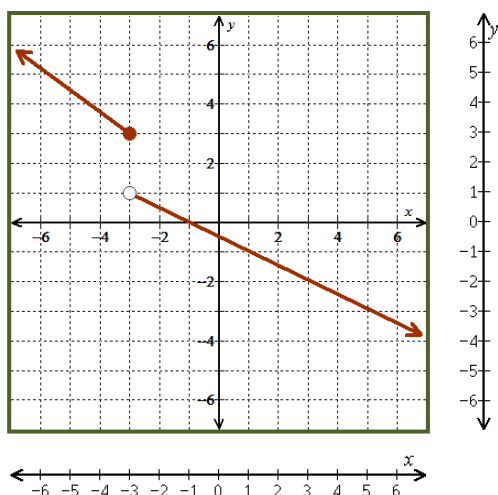
Range \_\_\_\_\_



Function? \_\_\_\_\_

Domain \_\_\_\_\_

Range \_\_\_\_\_



Function? \_\_\_\_\_

Domain \_\_\_\_\_

Range \_\_\_\_\_