

Function is an expression it contains letters and numbers separated by the + and - operators

Eg) A linear expression

$$\rightarrow ax+by+c=0$$

$$\rightarrow y=mx+c$$

↓

$$f(x)=ax+b, a \text{ and } b \in \mathbb{Z}$$

you will be given a value of  $x$   
sub the value in to the  $x$  part of the  
function to find the  $y$  value

Q1 find  $f(3)$  when  $f(x)=3x+1$  Use brackets when you substitute

$$f(3)=3(3)+1$$

$$= 10$$

$$x=3, y=10 \text{ Point } (3,10) \text{ Couple}$$

### Function words

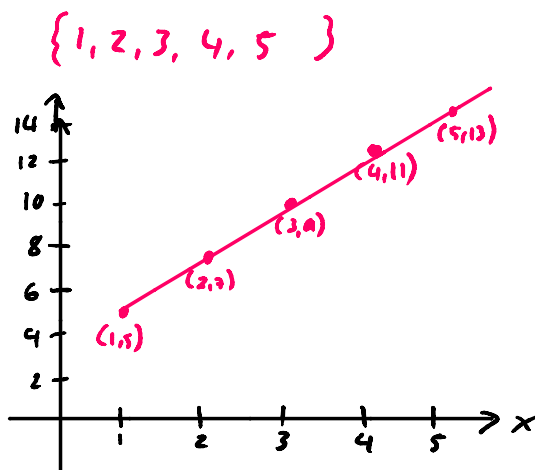
$x$  values Input values  $\rightarrow$  Domain

$y$  value Output values  $\rightarrow$  Range

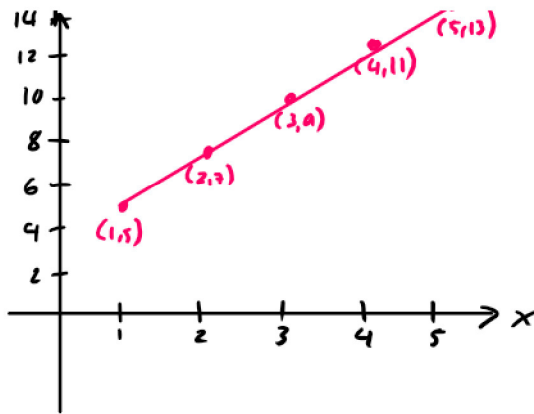
$(x,y)$  Point  $\rightarrow$  Couple.

Eg1)  $f(x)=2x+3$  is a function, graph the function in the domain  $1 \leq x \leq 5$ .

Domain $x$	Range $y$	Couple $(x,y)$
1	$2(1)+3=5$	$(1,5)$
2	$2(2)+3=7$	$(2,7)$
3	$2(3)+3=9$	$(3,9)$
4	$2(4)+3=11$	$(4,11)$
5	$2(5)+3=13$	$(5,13)$



Domain x	Range y	Couple (x, y)
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5	$2(5)+3=13$	(5, 13)



Note: When a value is in the bracket  
Replace the x value in the function.

Eg)  $f(x) = 2x - 3$  find

H/w

H/w

1)  $f(1)$

$$\begin{aligned} &2(1) - 3 \\ &= -1 \\ f(1) &= -1 \\ &(1, -1) \end{aligned}$$

2)  $f(0)$

$$\begin{aligned} &2(0) - 3 \\ &= -3 \\ f(0) &= -3 \\ &(0, -3) \end{aligned}$$

3)  $f(-1)$

$$\begin{aligned} &2(-1) - 3 \\ &= -2 - 3 \\ &= -5 \\ f(-1) &= -5 \\ &(-1, -5) \end{aligned}$$

4)  $f(-3)$

$$\begin{aligned} &2(-3) - 3 \\ &= -6 - 3 \\ &= -9 \\ f(-3) &= -9 \\ &(-3, -9) \end{aligned}$$

When the function is equal to a value  
i.e.  $f(x) = 2$ , you will be asked to find x  
Therefore

Recall:  $f(x) = y$   $\therefore$  the value of y is 2

Method:

- 1) Put the given function equal to the given value
- 2) Use stabilizers and solve for x.

Eg 1) Solve the equation when  ~~$g(x) = x + 2$~~

Eg 1) Solve the equation when  $g(x) = (x+2)$   
and  $g(x) = 3$

we need to find  $x$

$$g(x) = 3$$

↓

$$\begin{array}{l|l} \cancel{-2} & \cancel{x+2} = 3 \\ & x = 1 \end{array} \quad | -2$$

Remember there is only two ways these function questions can be asked

- ① The value of  $x$  is in the bracket - replace the  $x$  value in the function with the given value of  $x$  and find  $y$ .
- ② The function is equal to a value - you need to put the function equal to the given value and solve to find  $x$ .

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## Section 19.3 Notation for functions

Linear Equation:  $ax+by=c$  or  $ax+by+c=0$  or  $y=mx+c$

$$f(x) = y$$

Domain  $\rightarrow$   $x$  values inputs }  $(x,y)$  = Couple  
 Range  $\rightarrow$   $y$  values outputs } <sup>Point</sup>

HIW Pg 389/390 Q2-5

### Example 1

The functions  $f$  and  $g$  are defined on  $R$  such that

$$f: x \rightarrow x + 5 \quad \text{and} \quad g: x \rightarrow x^2 - 1.$$

Find (i)  $f(3)$  (ii)  $g(-3)$  (iii)  $f(2k)$  (iv)  $f(k+1)$  (v)  $g(3k)$  (vi)  $g(k+1)$

### Example 2

A function is defined by  $f: x \rightarrow 4x - 5$ .

- (i) Find  $f(3)$
- (ii) Find the value of  $k$  for which  $kf(3) = f(10)$ .

### Exercise 19.3 Pg 389

1. If  $f(x) = 2x - 3$ , find

(i)  $f(1)$

(ii)  $f(0)$

(iii)  $f(2)$

(iv)  $f(-1)$

(v)  $f(-3)$ .

2. If  $f(x) = 4x - 5$ , find

(i)  $f(2)$   $4(2) - 5 \Rightarrow 8 - 5 = 3$   $f(2) = 3$  (2,3)

(ii)  $f(0)$   $4(0) - 5 \Rightarrow 0 - 5 = -5$

(iii)  $f(-3)$   $4(-3) - 5 \Rightarrow -12 - 5 = -17$

(iv)  $f(\frac{1}{2})$   $4(\frac{1}{2}) - 5 = 2 - 5 = -3$

(v)  $f(\frac{1}{4})$ .  $4(\frac{1}{4}) - 5 = 1 - 5 = -4$

3. If  $f(x) = x^2 - 3$ , find

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

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

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

(iv)  $f(-2)$   $(-2)^2 - 3$   $-2 \times -2 = +4 - 3 = 1$

(v)  $f(-4)$ .  $(-4)^2 - 3 = 16 - 3 = 13$

4. If  $f(x) = 5 - 2x$ , find

(i)  $f(0) \Rightarrow 5 - 2(0) = 5$

(ii)  $f(2) \Rightarrow 5 - 2(2) = 5 - 4 = 1$

(iii)  $f(-3) \Rightarrow 5 - 2(-3) \Rightarrow 5 + 6 = 11$

(iv)  $f(-\frac{1}{2}) \Rightarrow 5 - 2(-\frac{1}{2}) = 5 + 1 = 6$

(v)  $f(k) \Rightarrow 5 - 2(k) = 5 - 2k$

5. If  $f(x) = 5x - 2$ , solve the following equations:

(i)  $f(x) = 8$

$$\begin{aligned} &\downarrow \\ &5x - 2 = 8 \\ +2 \quad | \quad 5x = 10 \quad | \quad +2 \\ \div 5 \quad | \quad x = 2 \quad | \quad \div 5 \end{aligned}$$

$$\begin{aligned} &5(2) - 2 \\ &= 8 \end{aligned}$$

(ii)  $f(x) = 3$

$$\begin{aligned} &\downarrow \\ &5x - 2 = 3 \\ +2 \quad | \quad 5x = 5 \quad | \quad +2 \\ \div 5 \quad | \quad x = 1 \quad | \quad \div 5 \end{aligned}$$

(iii)  $f(k) = -12$

$$\begin{aligned} &\downarrow \\ &5(k) - 2 = -12 \\ 5k - 2 = -12 \\ +2 \quad | \quad 5k = -10 \quad | \quad +2 \\ \div 5 \quad | \quad k = -2 \quad | \quad \div 5 \end{aligned}$$

6. If  $f(x) = 3x - 2$  and  $g(x) = 2 - 4x$ , solve these equations:

(i)  $f(x) = 4$

$$\begin{aligned} &\downarrow \\ &3x - 2 = 4 \\ +2 \quad | \quad 3x = 6 \quad | \quad +2 \\ \div 3 \quad | \quad x = 2 \quad | \quad \div 3 \end{aligned}$$

(ii)  $g(x) = -10$

$$\begin{aligned} &\downarrow \\ &2 - 4x = -10 \\ -2 \quad | \quad -4x = -12 \quad | \quad -2 \\ \div -4 \quad | \quad x = 3 \quad | \quad \div -4 \end{aligned}$$

(iii)  $g(x) = f(4)$

$$\begin{aligned} &\downarrow \\ &2 - 4x = 3(4) - 2 \\ &2 - 4x = 12 - 2 \\ &2 - 4x = 10 \\ -2 \quad | \quad -4x = 8 \quad | \quad -2 \\ \div -4 \quad | \quad x = -2 \quad | \quad \div -4 \end{aligned}$$

HW Pg 390 Q7, 9.

7. Given  $f(x) = 5x - 1$ , find

(i)  $f(-3)$

(ii)  $f\left(\frac{1}{5}\right)$

(iii)  $f(k)$

(iv)  $f(2k)$

(v)  $f(2k - 1)$ .

8. Pg 390 Q6,7  
The function  $f$  is defined as  $f: x \rightarrow 2 - 3x$ .  
Find the value of the number  $k$  if  $kf(3) = 7f(2)$ .

$$k(2 - 3(3)) = 7(2 - 3(2))$$

$$k(2 - 9) = 7(2 - 6)$$

$$k(-7) = 7(-4)$$

$$-7k = -28$$

$$\therefore k = 4$$

9. If  $f(x) = 2x - 3$  and  $g(x) = 3 - 5x$ , solve these equations:

(i)  $f(x) = 7$

(ii)  $g(x) = -7$

(iii)  $f(x) = g(-3)$ .

**10.** A function is defined by  $f: x \rightarrow 5x - 7$ .

- (i) Find  $f(4)$ .                      (ii) Find the value of  $k$  for which  $f(-3) = kf(3)$ .

**11.** The function  $f$  is defined by  $f: x \rightarrow 3x - 4$ .

For what value of  $k$  is  $f(k) + f(2k) = 0$ ?

**12.**  $f: x \rightarrow 4x$  and  $g: x \rightarrow x + 1$  define two functions.

If  $g(3) + k[f(3)] = 8$ , find the value of  $k$ .



**13.**  $f: x \rightarrow 2x^2 - 1$  and  $g(x) = x + 2$  define two functions.

Solve these equations:

(i)  $f(x) = 3$

(ii)  $g(x) = f(3)$

(iii)  $f(x) = g(x)$ .

**14.**  $h: x \rightarrow 2x + a$  and  $k: x \rightarrow b - 5x$  are two functions where  $a$  and  $b$  are real numbers.

If  $h(1) = -5$  and  $k(-1) = 4$ , find the value of  $a$  and the value of  $b$ .

**15.** A function  $f(x)$  is defined by  $f(x) = 1 + \frac{2}{x}$ .

(i) Evaluate  $f(-4)$  and  $f\left(\frac{1}{5}\right)$ .

(ii) Find the value of  $x$  for which  $f(x) = 2$ .

(iii) Find the value of  $k$  if  $kf(2) = f\left(\frac{1}{2}\right)$ .

16.  $g(x) = 1 - 4x$  defines a function.
- Find  $g(k + 1)$ .
  - Solve the equation  $g(k + 1) = g(-3)$ .

17. Given that  $f(x) = 2^x$ , find

(i)  $f(4)$

(ii)  $f(-2)$

(iii) the value of  $x$  for which  $f(x) = \frac{\sqrt{2}}{2}$ .

## Answers

### Exercise 19.3

- (i)  $-1$  (ii)  $-3$  (iii)  $1$  (iv)  $-5$  (v)  $-9$
- (i)  $3$  (ii)  $-5$  (iii)  $-17$  (iv)  $-3$  (v)  $-4$
- (i)  $-3$  (ii)  $-2$  (iii)  $1$  (iv)  $1$  (v)  $13$
- (i)  $5$  (ii)  $1$  (iii)  $11$   
(iv)  $6$  (v)  $5 - 2k$
- (i)  $x = 2$  (ii)  $x = 1$  (iii)  $k = -2$
- (i)  $x = 2$  (ii)  $x = 3$  (iii)  $x = -2$
- (i)  $-16$  (ii)  $0$  (iii)  $5k - 1$   
(iv)  $10k - 1$  (v)  $10k - 6$
- $k = 4$
- (i)  $x = 5$  (ii)  $x = 2$  (iii)  $x = \frac{21}{2}$   
(ii)  $k = \frac{-11}{4}$
- (i)  $13$
- $k = \frac{8}{9}$
- $k = \frac{1}{3}$
- (i)  $x = \pm\sqrt{2}$  (ii)  $x = 15$   
(iii)  $x = -1, \frac{3}{2}$
- $a = -7, b = -1$
- (i)  $\frac{1}{2}, 11$  (ii)  $2$  (iii)  $\frac{5}{2}$
- (i)  $-4k - 3$  (ii)  $k = -4$
- (i)  $16$  (ii)  $\frac{1}{4}$  (iii)  $-\frac{1}{2}$