

Line  $\rightarrow$  linear equation  $ax+by+c=0$   
 $y=mx+c$

Linear function  $f(x)=ax+b$   
 $f \rightarrow x: ax+b$   
 $y=ax+b$

Sub in a value for  $(x)$  to find the corresponding value for  $y$ .  $(x, y)$  point

Point  $\rightarrow (x, y)$  couple

Inputs  $\rightarrow x$  values  $\rightarrow$  Make up the domain  
 Outputs  $\rightarrow y$  values  $\rightarrow$  Make up the range.

To form a function one input can only have one output.  
 A function is not a function if one input has two or more outputs

Codomain  $\rightarrow$  All the possible outputs.

Pg 460 Q2+3

Note : 1) When the value in the bracket is given  
 Replace the value of  $x$  in the function with the value in the bracket. Find  $y$ .  
 2) When the function is equal to a value  
 You put the function equal to value, and solve the equation to find  $x$ .

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Q2  $f(x)=x^2-3$

...

...)

...)

$$Q2 \quad f(x) = x^2 - 3$$

$$i) \quad f(0)$$

$$f(0) = \overset{x}{(0)}^2 - \overset{y}{3}$$

$$= -3$$

$$ii) \quad f(1)$$

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

$$= -2$$

$$iii) \quad f(2)$$

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

$$= 1$$

$$iv) \quad f(-2)$$

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

$$= 1$$

$$f(-4)$$

$$(-4)^2 - 3$$

$$16 - 3$$

$$= 13$$

$$Q3 \quad f(x) = 5x - 2$$

$$f(x) = \overset{y}{8}$$

$$\downarrow$$

$$5x - 2 = 8$$

$$\begin{array}{l|l} +2 & 5x = 10 \\ \hline \div 5 & x = 2 \end{array} \quad \begin{array}{l} +2 \\ \hline \div 5 \end{array}$$

$$f(x) = 3$$

$$\downarrow$$

$$5x - 2 = 3$$

$$\begin{array}{l|l} +2 & 5x = 5 \\ \hline \div 5 & x = 1 \end{array} \quad \begin{array}{l} +2 \\ \hline \div 5 \end{array}$$

$$f(x) = -12$$

$$\downarrow$$

$$5x - 2 = -12$$

$$\begin{array}{l|l} +2 & 5x = -10 \\ \hline \div 5 & x = -2 \end{array} \quad \begin{array}{l} +2 \\ \hline \div 5 \end{array}$$

## Finding unknown coefficients

Sub in the value in the bracket to the x part of the function and put it equal to the value for y.

$$Eg) \quad f(x) = ax - 6$$

If  $f(2) = -2$  find the value of a.

$$a(2) - 6 = -2$$

$$2a - 6 = -2 \quad \text{solve for a}$$

$$\begin{array}{l|l} +6 & 2a = 4 \\ \hline \div 2 & a = 2 \end{array} \quad \begin{array}{l} +6 \\ \hline \div 2 \end{array}$$

$$f(x) = 2x - 6$$

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**PROJECT MATHS**

# Text & Tests

Leaving **3** Certificate

chapter

**16**

**Functions**

**Section 16.3 Finding unknown coefficients**

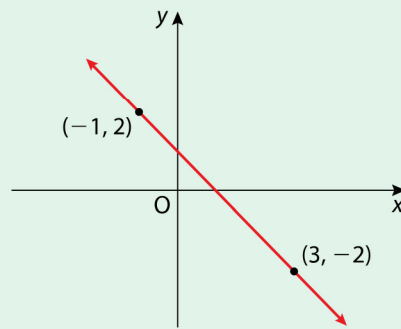
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### Example 1

The given diagram shows part of the graph of the function

$$y = ax + b.$$

Find the values of  $a$  and  $b$ .



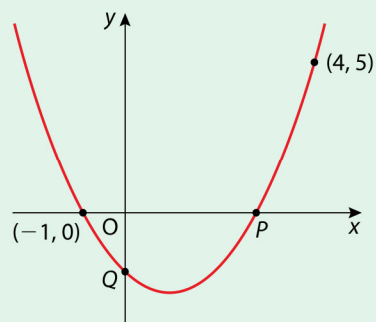
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### Example 2

The graph of the quadratic function  $f(x) = x^2 + bx + c$  is shown.

Find the values of  $b$  and  $c$ .

Hence write down the coordinates of  $P$  and  $Q$ .



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### Exercise 16.3

1.  $f(x) = ax - 6$  defines a function.  
If  $f(2) = -2$ , find the value of  $a$ .

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### Exercise 16.3

2. If  $(1, 5)$  is a couple of the function  $f(x) = kx + 4$ , find the value of  $k$ .

$$\begin{aligned} f(x) &= y \\ f(1) &= 5 \\ 5 &= k(1) + 4 \\ 5 &= k + 4 \\ -4 \quad | \quad 1 &= k \quad | \quad -4 \end{aligned}$$

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### Exercise 16.3

3.  $g(x) = 3x + k$  defines a function.  
If  $g(4) = 10$ , find the value of  $k$ .

$$10 = 3(4) + k$$

$$10 = 12 + k$$

$$\begin{array}{r|l} -12 & -2 = k \\ \hline & \end{array} \quad \begin{array}{l} | \div -12 \end{array}$$

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### Exercise 16.3

4. If  $(-3, 2)$  is a point on the line  $y = kx + 11$ , find the value of  $k$ .

$$\begin{array}{c} \downarrow \\ 2 = k(-3) + 11 \end{array}$$

$$2 = -3k + 11$$

$$\begin{array}{r|l} -11 & -9 = -3k \\ \hline \div -3 & 3 = k \end{array} \quad \begin{array}{l} | \div -3 \end{array}$$

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**Exercise 16.3**

5.  $f(x) = ax^2 + 3$  is a function.

If  $(-1, -1)$  is a couple of this function, find the value of  $a$ .

$$-1 = a(-1)^2 + 3$$

$$-1 = a + 3$$

$$-3 \quad | \quad -4 = a \quad | \quad -3$$

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**Exercise 16.3**

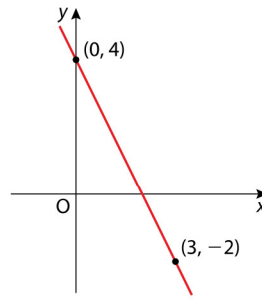
6.  $g(x)$  is a function such that  $g(x) = x^2 - 2x + p$ , where  $p \in \mathbb{R}$ .

If  $(1, 2)$  is a couple of this function, find the value of  $p$ .

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### Exercise 16.3

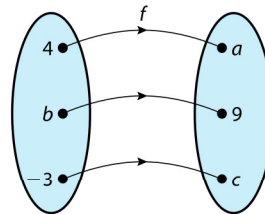
7. The graph of the linear function  $f(x) = ax + b$  is shown.  
Find the values of  $a$  and  $b$ .



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### Exercise 16.3

8. A function  $f$  is defined as  $f: x \rightarrow 2x - 1$ .  
If the mapping diagram on the right represents  $f$ ,  
find the values of  $a$ ,  $b$  and  $c$ .



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Exercise 16.3

Finding coefficients from Quadratics

9.  $g: x \rightarrow ax^2 + bx + 1$  is a function defined on  $\mathbb{R}$ .  
 If  $g(1) = 0$  and  $g(2) = 3$ , write down two equations in  $a$  and  $b$ .  
 Solve these equations to find the values of  $a$  and  $b$ .

① Make two equations from the given information

$$\begin{aligned} g(1) &= 0 \\ a(1)^2 + b(1) + 1 &= 0 \\ a + b + 1 &= 0 \\ a + b &= -1 \end{aligned}$$

$$\begin{aligned} g(2) &= 3 \\ a(2)^2 + b(2) + 1 &= 3 \\ 4a + 2b + 1 &= 3 \\ 4a + 2b &= 2 \end{aligned}$$

Simultaneous Equations

$$\begin{array}{r} a + b = -1 \\ 4a + 2b = 2 \end{array} \quad (-2) \Rightarrow \begin{array}{r} -2a - 2b = -2 \\ 4a + 2b = 2 \\ \hline 2a = 4 \\ a = 2 \end{array}$$

$$\begin{array}{r} a = 2 \Rightarrow a + b = -1 \\ (2) + b = -1 \\ -2 \mid b = -3 \end{array} \quad \left. \begin{array}{l} \\ \\ \end{array} \right\} -2$$

$$g(x) = 2x^2 - 3x + 1$$

C/W Pg 465 Q10.

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Exercise 16.3

10. A function is defined by  $f: x \rightarrow ax^2 + bx + 1$ .  
 If  $f(1) = 0$  and  $f(-1) = 0$ , find the value of  $a$  and the value of  $b$ .

$$\begin{aligned} \textcircled{1} f(1) &= 0 \\ a(1)^2 + b(1) + 1 &= 0 \\ a + b + 1 &= 0 \\ a + b &= -1 \end{aligned}$$

$$\begin{aligned} \textcircled{2} f(-1) &= 0 \\ a(-1)^2 + b(-1) + 1 &= 0 \\ a - b + 1 &= 0 \\ a - b &= -1 \end{aligned}$$

Simultaneous Equations

$$\begin{array}{r} a + b = -1 \\ a - b = -1 \end{array} \quad \begin{array}{r} 2a = -2 \\ a = -1 \end{array}$$

$$\begin{array}{r} a = -1 \Rightarrow a + b = -1 \\ (-1) + b = -1 \\ b = 0 \end{array}$$

$$\begin{aligned} f(x) &= (-1)x^2 + 0(x) + 1 \\ f(x) &= -x^2 + 1 \end{aligned}$$

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Exercise 16.3

11.  $f: x \rightarrow x^2 + px + q$  defines a function.

Given that  $f(3) = 4$  and  $f(-1) = 4$ , find the values of  $p$  and  $q$ .

Using these values for  $p$  and  $q$ , solve the equation  $x^2 + px + q = 0$ .

$$\textcircled{1} f(3) = 4$$

$$(3)^2 + p(3) + q = 4$$

$$9 + 3p + q = 4$$

$$-9 \quad | \quad 3p + q = -5 \quad | \quad -q$$

$$\textcircled{2} f(-1) = 4$$

$$(-1)^2 + p(-1) + q = 4$$

$$1 - p + q = 4$$

$$-1 \quad | \quad -p + q = 3 \quad | \quad -1$$

S.E

$$\begin{array}{r} 3p + q = -5 \\ -p + q = 3 \end{array}$$

(-1)

$\Rightarrow$

$$-3p \quad -q = 5$$

$$-p \quad +q = 3$$

$$\begin{array}{r} -3p \quad -q = 5 \\ -p \quad +q = 3 \\ \hline -4p \quad = 8 \\ p = -2 \end{array}$$

$$p = -2 \Rightarrow$$

$$3p + q = -5$$

$$3(-2) + q = -5$$

$$-6 + q = -5$$

$$+6 \quad | \quad q = +1 \quad | \quad +6$$

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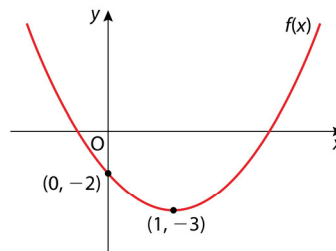
Exercise 16.3

12. The diagram shows part of the graph of the function

$$f: x \rightarrow x^2 + bx + c.$$

The named couples are elements of the function.

- Find the values of  $b$  and  $c$ .
- If  $(2, y)$  is a point on the graph, find the value of  $y$ .



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### Exercise 16.3

13. Functions  $f$  and  $g$  are defined as follows:

$f: x \rightarrow x^2 + 1$  and  $g: x \rightarrow ax + b$ , where  $a$  and  $b$  are constants.

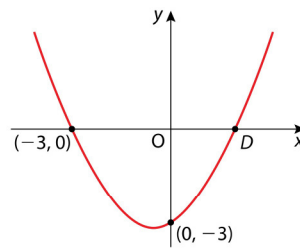
If  $f(0) = g(0)$  and  $g(2) = 15$ , find the values of  $a$  and  $b$ .

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### Exercise 16.3

14. The function  $f(x) = x^2 + bx + c$  is graphed on the right.

- Use the graph to find two equations in  $b$  and  $c$ .
- Solve the equations to find the value of  $b$  and the value of  $c$ .
- Using these values for  $b$  and  $c$ , solve the equation  $x^2 + bx + c = 0$  to find the coordinates of the point  $D$ .



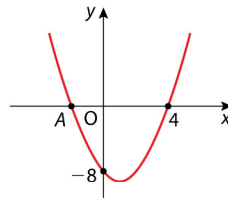
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**Exercise 16.3**

- 15.** The graph of the function  $f(x) = x^2 + kx + p$  is shown on the right.

Use the information given to find the values of  $k$  and  $p$ .

Hence find the coordinates of the point A.



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**Answers 16.3**

- |                                      |              |              |
|--------------------------------------|--------------|--------------|
| <b>1.</b> 2                          | <b>2.</b> 1  | <b>3.</b> -2 |
| <b>4.</b> 3                          | <b>5.</b> -4 | <b>6.</b> 3  |
| <b>7.</b> $a = -2, b = 4$            |              |              |
| <b>8.</b> $a = 7, b = 5, c = -7$     |              |              |
| <b>9.</b> $a = 2, b = -3$            |              |              |
| <b>10.</b> $a = -1, b = 0$           |              |              |
| <b>11.</b> $p = -2, q = 1; x = 1$    |              |              |
| <b>12.</b> (i) $b = -2, c = -2$      |              |              |
| (ii) $y = -2$                        |              |              |
| <b>13.</b> $a = 7, b = 1$            |              |              |
| <b>14.</b> (ii) $b = 2, c = -3$      |              |              |
| (iii) $(1, 0)$                       |              |              |
| <b>15.</b> $k = -2, p = -8; (-2, 0)$ |              |              |