

# 19. [Algebra - Graphs & Functions]

## Skill 19.1 Completing a table of values for a linear function.

MMMauve 1 2 2 3 3 4 4  
MMLime 1 1 2 2 3 3 4 4

- Substitute the variable  $x$  with the given values.
- Find the value of  $y$ .
- Use the order of operations rules: Multiply ( $\times$ ) and/or divide ( $\div$ ) in order from left to right. Add ( $+$ ) and/or subtract ( $-$ ) in order from left to right.
- Use the sign rules:  $++=+$ ,  $--=+$ ,  $+--=-$ ,  $-+-=-$  (see skill 8.3, page 87)

**Q.** Complete this table of values for equation  $y = -4x + 2$

$x$	$y = -4x + 2$	$y$	$(x, y)$
0	$y = -4 \times 0 + 2$	2	(0, 2)
1			

**A.**  $y = -4x + 2$   $\leftarrow 4x = 4 \cdot x$   
 $y = -4 \cdot x + 2$       Substitute  $x = 1$   
 $= -4 \cdot 1 + 2$       Multiply  $-4$  by 1  
 $= -4 + 2$       Add  $-4$  to 2  
 $= -2$

$x$	$y = -4x + 2$	$y$	$(x, y)$
0	$y = -4 \times 0 + 2$	2	(0, 2)
$\Rightarrow$ 1	$y = -4 \times 1 + 2$	-2	(1, -2)

**a)** Complete this table of values for the equation  $y = x - 1$

$x$	$y = x - 1$	$y$	$(x, y)$
0	$y = 0 - 1$	-1	(0, -1)
1	$y = 1 - 1$	0	(1, 0)
2			

**b)** Complete this table of values for the equation  $y = 6x$

$x$	$y = 6x$	$y$	$(x, y)$
0	$y = 6 \times 0$	0	(0, 0)
1			
2			

**c)** Complete this table of values for the linear function  $y = -x - 3$

$x$	$y = -x - 3$	$y$	$(x, y)$
-3	$y = -(-3) - 3$	0	(-3, 0)
-1			
1			
3			
5			

**d)** Complete this table of values for the equation  $y = -4x$

$x$	$y = -4x$	$y$	$(x, y)$
0	$y = -4 \times 0$	0	(0, 0)
0.5			
1			
1.5			
2			

**e)** Complete this table of values for the function  $f(x) = 3x - 4$

$x$	$f(x) = 3x - 4$	$y$	$(x, y)$
-4	$f(-4) = 3 \times (-4) - 4$	-16	(-4, -16)
-2			
0			
2			
4			

**f)** Complete this table of values for the function  $f(x) = -5x + 1$

$x$	$f(x) = -5x + 1$	$y$	$(x, y)$
-2	$f(-2) = -5 \times (-2) + 1$	11	(-2, 11)
-1			
0			
1			
2			

- Substitute the values of the  $x$ -coordinate and the  $y$ -coordinate into each of the given rules.
- Simplify both sides of the equation.
- Check if the statement is true, which means that the point of coordinates  $(x,y)$  lies on the line defined by the equation.

**Q.** On which line does the point  $(1,-2)$  lie?

- A)  $y = x$
- B)  $y = 2x - 3$
- C)  $y = 6x - 8$

**A.** A)  $y = x \Rightarrow -2 = 1$  (false)    Substitute  
 B)  $y = 2x - 3 \Rightarrow -2 = 2 \cdot 1 - 3$      $x = 1$  and  
 $\Rightarrow -2 = -1$  (false)     $y = -2$   
 C)  $y = 6x - 8 \Rightarrow -2 = 6 \cdot 1 - 8$     into each  
 $\Rightarrow -2 = -2$  (true)    rule.

The answer is **C**

**a)** On which line does the point  $(-3,0)$  lie?

- A)  $y = 4x + 3$
- B)  $y = 2 - 2x$
- C)  $y = -x - 3$

Substitute  $x = -3$  and  $y = 0$

A)  $y = 4x + 3 \Rightarrow 0 = 4 \cdot (-3) + 3$   
 $\Rightarrow 0 = -9$  (false)

B)  $y = 2 - 2x \Rightarrow 0 = 2 - 2 \cdot (-3)$   
 $\Rightarrow 0 = 8$  (false)

C)  $y = -x - 3 \Rightarrow 0 = -(-3) - 3$   
 $\Rightarrow 0 = 0$  (true)

**b)** On which line does the point  $(-1,7)$  lie?

- A)  $y = -x - 7$
- B)  $y = -2x + 5$
- C)  $y = 7x$

A)  $y = -x - 7 \Rightarrow$   
 $\Rightarrow$

B)  $y = -2x + 5 \Rightarrow$   
 $\Rightarrow$

C)  $y = 7x \Rightarrow$   
 $\Rightarrow$

**c)** On which line does the point  $(2,-1)$  lie?

- A)  $y = x + 1$
- B)  $y = 5 - 3x$
- C)  $y = 2x$

A)  $y = x + 1 \Rightarrow$   
 $\Rightarrow$

B)  $y = 5 - 3x \Rightarrow$   
 $\Rightarrow$

C)  $y = 2x \Rightarrow$   
 $\Rightarrow$

**d)** On which line does the point  $(-1,1)$  lie?

- A)  $y = -3x$
- B)  $y = 7 - 4x$
- C)  $y = 5x + 6$

A)  $y = -3x \Rightarrow$   
 $\Rightarrow$

B)  $y = 7 - 4x \Rightarrow$   
 $\Rightarrow$

C)  $y = 5x + 6 \Rightarrow$   
 $\Rightarrow$

**Skill 19.3** Graphing vertical and horizontal lines on a coordinate plane  
(e.g.  $x = 1$ ,  $y = 2$ ).

- Complete the table of values. (see skill 19.1, page 198)
- Graph each point on the coordinate plane.
- Draw the line that joins these points.
- Label the line with the rule.

*Hints: The graph of the equation  $x = \text{constant}$  is a vertical line.  
The graph of the equation  $y = \text{constant}$  is a horizontal line.*

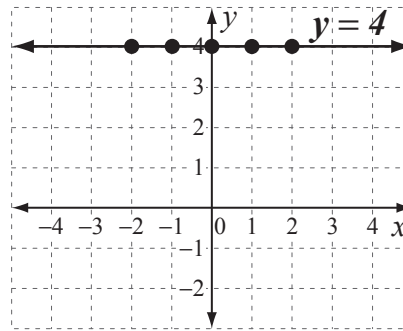
**Q.** Graph the line of equation  $y = 4$  by first completing this table of values.

$x$	-2	-1	0	1	2
$y$	4				
$(x,y)$	(-2,4)	( , )	( , )	( , )	( , )

**A.**

$x$	-2	-1	0	1	2
$y$	4	4	4	4	4
$(x,y)$	(-2,4)	(-1,4)	(0,4)	(1,4)	(2,4)

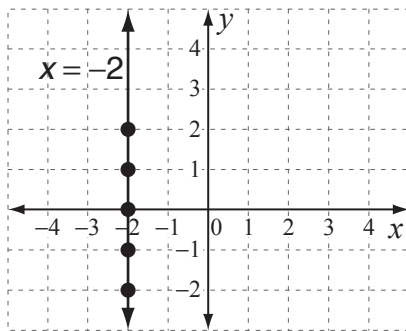
$y = 4$ , no matter the value of  $x$ .



Graph the points.  
Join the points with a line.

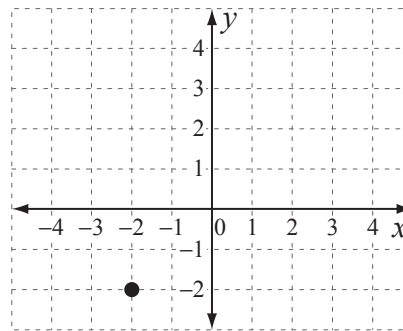
**a)** Graph the line of equation  $x = -2$  by first completing this table of values.

$x$	-2	-2	-2	-2	-2
$y$	-2	-1	0	1	2
$(x,y)$	(-2,-2)	(-2,-1)	(-2, 0)	(-2, 1)	(-2, 2)



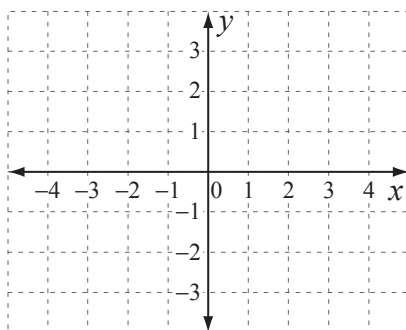
**b)** Graph the line of equation  $y = -2$  by first completing this table of values.

$x$	-2	-1	0	1	2
$y$	-2				
$(x,y)$	(-2,-2)	( , )	( , )	( , )	( , )



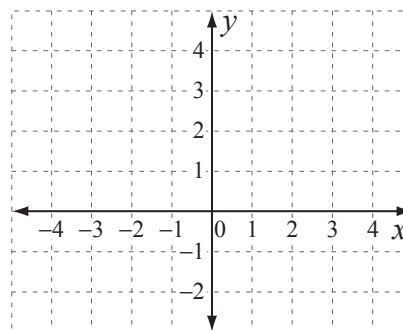
**c)** Graph the function  $f(x) = -3$  by first completing this table of values.

$x$	-2	-1	0	1	2
$f(x)$	-3				



**d)** Graph the function  $x = 3$  by first completing this table of values.

$x$	3				
$y$	-2	-1	0	1	2

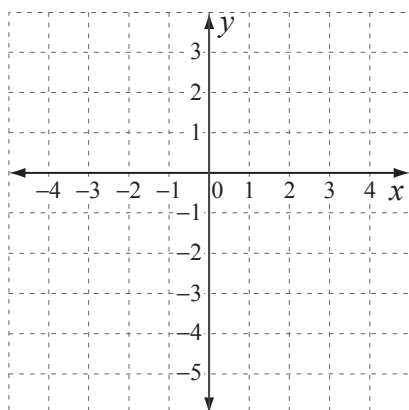


**Skill 19.4** Graphing linear equations on a coordinate plane, by first completing a table of values (1).

- Complete the table of values for the equation. (see skill 19.1, page 198)
- Graph each point on the coordinate plane.
- Draw the line that joins these points.
- Label the line with the equation.

**Q.** Graph the line of the equation  $y = -2x - 1$  by first completing this table of values.

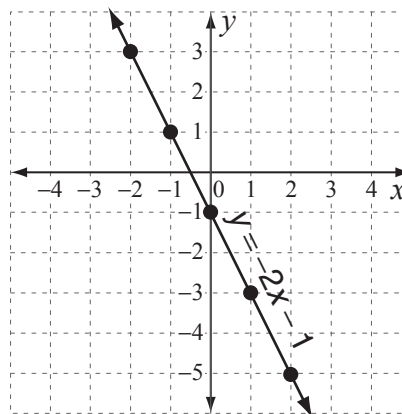
$x$	-2	-1	0	1	2
$y$	3				
$(x,y)$	(-2,3)	( , )	( , )	( , )	( , )



**A.**  $y = -2x - 1 = -2 \cdot x - 1$   $\leftarrow 2x = 2 \cdot x$   
 $x = -1 \Rightarrow y = -2 \cdot (-1) - 1 = 1 \Rightarrow (-1, 1)$   
 $x = 0 \Rightarrow y = -2 \cdot 0 - 1 = -1 \Rightarrow (0, -1)$   
 $x = 1 \Rightarrow y = -2 \cdot 1 - 1 = -3 \Rightarrow (1, -3)$   
 $x = 2 \Rightarrow y = -2 \cdot 2 - 1 = -5 \Rightarrow (2, -5)$

$x$	-2	-1	0	1	2
$y$	3	1	-1	-3	-5
$(x,y)$	(-2,3)	(-1,1)	(0,-1)	(1,-3)	(2,-5)

Complete the table of values.

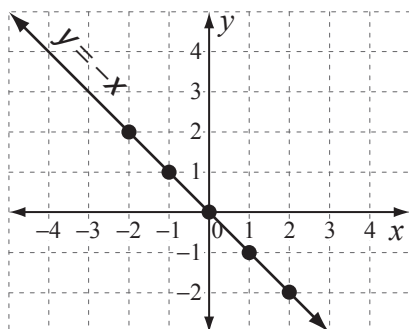


Graph the points.  
Join the points with a line.  
Label the line with the equation  $y = -2x - 1$

**a)** Graph the line of the equation  $y = -x$  by first completing this table of values.

$x = -1 \Rightarrow y = -(-1) = 1 \Rightarrow (-1, 1)$   
 $x = 0 \Rightarrow y = -0 = 0 \Rightarrow (0, 0)$   
 $x = 1 \Rightarrow y = -1 \Rightarrow (1, -1)$   
 $x = 2 \Rightarrow y = -2 \Rightarrow (2, -2)$

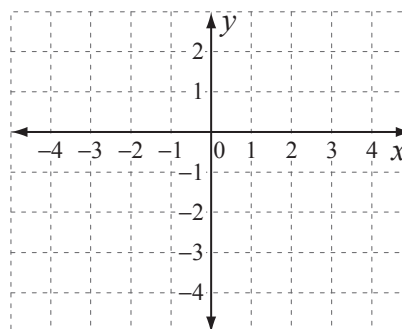
$x$	-2	-1	0	1	2
$y$	2	1	0	-1	-2
$(x,y)$	(-2,2)	(-1, 1)	(0, 0)	(1, -1)	(2, -2)



**b)** Graph the line of the equation  $y = x - 4$  by first completing this table of values.

$x = 1 \Rightarrow y = 1 - 4 = -3 \Rightarrow (1, -3)$   
 $x = 2 \Rightarrow y = \quad \Rightarrow$   
 $x = 3 \Rightarrow y = \quad \Rightarrow$   
 $x = 4 \Rightarrow y = \quad \Rightarrow$

$x$	0	1	2	3	4
$y$	-4				
$(x,y)$	(0,-4)	( , )	( , )	( , )	( , )



### Skill 19.4 Graphing linear equations on a coordinate plane, by first completing a table of values (2).

- c) Graph the line of the equation  $y = 2x$  by first completing this table of values.

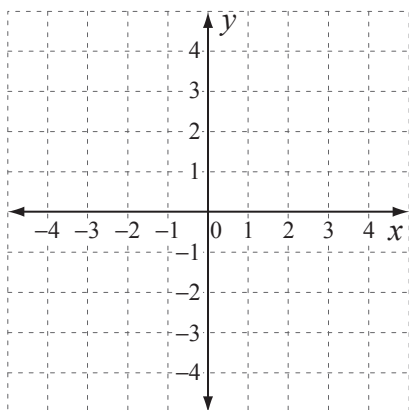
$$x = -1 \Rightarrow y = 2 \times -1 = -2 \Rightarrow (-1, -2)$$

$$x = 0 \Rightarrow y = \quad \Rightarrow$$

$$x = 1 \Rightarrow y = \quad \Rightarrow$$

$$x = 2 \Rightarrow y = \quad \Rightarrow$$

$x$	-2	-1	0	1	2
$y$	-4				



- d) Graph the function  $f(x) = -x + 5$  by first completing this table of values.

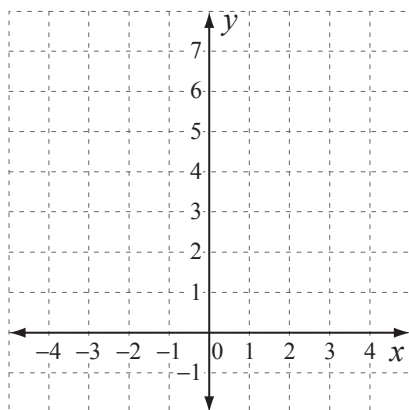
$$x = -1 \Rightarrow f(-1) = -(-1) + 5 = 6 \Rightarrow (-1, 6)$$

$$x = 0 \Rightarrow f(0) = \quad \Rightarrow$$

$$x = 1 \Rightarrow f(1) = \quad \Rightarrow$$

$$x = 2 \Rightarrow f(2) = \quad \Rightarrow$$

$x$	-2	-1	0	1	2
$f(x)$	7				



- e) Graph the function  $f(x) = 3x - 2$  by first completing this table of values.

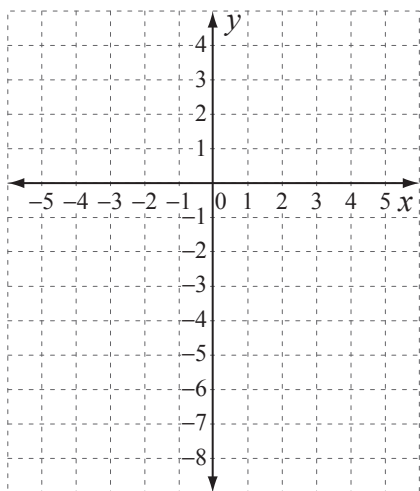
$$x = -1 \Rightarrow f(-1) = 3 \times -1 - 2 = -5 \Rightarrow (-1, -5)$$

$$x = 0 \Rightarrow f(0) = \quad \Rightarrow$$

$$x = 1 \Rightarrow f(1) = \quad \Rightarrow$$

$$x = 2 \Rightarrow f(2) = \quad \Rightarrow$$

$x$	-2	-1	0	1	2
$f(x)$	-8				



- f) Graph the line of the equation  $y = -2x - 3$  by first completing this table of values.

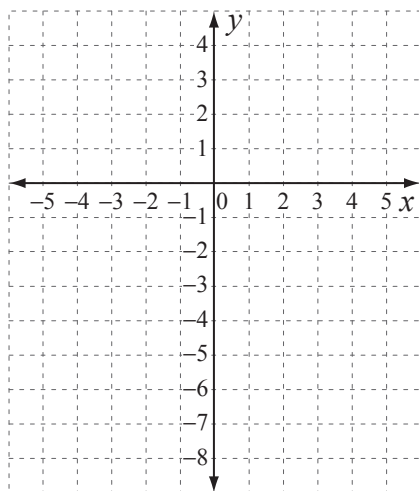
$$x = -1 \Rightarrow y = \quad \Rightarrow$$

$$x = 0 \Rightarrow y = \quad \Rightarrow$$

$$x = 1 \Rightarrow y = \quad \Rightarrow$$

$$x = 2 \Rightarrow y = \quad \Rightarrow$$

$x$	-2	-1	0	1	2
$y$	1				



- To find the  $x$ -intercept, substitute  $y = 0$  into the equation.
- Solve for  $x$ .
- To find the  $y$ -intercept, substitute  $x = 0$  into the equation.
- Solve for  $y$ .

**Q.** Find the  $x$ -intercept and the  $y$ -intercept of the graph defined by the equation  $2x - 5y = 10$

**A.**  $x$ -intercept  $\Rightarrow y = 0$   
 $\Rightarrow 2x - 0 = 10$   
 $2x \div 2 = 10 \div 2$   
 $x = 5$

$x$ -intercept is **(5,0)**

$y$ -intercept  $\Rightarrow x = 0$   
 $\Rightarrow 0 - 5y = 10$   
 $-5y \div (-5) = 10 \div (-5)$   
 $y = -2$

$y$ -intercept is **(0,-2)**

**a)** Find the  $x$ -intercept of the graph defined by the equation  $y = -3x + 6$

$$y = 0 \Rightarrow 0 = -3x + 6$$

$$0 - 6 = -3x + 6 - 6$$

$$-3x = -6$$

$$-3x \div (-3) = -6 \div (-3)$$

$$x = 2 \Rightarrow x\text{-intercept is } \boxed{(2,0)}$$

**b)** Find the  $x$ -intercept of the graph defined by the equation  $y = 2x + 8$

$$y = 0 \Rightarrow$$

$$\Rightarrow x\text{-intercept is } \boxed{\phantom{00}}$$

**c)** Find the  $y$ -intercept of the graph defined by the equation  $y = 7x - 3$

$$x = 0 \Rightarrow y = 0 - 3$$

$$\Rightarrow y = -3 \Rightarrow y\text{-intercept is } \boxed{\phantom{00}}$$

**d)** Find the  $y$ -intercept of the graph defined by the equation  $y = -5x + 4$

$$x = 0 \Rightarrow$$

$$\Rightarrow \Rightarrow y\text{-intercept is } \boxed{\phantom{00}}$$

**e)** Find the  $x$ -intercept of the graph defined by the equation  $3x - 2y = -12$

$$\Rightarrow$$

$$\Rightarrow x\text{-intercept is } \boxed{\phantom{00}}$$

**f)** Find the  $y$ -intercept of the graph defined by the equation  $4y - x = 16$

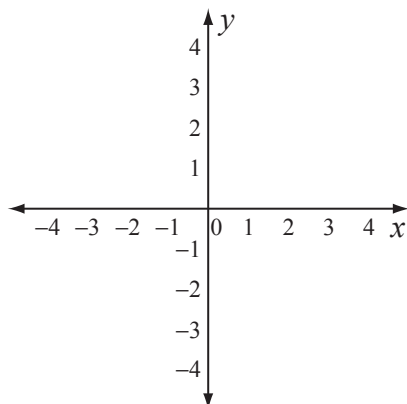
$$\Rightarrow$$

$$\Rightarrow y\text{-intercept is } \boxed{\phantom{00}}$$

**Skill 19.6** Sketching linear equations by finding the  $x$ -intercept and the  $y$ -intercept (1).

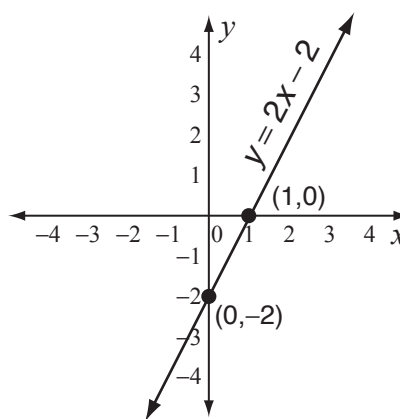
- Find the  $x$ -intercept and the  $y$ -intercept. (see skill 19.5, page 203)
- Mark each intercept point on the coordinate plane.
- Draw the line that joins these points.
- Label the line with the equation.

**Q.** Sketch the line of equation  $y = 2x - 2$  showing the  $x$ -intercept and the  $y$ -intercept.



**A.**  $x$ -intercept  $\Rightarrow y = 0 \Rightarrow 2x - 2 = 0$   
 $2x - 2 + 2 = 0 + 2$   
 $2x + 2 = 2 \div 2$   
 $x = 1$   
 $\Rightarrow x$ -intercept is  $(1, 0)$

$y$ -intercept  $\Rightarrow x = 0 \Rightarrow y = 2 \cdot 0 - 2$   
 $\Rightarrow y = -2$   
 $\Rightarrow y$ -intercept is  $(0, -2)$

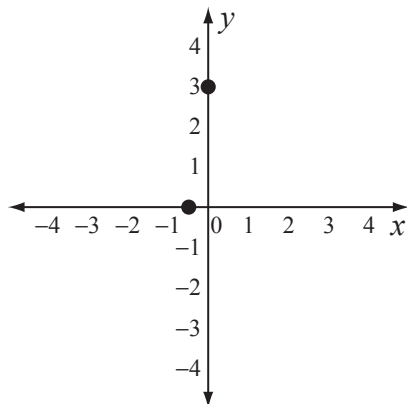


Mark the intercept points.  
 Join these points with a line.  
 Label the line with the equation  $y = 2x - 2$

**a)** Sketch the line of equation  $y = 6x + 3$  showing the  $x$ -intercept and the  $y$ -intercept.

$y = 0 \Rightarrow 6x + 3 = 0 \Rightarrow 6x = -3 \Rightarrow x = -\frac{1}{2}$   
 $\Rightarrow x$ -intercept is  $(-\frac{1}{2}, 0)$

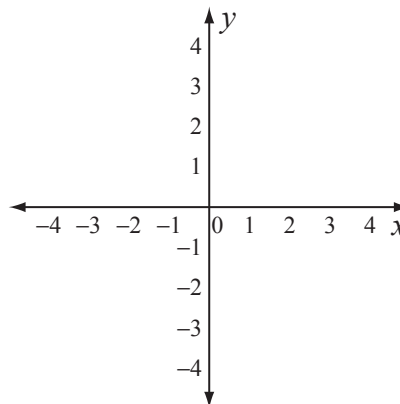
$x = 0 \Rightarrow y = 6 \cdot 0 + 3 \Rightarrow y = 3$   
 $\Rightarrow y$ -intercept is  $(0, 3)$



**b)** Sketch the line of equation  $y = -3x + 4$  showing the  $x$ -intercept and the  $y$ -intercept.

$y = 0 \Rightarrow$   
 $\Rightarrow x$ -intercept is

$x = 0 \Rightarrow$   
 $\Rightarrow y$ -intercept is



### Skill 19.6 Sketching linear equations by finding the $x$ -intercept and the $y$ -intercept (2).

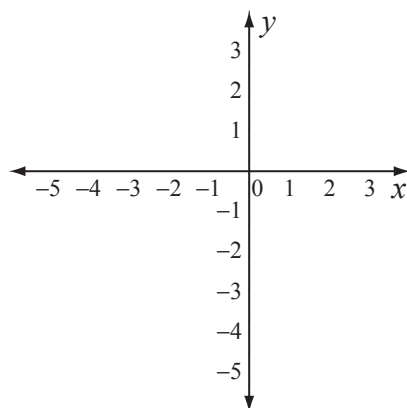
- c) Sketch the line of equation  $y = -x - 5$  showing the  $x$ -intercept and the  $y$ -intercept.

$$y = 0 \Rightarrow$$

$\Rightarrow x$ -intercept is

$$x = 0 \Rightarrow$$

$\Rightarrow y$ -intercept is



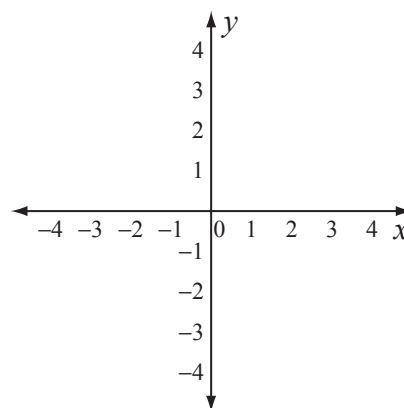
- d) Sketch the line of equation  $y = 9x - 3$  showing the  $x$ -intercept and the  $y$ -intercept.

$$y = 0 \Rightarrow$$

$\Rightarrow x$ -intercept is

$$x = 0 \Rightarrow$$

$\Rightarrow y$ -intercept is



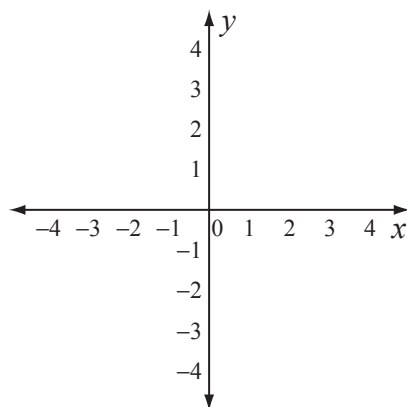
- e) Sketch the line of equation  $y = -4x - 2$  showing the  $x$ -intercept and the  $y$ -intercept.

$$y = 0 \Rightarrow$$

$\Rightarrow x$ -intercept is

$$x = 0 \Rightarrow$$

$\Rightarrow y$ -intercept is



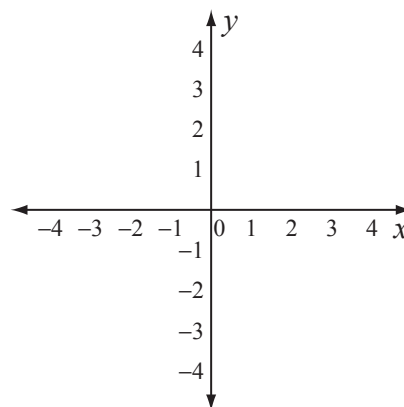
- f) Sketch the line of equation  $y = -2x + 4$  showing the  $x$ -intercept and the  $y$ -intercept.

$$y = 0 \Rightarrow$$

$\Rightarrow x$ -intercept is

$$x = 0 \Rightarrow$$

$\Rightarrow y$ -intercept is



**Skill 19.7** Writing expressions to represent real-life situations (1).

- Find the rate of change over time (per hour, per day, per month, per year, etc.).
- Multiply this rate of change by the total number of units of time.
- Add to or subtract this result from any initial amount.
- Simplify the expression.

If the change is not related to time:

- Find the rate of change between two consecutive units of measurement (length, volume, weight, etc.).
- Multiply this rate of change by the total number of units (length, volume, weight etc.).
- Add to or subtract this result from any initial amount.
- Simplify the expression.

**Q.** An electrician's service fee is \$30 and his hourly rate is \$60. Write a formula for the electrician's fee for  $n$  hours of work.

**A.** *rate of change = \$60 per hour*  
*fee for  $n$  hours =  $60n$*   
*initial fee = 30*  
*total fee =  $60n + 30$*

**a)** The skating rink admission tickets are \$8 for an adult and \$5 for a child. Which expression represents the total cost of admission for 4 adults and 6 children?

- A)  $8 \times (4 + 6)$   
B)  $5 \times (4 + 6)$   
C)  $4 \times 8 + 5 \times 6$

*4 adult tickets =  $\$8 \times 4$*

*6 children tickets =  $\$5 \times 6$*

*total cost =  $4 \times 8 + 6 \times 5 \Rightarrow$*

**c)** Matt has a base salary of \$800 and a commission of \$1250 for every house he sells. Write a formula for Matt's total earnings after selling  $n$  houses.

*rate of change = \$1250 per sale*

*sales for  $n$  houses =  $1250n$*

*base salary = 800*

*total earnings =*

**b)** The starting balance of an account was \$500. If Lewis started to withdraw \$60 every day, which expression represents the closing balance after 14 days?

- A)  $14 \times 60 - 500$   
B)  $500 - 14 \times 60$   
C)  $500 + 14 \times 60$

*rate of change = \$60 per day*

*withdrawals over 14 days =*

*closing balance =*

**d)** Beau drove at an average speed of 50 mph. If the car's odometer showed 55,690 mi when he left home, write a formula for the distance shown after  $n$  hours.

*rate of change =*

*distance for  $n$  hours =*

*initial distance =*

*total distance =*

## Skill 19.7 Writing expressions to represent real-life situations (2).

- e) A cell phone company charges \$30 per month and 15 cents for each call made. Write an expression for the total monthly bill if  $n$  calls were made.

*rate of change* =

.....

*fee for  $n$  calls* =

.....

*monthly fee* =

.....

*total fee* =

.....

- f) The parking fare is \$6 for the first 3 hours and then \$2.50 for every half an hour. Write a formula for the parking charge for  $n$  hours, where  $n \geq 3$ .

*rate of change* =

.....

*fare for first 3 hours* =

.....

*fare for  $(n - 3)$  hours* =

.....

*total fare* =

.....

- g) A scuba diver descended at a rate of 15 ft per minute. Which expression represents the change in depth after 4 minutes?

A)  $-15 \times (-4)$

B)  $15 \times 4$

C)  $-15 \times 4$

*rate of change* =

.....

*depth after 4 minutes* =

.....

*change in depth* =

.....

- h) The temperature drops  $10^\circ\text{C}$  for each 1000 m increase in altitude. Which expression represents the change in temperature at 8000 m altitude?

A)  $-10 \times 8000$

B)  $-10 \times 1000$

C)  $-10 \times 8$

*rate of change* =

.....

*temperature at 8000 m* =

.....

*change in temperature* =

.....

- i) The price of a pizza was \$3.00 and it went up by 25 cents every year. Write a formula for the price of a pizza after  $n$  years.

*rate of change* =

.....

*price after 1st year* =

.....

*price after 2nd year* =

.....

*price after  $n$  years* =

.....

.....

- j) A taxi company charges \$5 for the first mile and \$1.50 for each additional mile. Write an expression for the fare for an  $x$  mile trip.

*rate of change* =

.....

*fare: 1 mile trip* =

.....

*fare: 2 mile trip* =

.....

*fare: 3 mile trip* =

.....

*fare:  $x$  mile trip* =

.....

.....

**Skill 19.8** Interpreting distance-time graphs (1).

**To find the time taken to travel when the distance is given:**

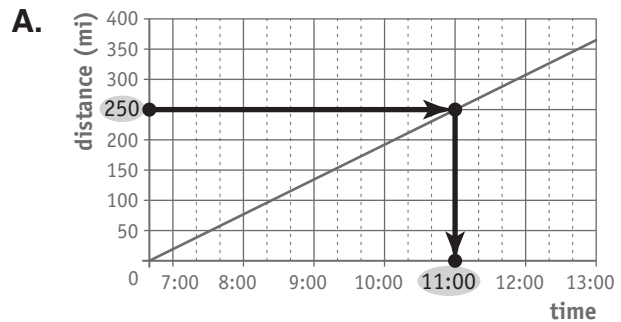
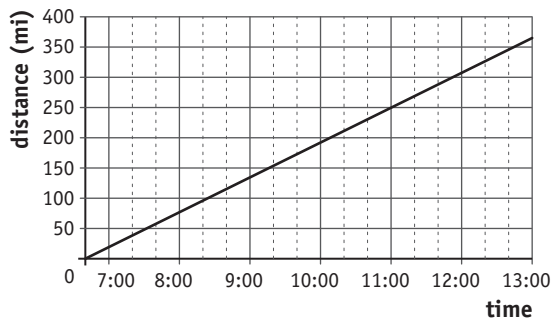
- Locate the point on the vertical axis, marking the given distance.
- Draw a horizontal line through that point.
- Locate the intersection between this horizontal line and the graph.
- Draw a vertical line through the intersection point till it intersects the horizontal axis.
- Mark and read the value of the time on the horizontal axis at the intersection point.

**To find the rate (speed):**

- Locate the numerical values of the distance and time on the axes.
- Divide the distance traveled (vertical rise) by the time taken to travel (horizontal run).

*Hint: The slope of a distance-time graph indicates the speed of the object.*

**Q.** This graph shows the distance Pam traveled between 6:40 A.M. and 1:00 P.M. How long in minutes did the car take to travel 250 miles?



*Pam reached 250 miles at 11:00 A.M.*

*Pam started at 6:40 A.M.*

*time = 4 h 20 min*

**= 260 min**

**a)** This graph shows the distance traveled by a car on a trip. What is the car's speed in miles per hour?

*distance = 150 miles*

*time = 150 min = 2.5 hours*

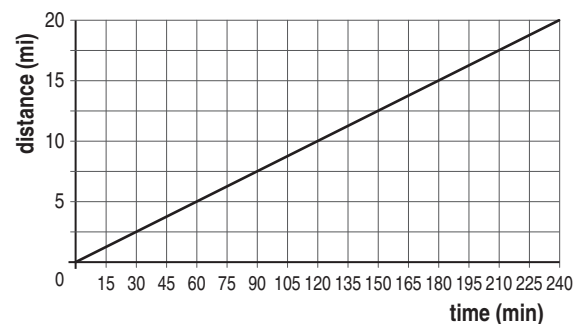
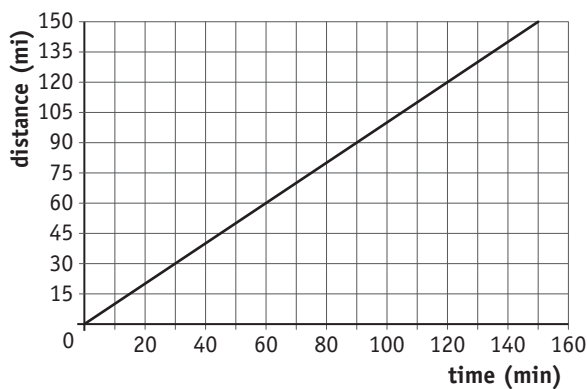
$$\text{rate} = \frac{d}{t} = \frac{150}{2.5} = \boxed{\phantom{000}}$$

**b)** This graph shows the distance run by Sam at constant speed. What is his speed in miles per hour?

*distance =*

*time =*

$$\text{rate} = \frac{\phantom{000}}{\phantom{000}} = \frac{\phantom{000}}{\phantom{000}} = \boxed{\phantom{000}}$$

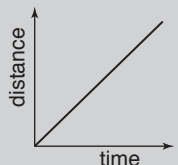


### Skill 19.8 Interpreting distance-time graphs (2).

#### To interpret distance-time graphs:

**Object moving at a constant rate**

It covers the same distance in the same time interval.



**Object not moving**

Time increasing, but distance not changing.



**Object moving at a changing rate**

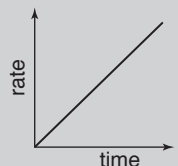
At first it travels at a faster rate and then it travels at a gradually slower rate.



#### To interpret rate-time graphs:

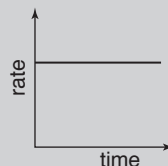
**Object moving at a constant acceleration**

The rate increases by the same amount in the same time interval.



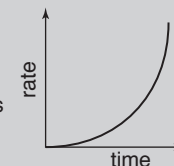
**Object moving at a constant speed**

Time increasing, but rate not changing.



**Object moving at a changing speed**

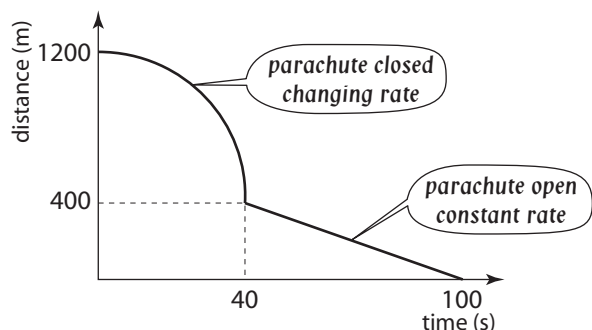
At first the rate increases slowly and then it increases faster.



#### To find the average rate (speed):

- Divide the total distance traveled by the total time taken to travel that distance.

**Q.** This graph shows David's descent when he parachutes from an airplane. At what rate did David descend with his parachute open?



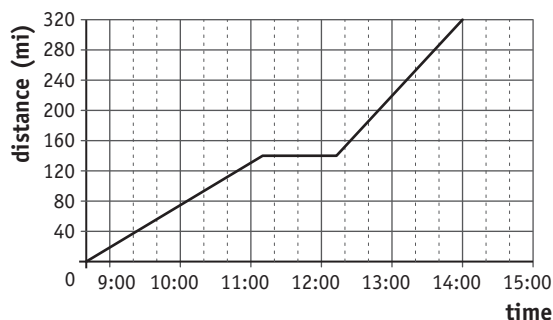
**A.** *parachute closed (curved line)*  
 $distance = 1200 - 400 = 800\text{ m}$   
 $time = 40\text{ s}$   
*parachute open (straight line)*  
 $distance = 400\text{ m}$   
 $time = 100\text{ s} - 40\text{ s} = 60\text{ s}$   
 $\Rightarrow rate = \frac{d}{t} = \frac{400}{60} = \frac{40}{6} = 6.66\text{ m/s}$  (Simplify:  $\div 20$ )

**c)** Mia started her trip at 8:40 A.M. and arrived at the destination at 2:00 P.M. What was her average rate for the trip in miles per hour?

*total distance =* .....

*total time =* .....

*rate =* = =

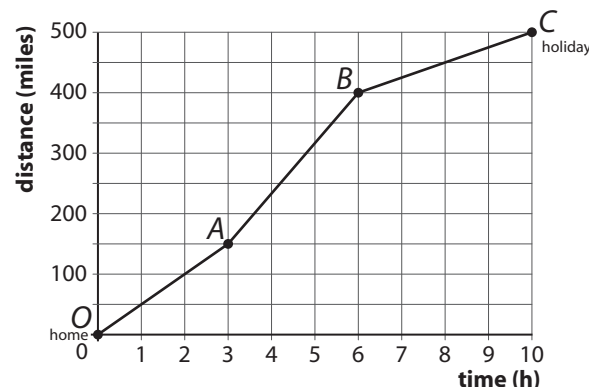


**d)** A family drives to a holiday resort 500 miles away from home. What is the car's average rate between B and C?

*distance =* .....

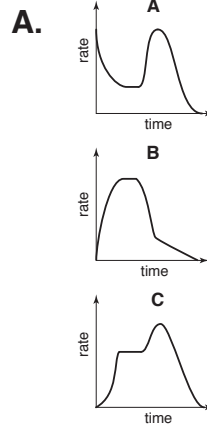
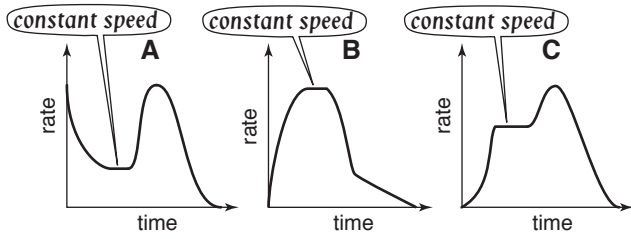
*time =* .....

*rate =* = =



**Skill 19.8** Interpreting distance-time graphs (3).

**Q.** Lucy leaves home driving on a gravel road and travels at a constant speed. She then enters a highway, where she overtakes one vehicle before stopping to refuel the car. Which car shows her trip?



Graph does not start from origin  $\Rightarrow$  trip does not start from rest (false)

Graph does not show an increasing acceleration for entering highway and overtaking (false)

Graph shows all the stages of the trip.

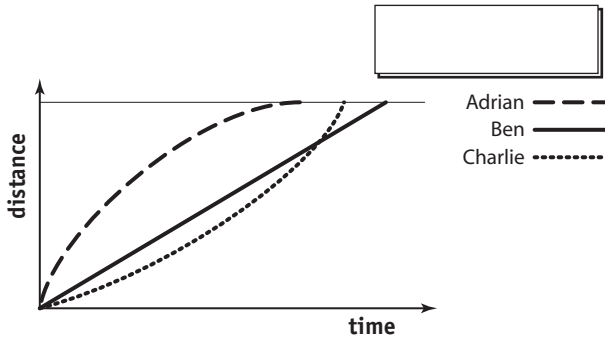
The answer is **C**

**e)** This graph shows a cross country running race between three students. Who came last in the race?

Adrian

Ben

Charlie

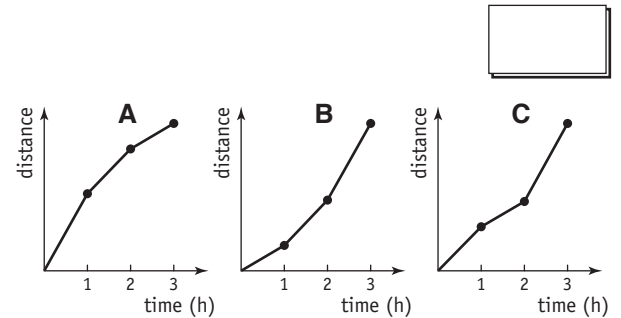


**f)** Buzz rode his bike averaging 6 mph in the first hour, 3 mph in the second hour and 9 mph in the third hour. Which graph shows this?

A

B

C

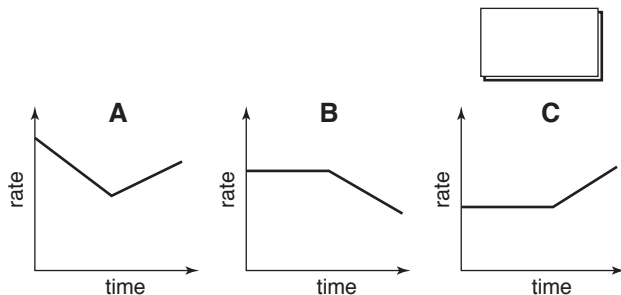


**g)** Franco walks down a mountain at a steady pace. He then carefully picks his way up a rocky face. Which graph shows his walk?

A

B

C

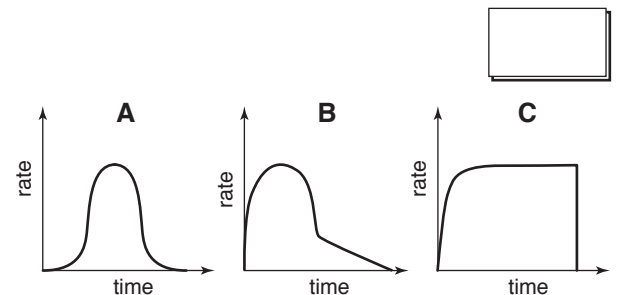


**h)** Tom competed in a one-lap, 25 meter free style swimming race. Which graph shows his swim?

A

B

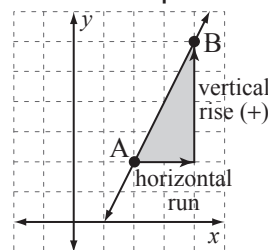
C



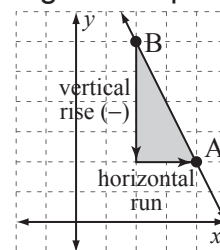
**Skill 19.9** Finding the slope of a linear graph (1).

- Choose two convenient points on the graph and draw a right triangle using the line of the graph as the hypotenuse.
- Measure the vertical rise of the graph (the vertical side of the triangle):
  - positive value if the graph rises from left to right
  - negative value if the graph drops from left to right
- Measure the horizontal run of the graph (the horizontal side of the triangle):
  - always a positive value.
- Substitute these values into the slope formula (divide the vertical rise by the horizontal run).

Positive slope



Negative slope



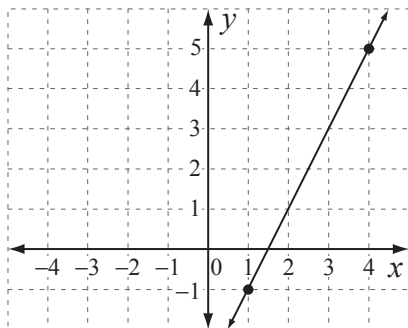
$$\text{Slope} = \frac{\text{vertical rise}}{\text{horizontal run}}$$

*Hints: The slope gives an indication of how steep a line (graph) is.*

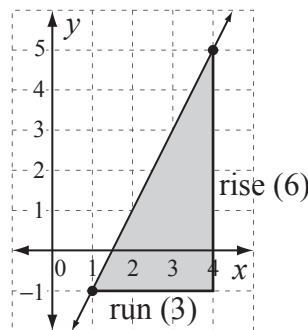
*The slope is positive if the graph rises from left to right.*

*The slope is negative if the graph falls from left to right.*

- Q.** Find the slope of the graph shown below, by measuring the vertical rise and the horizontal run. [Slope =  $\frac{\text{vertical rise}}{\text{horizontal run}}$ ]



**A.**



rise = 6  
run = 3  
slope =  $\frac{\text{rise}}{\text{run}} = \frac{6}{3} = 2$

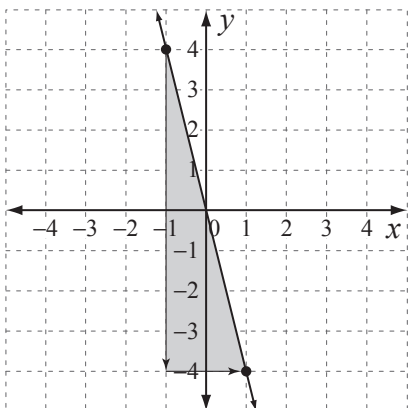
- Draw a right triangle.
- Measure the rise and run.
- Substitute these values into the slope formula.

- a)** Find the slope of the graph shown below, by measuring the vertical rise and the horizontal run. [Slope =  $\frac{\text{vertical rise}}{\text{horizontal run}}$ ]

rise = -8

run = 2

slope =  $\frac{\text{rise}}{\text{run}} = \frac{-8}{2} = \boxed{\phantom{00}}$

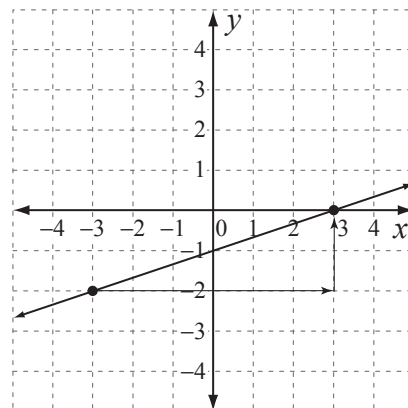


- b)** Find the slope of the graph shown below, by measuring the vertical rise and the horizontal run.

rise =

run =

slope = = =  $\boxed{\phantom{00}}$



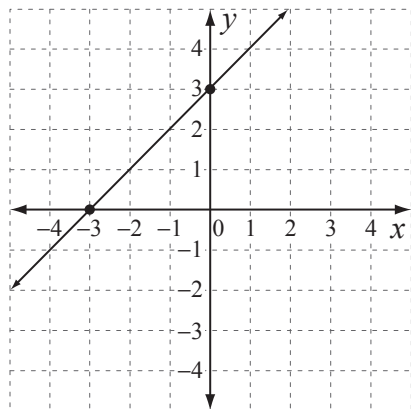
**Skill 19.9** Finding the slope of a linear graph (2).

- c)** Find the slope of the graph shown below, by measuring the vertical rise and the horizontal run.

*rise* = \_\_\_\_\_

*run* = \_\_\_\_\_

*slope* =  $\frac{\text{rise}}{\text{run}}$  = \_\_\_\_\_ =

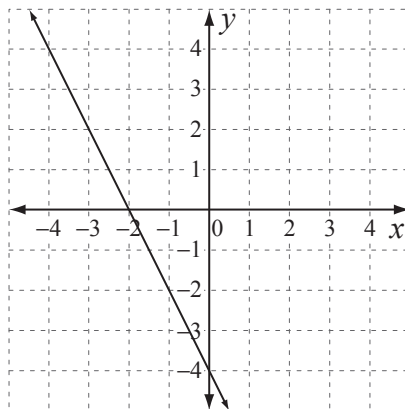


- d)** Find the slope of the graph shown below, by measuring the vertical rise and the horizontal run.

*rise* = \_\_\_\_\_

*run* = \_\_\_\_\_

*slope* = \_\_\_\_\_ = \_\_\_\_\_ =

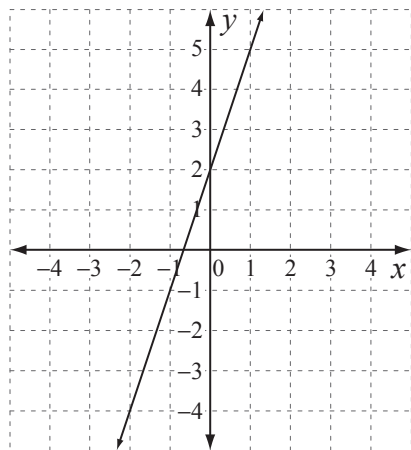


- e)** Find the slope of the graph shown below, by measuring the vertical rise and the horizontal run.

*rise* = \_\_\_\_\_

*run* = \_\_\_\_\_

*slope* = \_\_\_\_\_ = \_\_\_\_\_ =

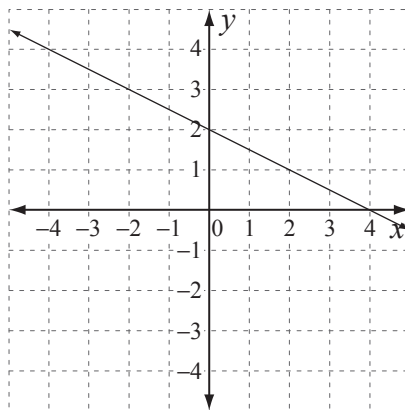


- f)** Find the slope of the graph shown below, by measuring the vertical rise and the horizontal run.

*rise* = \_\_\_\_\_

*run* = \_\_\_\_\_

*slope* = \_\_\_\_\_ = \_\_\_\_\_ =



**Skill 19.10** Finding the slope, the x-intercept and the y-intercept of an equation written in the slope-intercept form  $y = mx + b$  (1).

- Make sure the equation in the table is written in slope-intercept form  $y = mx + b$  (see skill 19.14, page 220)
- Identify the slope ( $m$ ) of the equation as the coefficient of  $x$ .
- Identify the y-intercept of the equation as the constant  $b$ .
- Find the x-intercept of the equation. (see skill 19.5, page 203)
- Fill in the table.

**Q.** Complete the following table:

equation	slope ( $m$ )	x-intercept	y-intercept ( $b$ )
$y = -2x - 10$			

**A.**  $y = -2x - 10$

$$y = -2x + (-10)$$

$$y = mx + b \Rightarrow m = -2 \text{ (slope)}$$

$$\Rightarrow b = -10 \text{ (y-intercept)}$$

y-intercept is  $(0, -10)$

$$x\text{-intercept} \Rightarrow y = 0$$

$$\Rightarrow -2x - 10 = 0$$

$$-2x - 10 + 10 = 0 + 10$$

$$-2x = 10$$

$$\frac{-2x}{-2} = \frac{10}{-2}$$

$$x = -5$$

x-intercept is  $(-5, 0)$

equation	slope ( $m$ )	x-intercept	y-intercept ( $b$ )
$y = -2x - 10$	-2	$(-5, 0)$	$(0, -10)$

**a)** Complete the following table:

equation	slope ( $m$ )	x-intercept	y-intercept ( $b$ )
$y = 2x - 6$	2	$(3, 0)$	$(0, -6)$

$$y = 2x - 6$$

$$y = mx + b \Rightarrow m = 2$$

$$\Rightarrow b = -6 \Rightarrow y\text{-intercept is } (0, -6)$$

$$y = 0 \Rightarrow 2x - 6 = 0$$

$$2x - 6 + 6 = 0 + 6$$

$$2x = 6$$

$$2x \div 2 = 6 \div 2$$

$$x = 3 \Rightarrow x\text{-intercept is } (3, 0)$$

**b)** Complete the following table:

equation	slope ( $m$ )	x-intercept	y-intercept ( $b$ )
$y = -x + 5$			

$$y = -x + 5$$

$$y = mx + b \Rightarrow m =$$

$$\Rightarrow b = \Rightarrow y\text{-intercept is}$$

$$y = 0 \Rightarrow$$

$$\Rightarrow x\text{-intercept is}$$

**Skill 19.10** Finding the slope, the  $x$ -intercept and the  $y$ -intercept of an equation written in the slope-intercept form  $y = mx + b$  (2).

**c)** Complete the following table:

equation	slope ( $m$ )	$x$ -intercept	$y$ -intercept ( $b$ )
$y = \frac{1}{3}x - 2$			

$y = \frac{1}{3}x - 2$

$y = mx + b \Rightarrow m =$

$\Rightarrow b = \Rightarrow y$ -intercept is

$y = 0 \Rightarrow$

$\Rightarrow x$ -intercept is

**d)** Complete the following table:

equation	slope ( $m$ )	$x$ -intercept	$y$ -intercept ( $b$ )
$y = \frac{2}{5}x + 4$			

$y = \frac{2}{5}x + 4$

$y = mx + b \Rightarrow m =$

$\Rightarrow b = \Rightarrow y$ -intercept is

$y = 0 \Rightarrow$

$\Rightarrow x$ -intercept is

**e)** Complete the following table:

equation	slope ( $m$ )	$x$ -intercept	$y$ -intercept ( $b$ )
$y = 5x + 3$			

$y = 5x + 3$

$y = mx + b \Rightarrow m =$

$\Rightarrow b = \Rightarrow y$ -intercept is

$y = 0 \Rightarrow$

$\Rightarrow x$ -intercept is

**f)** Complete the following table:

equation	slope ( $m$ )	$x$ -intercept	$y$ -intercept ( $b$ )
$y = -2x + 1$			

$y = -2x + 1$

$y = mx + b \Rightarrow m =$

$\Rightarrow b = \Rightarrow y$ -intercept is

$y = 0 \Rightarrow$

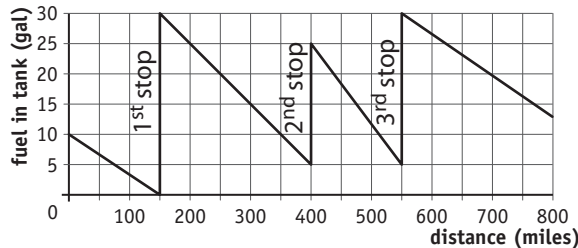
$\Rightarrow x$ -intercept is

**Skill 19.11** Interpreting graphs describing other rates (1).

**To interpret graphs comparing any two changing variables:**

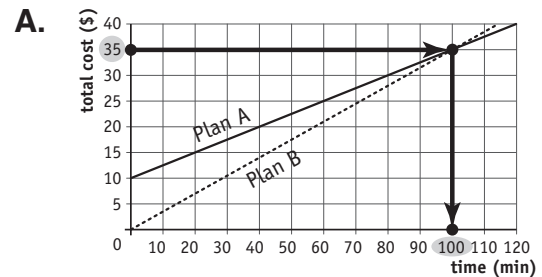
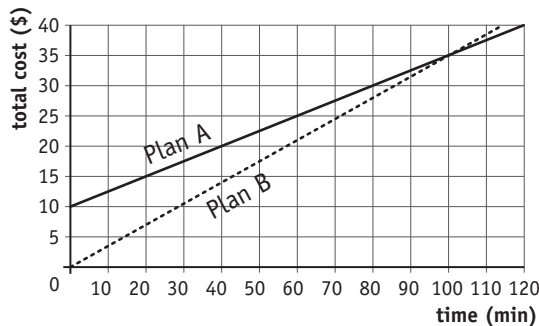
- Locate the points on the vertical and horizontal axes, marking the given and/or requested values.
- Analyse the type of change (increase, decrease, constant) of one variable when the other one is known.

Example: This graph shows the fuel consumption for a truck over an 800 mile journey. After how many miles did the driver make the third stop to buy fuel?



The oblique lines show the fuel consumption. (e.g. in the first 150 mi the truck used 10 gal)  
The vertical lines show the stops for refueling. (e.g. at 400 mi, the truck stopped for the second time and bought 20 gal of fuel)  
The third stop was made after traveling 550 mi.

**Q.** Two cell phone monthly plans are graphed below. What is the difference in cents per minute between the two plans?



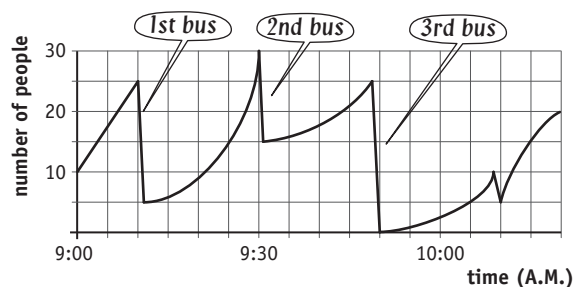
- A) 100 min = \$35, with an initial \$10 fee  
 ⇒ 100 min = \$25  
 ⇒ 1 min = 25 cents
- B) 100 min = \$35, with no initial fee  
 ⇒ 1 min = 35 cents  
 ⇒ Difference between plans = 10 cents/min

**a)** This graph shows the number of people at a bus stop in the morning. How many people caught the third bus?

1<sup>st</sup> bus = 20 people

2<sup>nd</sup> bus = 15 people

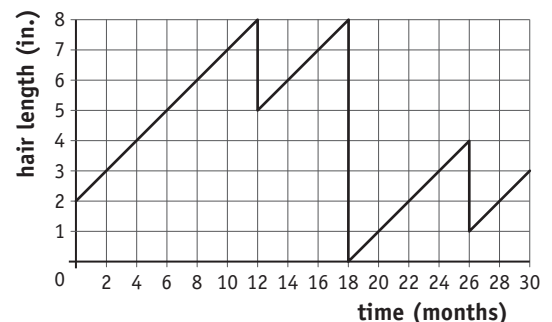
3<sup>rd</sup> bus =



**b)** This graph shows Sam's hair length over a two and a half year period. How many months passed between her first trim and shaving her hair?

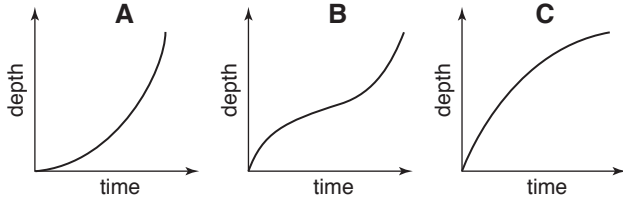
trim =

shaving =

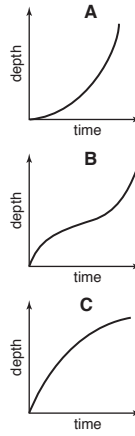


**Skill 19.11** Interpreting graphs describing other rates (2).

**Q.** This glass is being filled with water at a constant rate. Which graph best represents this?



**A.**



Glass fills slowly first and then gradually faster (false).

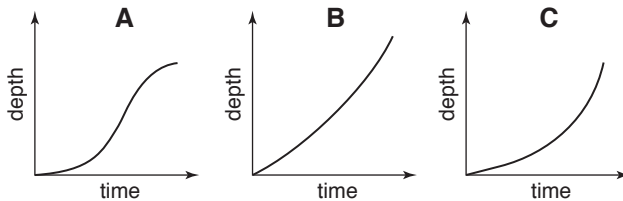
Glass fills quickly in the bottom part, then gradually slower for the wider part of the glass, and finally faster for the narrow part (true).

Glass fills quickly first and then gradually slower (false).

The answer is **B**

**c)** The following glasses are being filled at the same constant rate. Match the graphs to the glasses they best represent.

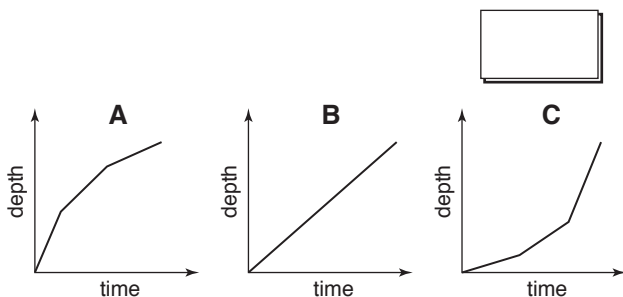
A .....  
B .....  
C .....



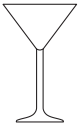
**e)** This container is being filled with water at a constant rate. Which graph best represents this?



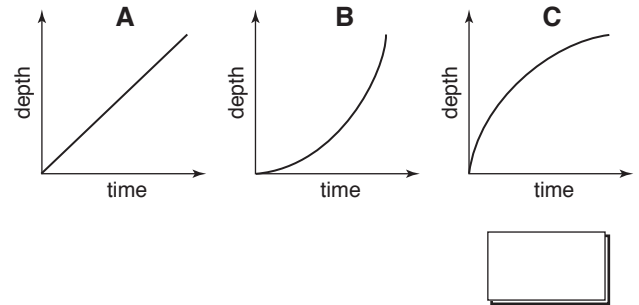
A .....  
B .....  
C .....



**d)** This glass is being filled with water at a constant rate. Which graph best represents this?



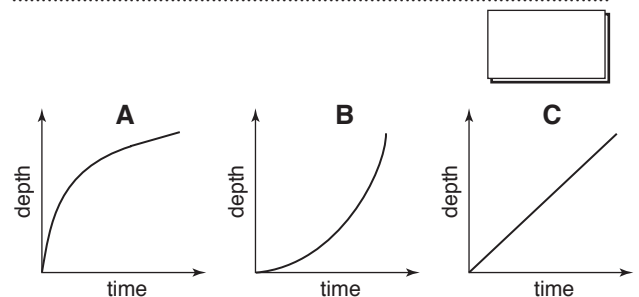
A .....  
B .....  
C .....



**f)** This glass is being filled with water at a constant rate. Which graph best represents this?



A .....  
B .....  
C .....



**Skill 19.12** Finding the slope of a linear graph when two points are given.

- Identify  $(x_1, y_1)$  and  $(x_2, y_2)$  as the coordinates of the given points.
- Write the formula for the slope of a linear graph.
- Substitute the values of  $x_1$ ,  $x_2$ ,  $y_1$  and  $y_2$  into the formula.
- Simplify and evaluate  $m$ .

$$\text{Slope } m = \frac{\text{rise}}{\text{run}} = \frac{y_2 - y_1}{x_2 - x_1}$$

**Q.** Use the formula  $m = \frac{y_2 - y_1}{x_2 - x_1}$  to find the slope of  $\overleftrightarrow{MN}$ , where  $M(6, -2)$  and  $N(-2, 4)$

**A.**  $(x_1, y_1) = (6, -2) \Rightarrow x_1 = 6$  and  $y_1 = -2$   
 $(x_2, y_2) = (-2, 4) \Rightarrow x_2 = -2$  and  $y_2 = 4$

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{4 - (-2)}{-2 - 6}$$

(-)(-) = +

$$= \frac{6}{-8}$$

Simplify:  $\div 2$

$$= -\frac{3}{4}$$

**a)** Use the formula  $m = \frac{y_2 - y_1}{x_2 - x_1}$  to find the slope of  $\overleftrightarrow{AB}$ , where  $A(-1, 3)$  and  $B(2, 0)$

$x_1 = -1, y_1 = 3, x_2 = 2, y_2 = 0$

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{0 - 3}{2 - (-1)} = \frac{-3}{3} = \boxed{\phantom{00}}$$

**b)** Use the formula  $m = \frac{y_2 - y_1}{x_2 - x_1}$  to find the slope of  $\overleftrightarrow{CD}$ , where  $C(2, 1)$  and  $D(-2, -7)$

$x_1 = \phantom{00}, y_1 = \phantom{00}, x_2 = \phantom{00}, y_2 = \phantom{00}$

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \phantom{00} = \phantom{00} = \boxed{\phantom{00}}$$

**c)** Use the formula  $m = \frac{y_2 - y_1}{x_2 - x_1}$  to find the slope of  $\overleftrightarrow{FG}$ , where  $F(3, -1)$  and  $G(1, 2)$

$x_1 = \phantom{00}, y_1 = \phantom{00}, x_2 = \phantom{00}, y_2 = \phantom{00}$

$$m = \phantom{00} = \phantom{00} = \phantom{00} = \boxed{\phantom{00}}$$

**d)** Use the formula  $m = \frac{y_2 - y_1}{x_2 - x_1}$  to find the slope of  $\overleftrightarrow{JK}$ , where  $J(-4, 0)$  and  $K(-1, 5)$

$x_1 = \phantom{00}, y_1 = \phantom{00}, x_2 = \phantom{00}, y_2 = \phantom{00}$

$$m = \phantom{00} = \phantom{00} = \phantom{00} = \boxed{\phantom{00}}$$

**e)** Use the formula  $m = \frac{y_2 - y_1}{x_2 - x_1}$  to find the slope of  $\overleftrightarrow{AB}$ , where  $A(0, -4)$  and  $B(6, 2)$

$x_1 = \phantom{00}, y_1 = \phantom{00}, x_2 = \phantom{00}, y_2 = \phantom{00}$

$$m = \phantom{00} = \phantom{00} = \phantom{00} = \boxed{\phantom{00}}$$

**f)** Use the formula  $m = \frac{y_2 - y_1}{x_2 - x_1}$  to find the slope of  $\overleftrightarrow{TU}$ , where  $T(-3, 2)$  and  $U(-4, -1)$

$x_1 = \phantom{00}, y_1 = \phantom{00}, x_2 = \phantom{00}, y_2 = \phantom{00}$

$$m = \phantom{00} = \phantom{00} = \phantom{00} = \boxed{\phantom{00}}$$

**g)** Use the formula  $m = \frac{y_2 - y_1}{x_2 - x_1}$  to find the slope of  $\overleftrightarrow{GH}$ , where  $G(5, 0)$  and  $H(2, -3)$

$x_1 = \phantom{00}, y_1 = \phantom{00}, x_2 = \phantom{00}, y_2 = \phantom{00}$

$$m = \phantom{00} = \phantom{00} = \phantom{00} = \boxed{\phantom{00}}$$

**h)** Use the formula  $m = \frac{y_2 - y_1}{x_2 - x_1}$  to find the slope of  $\overleftrightarrow{ST}$ , where  $S(10, 6)$  and  $T(-2, 8)$

$x_1 = \phantom{00}, y_1 = \phantom{00}, x_2 = \phantom{00}, y_2 = \phantom{00}$

$$m = \phantom{00} = \phantom{00} = \phantom{00} = \boxed{\phantom{00}}$$

**Skill 19.13** Finding the equation of a straight line when two points are given (1).

- Identify  $(x_1, y_1)$  and  $(x_2, y_2)$  as the coordinates of the given points.
- Find the slope of the line joining the two points.  
 (see skill 19.12, page 217)

$$\text{Slope } m = \frac{\text{rise}}{\text{run}} = \frac{y_2 - y_1}{x_2 - x_1}$$

- Write the equation of a straight line.

$$\text{Equation of a line } y - y_1 = m(x - x_1)$$

- Substitute the values of  $y_1$ ,  $m$  and  $x_1$  into the equation.
- Simplify to rearrange the equation:
  - $y$  on its own on the left hand side of the equal sign without coefficient
  - $x$  and the remaining number on the right hand side of the equal sign

**Q.** Use  $y - y_1 = m(x - x_1)$  where  $m = \frac{y_2 - y_1}{x_2 - x_1}$  to find the equation of the line joining the points  $M(-3, 2)$  and  $N(4, -1)$

**A.**  $(x_1, y_1) = (-3, 2) \Rightarrow x_1 = -3$  and  $y_1 = 2$   
 $(x_2, y_2) = (4, -1) \Rightarrow x_2 = 4$  and  $y_2 = -1$

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-1 - 2}{4 - (-3)} = \frac{-3}{7}$$

$$y - y_1 = m(x - x_1)$$

$$y - 2 = -\frac{3}{7} \cdot x - (-3)$$

$(-)(-) = +$

$$y - 2 = -\frac{3}{7} \cdot (x + 3)$$

$(+)(-) = -$

$$y - 2 = -\frac{3x}{7} + (-\frac{9}{7})$$

$$y - 2 + 2 = -\frac{3x}{7} - \frac{9}{7} + 2$$

$-\frac{9}{7} + 2 = -\frac{9}{7} + \frac{14}{7} = \frac{5}{7}$

$$y = -\frac{3}{7}x + \frac{5}{7}$$

**a)** Use  $y - y_1 = m(x - x_1)$  where  $m = \frac{y_2 - y_1}{x_2 - x_1}$  to find the equation of the line joining the points  $P(7, 0)$  and  $Q(-1, 8)$

$$x_1 = 7, y_1 = 0, x_2 = -1, y_2 = 8$$

$$m = \frac{8 - 0}{-1 - 7} = \frac{8}{-8} = -1$$

$$y - y_1 = m(x - x_1)$$

$$y - 0 = -1 \cdot (x - 7)$$

$$y = -1 \cdot x - (-1) \times 7$$

$$y =$$

$--- = +$

**b)** Use  $y - y_1 = m(x - x_1)$  where  $m = \frac{y_2 - y_1}{x_2 - x_1}$  to find the equation of the line joining the points  $S(-4, 5)$  and  $T(-3, 7)$

$$x_1 = \quad, y_1 = \quad, x_2 = \quad, y_2 =$$

$$m = \quad = \quad =$$

$$y - y_1 = m(x - x_1)$$

$$y =$$

**Skill 19.13** Finding the equation of a straight line when two points are given (2).

- c)** Use  $y - y_1 = m(x - x_1)$  where  $m = \frac{y_2 - y_1}{x_2 - x_1}$  to find the equation of the line joining the points  $A(1,5)$  and  $B(3,11)$

$$x_1 = \quad , y_1 = \quad , x_2 = \quad , y_2 = \quad$$

$$m = \quad = \quad = \quad$$

$$y - y_1 = m(x - x_1)$$

$$y =$$

- e)** Use  $y - y_1 = m(x - x_1)$  where  $m = \frac{y_2 - y_1}{x_2 - x_1}$  to find the equation of the line joining the points  $Q(4,-3)$  and  $R(-4,5)$

$$x_1 = \quad , y_1 = \quad , x_2 = \quad , y_2 = \quad$$

$$m = \quad = \quad = \quad$$

$$y - y_1 = m(x - x_1)$$

$$y =$$

- g)** Use  $y - y_1 = m(x - x_1)$  where  $m = \frac{y_2 - y_1}{x_2 - x_1}$  to find the equation of the line joining the points  $M(3,0)$  and  $N(-1,5)$

$$x_1 = \quad , y_1 = \quad , x_2 = \quad , y_2 = \quad$$

$$m = \quad = \quad = \quad$$

$$y - y_1 = m(x - x_1)$$

$$y =$$

- d)** Use  $y - y_1 = m(x - x_1)$  where  $m = \frac{y_2 - y_1}{x_2 - x_1}$  to find the equation of the line joining the points  $C(1,-3)$  and  $D(-4,-2)$

$$x_1 = \quad , y_1 = \quad , x_2 = \quad , y_2 = \quad$$

$$m = \quad = \quad = \quad$$

$$y - y_1 = m(x - x_1)$$

$$y =$$

- f)** Use  $y - y_1 = m(x - x_1)$  where  $m = \frac{y_2 - y_1}{x_2 - x_1}$  to find the equation of the line joining the points  $K(-6,2)$  and  $L(-2,-2)$

$$x_1 = \quad , y_1 = \quad , x_2 = \quad , y_2 = \quad$$

$$m = \quad = \quad = \quad$$

$$y - y_1 = m(x - x_1)$$

$$y =$$

- h)** Use  $y - y_1 = m(x - x_1)$  where  $m = \frac{y_2 - y_1}{x_2 - x_1}$  to find the equation of the line joining the points  $T(2,-4)$  and  $U(0,-1)$

$$x_1 = \quad , y_1 = \quad , x_2 = \quad , y_2 = \quad$$

$$m = \quad = \quad = \quad$$

$$y - y_1 = m(x - x_1)$$

$$y =$$

**Skill 19.14** Rewriting a linear equation in the slope-intercept form  $y = mx + b$ , where  $m$  is the slope and  $b$  is the  $y$ -intercept of the graph. MMMaive 11 22 33 44  
MMLime 11 22 33 44

- Use the inverse operations of addition, subtraction, multiplication and/or division to rearrange the terms in the rule:
  - $y$  on the left hand side of the equal sign without coefficient
  - $x$  on the right hand side of the equal sign.

*Hint: The slope-intercept form of a linear function (equation) is  $y = mx + b$   
The coefficient of  $x$  is the slope of the graph ( $m$ ).  
The number that is not attached to either  $x$  or  $y$  is the  $y$ -intercept ( $b$ ).*

**Q.** Rewrite the linear function  $-x + 2y = -3$  in the slope-intercept form  $y = mx + b$ , where  $m$  represents the slope and  $b$  the  $y$ -intercept.

**A.**

$$\begin{aligned}
 -x + 2y &= -3 \\
 -x + x + 2y &= -3 + x \\
 2y &= x - 3 \\
 \frac{2y}{2} &= \frac{x - 3}{2} \\
 y &= \frac{1}{2}x - \frac{3}{2}
 \end{aligned}$$

**a)** Rewrite the linear equation  $5 - y = 4x$  in the slope-intercept form  $y = mx + b$ , where  $m$  represents the slope and  $b$  the  $y$ -intercept.

$$5 - y - 5 = 4x - 5 \Rightarrow -y = 4x - 5$$

$$-(-y) = -(4x - 5)$$

$$y = -4x - (-5) \quad \boxed{y = -4x + 5}$$

**b)** Rewrite the linear equation  $x - 5y = 5$  in the slope-intercept form  $y = mx + b$ , where  $m$  represents the slope and  $b$  the  $y$ -intercept.

$$\boxed{y =}$$

**c)** Rewrite the linear equation  $3x + 2y = 1$  in the slope-intercept form  $y = mx + b$ , where  $m$  represents the slope and  $b$  the  $y$ -intercept.

$$\boxed{y =}$$

**d)** Rewrite the linear equation  $4x - 2y = 3$  in the slope-intercept form  $y = mx + b$ , where  $m$  represents the slope and  $b$  the  $y$ -intercept.

$$\boxed{y =}$$

**e)** Rewrite the linear equation  $-2x - y = 6$  in the slope-intercept form  $y = mx + b$ , where  $m$  represents the slope and  $b$  the  $y$ -intercept.

$$\boxed{y =}$$

**f)** Rewrite the linear equation  $3x + 4y = 12$  in the slope-intercept form  $y = mx + b$ , where  $m$  represents the slope and  $b$  the  $y$ -intercept.

$$\boxed{y =}$$

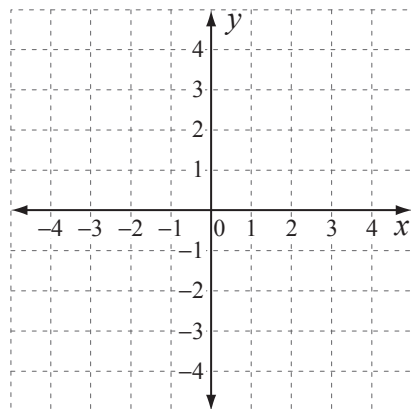
**Skill 19.15** Solving a system of equations by graphing them on a Cartesian plane (1).

- Graph the system of equations by finding the x-intercept and the y-intercept on the same Cartesian plane. (see skill 19.6, page 204)

OR

- Graph the system of equations by finding two convenient points that belong to each equation.
- Find the solution of the system of equations as the intersection point of the two graphs.

**Q.** Graph the system of equations  $3x + 4y = -10$  and  $5x - 2y = 18$ . Find the solution of the system.



**A.** Equation 1

$$x\text{-intercept} \Rightarrow y = 0 \Rightarrow 3x = -10$$

$$3x \div 3 = -10 \div 3$$

$$x = -\frac{10}{3}$$

$$\Rightarrow x\text{-intercept is } (-\frac{10}{3}, 0)$$

$$y\text{-intercept} \Rightarrow x = 0 \Rightarrow 4y = -10$$

$$4y \div 4 = -10 \div 4$$

$$y = -\frac{5}{2}$$

$$\Rightarrow y\text{-intercept is } (0, -\frac{5}{2})$$

Equation 2

$$x\text{-intercept} \Rightarrow y = 0 \Rightarrow 5x = 18$$

$$5x \div 5 = 18 \div 5$$

$$x = \frac{18}{5}$$

$$\Rightarrow x\text{-intercept is } (\frac{18}{5}, 0)$$

$$y\text{-intercept} \Rightarrow x = 0 \Rightarrow -2y = 18$$

$$-2y \div (-2) = 18 \div (-2)$$

$$y = -9$$

$$\Rightarrow y\text{-intercept is } (0, -9)$$

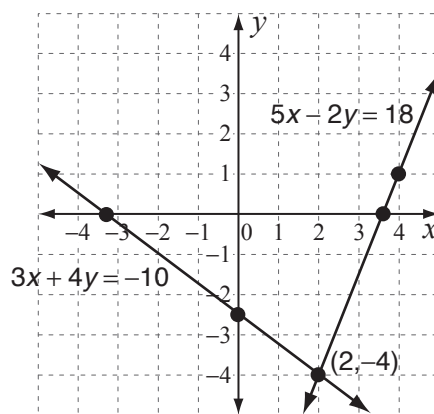
*-9 is too big, so choose a different point:*

$$x = 4 \Rightarrow 20 - 2y = 18$$

$$-2y \div (-2) = -2 \div (-2)$$

$$y = 1$$

$$\Rightarrow \text{point } (4, 1)$$



Graph all the points.  
Sketch both graphs by joining the respective pairs of points.  
Mark the intersection.

The lines intersect at the point  $(2, -4)$   
The solution is  $(2, -4)$

**Skill 19.15** Solving a system of equations by graphing them on a Cartesian plane (2).

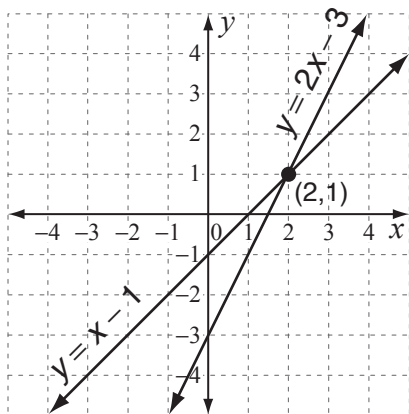
**a)** Graph the system of equations  $y = x - 1$  and  $y = 2x - 3$ . Find the solution of the system.

Equation 1  $y = 0 \Rightarrow x - 1 = 0 \Rightarrow x = 1 \Rightarrow (1, 0)$

Equation 1  $x = 0 \Rightarrow y = 0 - 1 = -1 \Rightarrow (0, -1)$

Equation 2  $y = 0 \Rightarrow 2x - 3 = 0 \Rightarrow x = \frac{3}{2} \Rightarrow (\frac{3}{2}, 0)$

Equation 2  $x = 0 \Rightarrow y = 0 - 3 = -3 \Rightarrow (0, -3)$



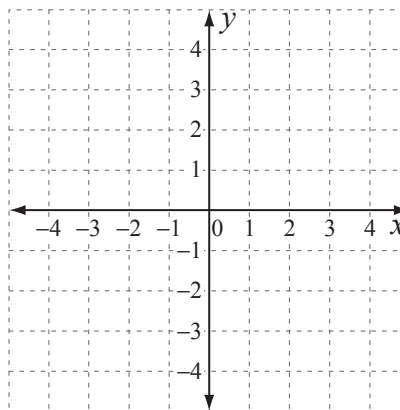

**b)** Graph the system of equations  $y = 3x + 1$  and  $x + 1 = 0$ . Find the solution of the system.

Equation 1  $y = 0 \Rightarrow$

Equation 1  $x = 0 \Rightarrow$

Equation 2  $y = 0 \Rightarrow$

Equation 2  $x = 0 \Rightarrow$



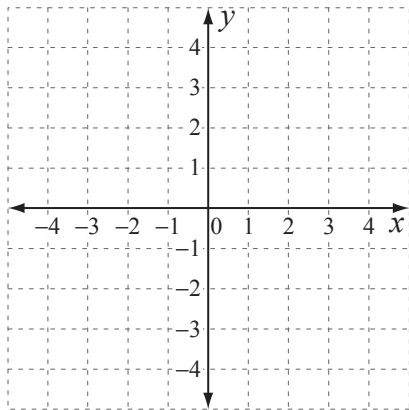

**c)** Graph the system of equations  $x + y = 4$  and  $2x + y = 6$ . Find the solution of the system.

Equation 1  $y = 0 \Rightarrow$

Equation 1  $x = 0 \Rightarrow$

Equation 2  $y = 0 \Rightarrow$

Equation 2  $x = 1 \Rightarrow$



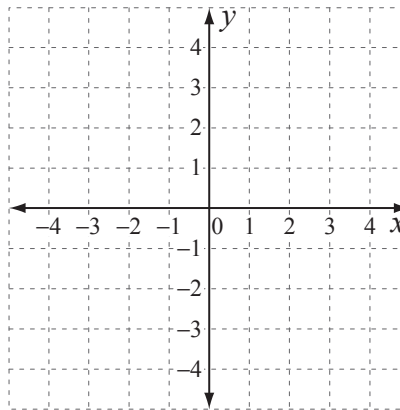

**d)** Graph the system of equations  $2x + y = 3$  and  $x - 2y = 4$ . Find the solution of the system.

Equation 1  $y = 0 \Rightarrow$

Equation 1  $x = 0 \Rightarrow$

Equation 2  $y = 0 \Rightarrow$

Equation 2  $x = 0 \Rightarrow$



- Substitute the variable  $x$  with the given values.
- Solve the equation for  $y$ .
- Use the order of operations rules: Multiply ( $\times$ ) and/or divide ( $\div$ ) in order from left to right. Add ( $+$ ) and/or subtract ( $-$ ) in order from left to right.
- Use the sign rules:  $++=+$ ,  $--=+$ ,  $+-=-$ ,  $-+=-$  (see skill 8.3, page 87)
- Complete the table of values for the non-linear function.

**Q.** Complete this table of values for the function  $f(x) = x^2 - 3$

$x$	-2	-1	0	1	2
$f(x)$	1				

**A.**  $f(x) = x^2 - 3 = x \cdot x - 3$   $x^2 = x \cdot x$

$$x = -1 \Rightarrow f(-1) = -1 \cdot (-1) - 3 = 1 - 3 \Rightarrow f(-1) = -2$$

$$x = 0 \Rightarrow f(0) = 0 \cdot 0 - 3 = 0 - 3 \Rightarrow f(0) = -3$$

$$x = 1 \Rightarrow f(1) = 1 \cdot 1 - 3 = 1 - 3 \Rightarrow f(1) = -2$$

$$x = 2 \Rightarrow f(2) = 2 \cdot 2 - 3 = 4 - 3 \Rightarrow f(2) = 1$$

$x$	-2	-1	0	1	2
$f(x)$	1	-2	-3	-2	1

Complete the table of values.

**a)** Complete this table of values for the function  $f(x) = 2x^2$

$$x = -1 \Rightarrow f(-1) = 2 \cdot (-1) \cdot (-1) = -2 \cdot (-1) \Rightarrow f(-1) = 2$$

$$x = 0 \Rightarrow f(0) = 2 \cdot 0 \cdot 0 = 2 \cdot 0 \Rightarrow f(0) = 0$$

$$x = 1 \Rightarrow f(1) = 2 \cdot 1 \cdot 1 = 2 \cdot 1 \Rightarrow f(1) = 2$$

$$x = 2 \Rightarrow f(2) = 2 \cdot 2 \cdot 2 = 4 \cdot 2 \Rightarrow f(2) = 8$$

$x$	-2	-1	0	1	2
$f(x)$	8	2	0	2	8

**b)** Complete this table of values for the function  $f(x) = x^2 + 4$

$$x = -1 \Rightarrow f(-1) = -1 \cdot (-1) + 4 = 1 + 4 \Rightarrow f(-1) = 5$$

$$x = 0 \Rightarrow f(0) = \quad \Rightarrow f(0) =$$

$$x = 1 \Rightarrow f(1) = \quad \Rightarrow f(1) =$$

$$x = 2 \Rightarrow f(2) = \quad \Rightarrow f(2) =$$

$x$	-2	-1	0	1	2
$f(x)$	8				

**c)** Complete this table of values for the function  $f(x) = -\frac{1}{x}$

$$x = -2 \Rightarrow f(-2) = \quad \Rightarrow f(-2) =$$

$$x = -1 \Rightarrow f(-1) = \quad \Rightarrow f(-1) =$$

$$x = 1 \Rightarrow f(1) = \quad \Rightarrow f(1) =$$

$$x = 2 \Rightarrow f(2) = \quad \Rightarrow f(2) =$$

$x$	-2	-1	0	1	2
$f(x)$			X		

**d)** Complete this table of values for the function  $f(x) = 5^x$

$$x = -1 \Rightarrow f(-1) = 5^{-1} \Rightarrow f(-1) = \frac{1}{5}$$

$$x = 0 \Rightarrow f(0) = \quad \Rightarrow$$

$$x = 1 \Rightarrow f(1) = \quad \Rightarrow$$

$$x = 2 \Rightarrow f(2) = \quad \Rightarrow$$

$x$	-2	-1	0	1	2
$f(x)$	$\frac{1}{25}$				

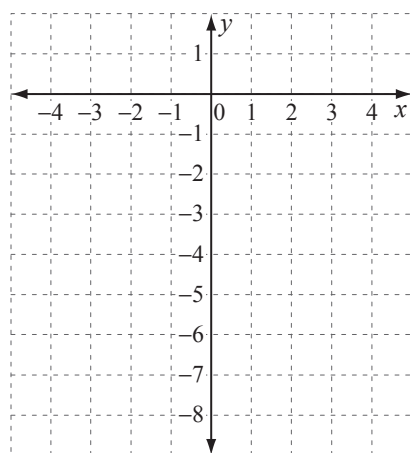
**Skill 19.17** Graphing non-linear functions on a coordinate plane, by first completing a table of values (1).

- Complete the table of values for the non-linear function. (see skill 19.1, page 198)
- Graph each point on the coordinate plane.
- Draw the curved line that joins these points.
- Label the line with the equation.

*Hints: The graph of a quadratic function  $f(x) = ax^2 + c$  is symmetrical about the vertical axis.  
 Note the likeness of the resulting values when  $x$  takes opposite values.*

**Q.** Graph the function  $f(x) = -x^2 + 2$  by first completing this table of values.

$x$	-3	-2	-1	0	1	2	3
$f(x)$							



**A.**  $f(x) = -x^2 + 2$

$x = 0 \Rightarrow f(0) = -0^2 + 2 = 0 + 2 = 2 \Rightarrow (0, 2)$

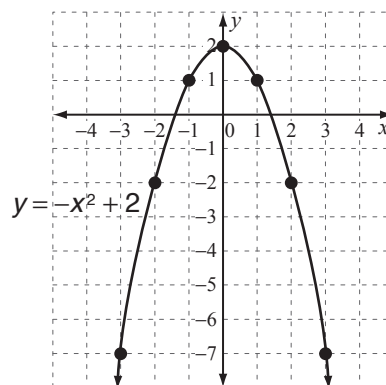
$x = 1 \Rightarrow f(1) = -1^2 + 2 = -1 + 2 = 1 \Rightarrow (1, 1)$

$x = 2 \Rightarrow f(2) = -2^2 + 2 = -4 + 2 = -2 \Rightarrow (2, -2)$

$x = 3 \Rightarrow f(3) = -3^2 + 2 = -9 + 2 = -7 \Rightarrow (3, -7)$

The  $f(x)$  values repeat for  $x = -1, -2, -3$

$x$	-3	-2	-1	0	1	2	3
$f(x)$	-7	-2	1	2	1	-2	-7



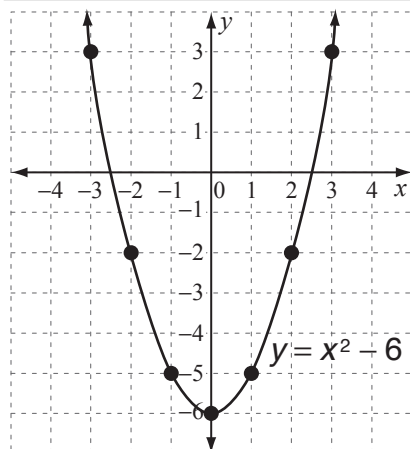
Complete the table of values.  
 Graph the points.  
 Join the points with a curved line.  
 Label the line with the equation  $y = -x^2 + 2$

**a)** Graph the function  $f(x) = x^2 - 6$  by first completing this table of values.

$x = -3 \Rightarrow f(-3) = 9 - 6 = 3 \Rightarrow (-3, 3)$

$x = -2 \Rightarrow f(-2) = 4 - 6 = -2 \Rightarrow (-2, -2)$

$x$	-3	-2	-1	0	1	2	3
$f(x)$	3	-2	-5	-6	-5	-2	3

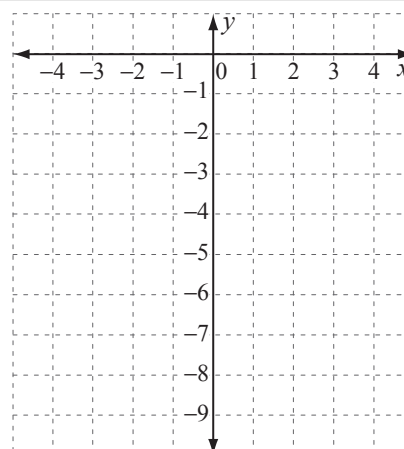


**b)** Graph the function  $f(x) = -x^2$  by first completing this table of values.

$x = 2 \Rightarrow f(2) = \quad \Rightarrow$

$x = 3 \Rightarrow f(3) = \quad \Rightarrow$

$x$	-3	-2	-1	0	1	2	3
$f(x)$							



**Skill 19.17** Graphing non-linear functions on a coordinate plane, by first completing a table of values (2).

**c)** Graph the function  $f(x) = \frac{1}{2}x^2$  by first completing this table of values.

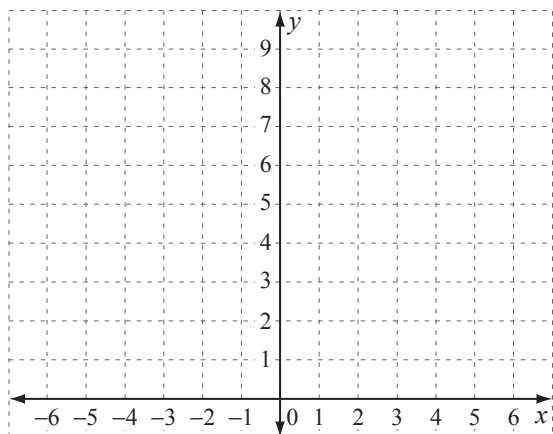
$x = 1 \Rightarrow f(1) = \quad \Rightarrow$

$x = 2 \Rightarrow f(2) = \quad \Rightarrow$

$x = 3 \Rightarrow f(3) = \quad \Rightarrow$

$x = 4 \Rightarrow f(4) = \quad \Rightarrow$

$x$	-4	-3	-2	-1	0	1	2	3	4
$f(x)$									



**e)** Graph the function  $f(x) = x^2 - 3$  by first completing this table of values.

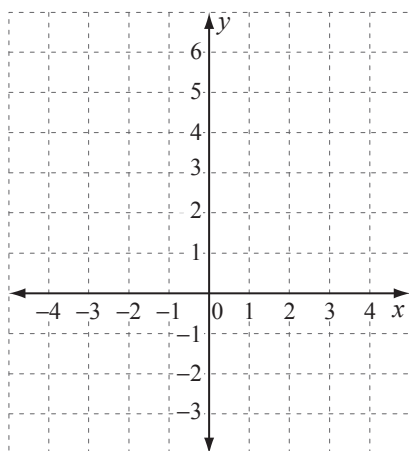
$x = 0 \Rightarrow f(0) = \quad \Rightarrow$

$x = 1 \Rightarrow f(1) = \quad \Rightarrow$

$x = 2 \Rightarrow f(2) = \quad \Rightarrow$

$x = 3 \Rightarrow f(3) = \quad \Rightarrow$

$x$	-3	-2	-1	0	1	2	3
$f(x)$							



**d)** Graph the function  $f(x) = \frac{1}{x}$  by first completing this table of values.

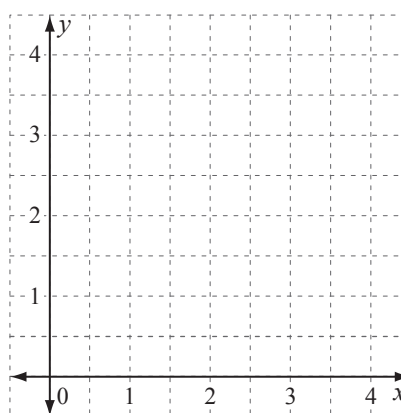
$x = \quad \Rightarrow f(\frac{1}{2}) = \quad \Rightarrow$

$x = 1 \Rightarrow f(1\frac{1}{2}) = \quad \Rightarrow$

$x = 2 \Rightarrow f(2\frac{1}{2}) = \quad \Rightarrow$

$x = 3 \Rightarrow f(3\frac{1}{2}) = \quad \Rightarrow$

$x$	0	$\frac{1}{4}$	$\frac{1}{2}$	1	$1\frac{1}{2}$	2	$2\frac{1}{2}$	3	$3\frac{1}{2}$
$f(x)$	$\times$								



**f)** Graph the function  $f(x) = -\frac{2}{x}$  by first completing this table of values.

$x = 1 \Rightarrow f(1) = \quad \Rightarrow$

$x = 2 \Rightarrow f(2) = \quad \Rightarrow$

$x = 3 \Rightarrow f(3) = \quad \Rightarrow$

$x$	-3	-2	-1	$-\frac{1}{2}$	0	$\frac{1}{2}$	1	2	3
$f(x)$					$\times$				

