

# 21. [Graphs & Functions]

## Skill 21.1 Finding the coordinates of a point on a Cartesian plane.

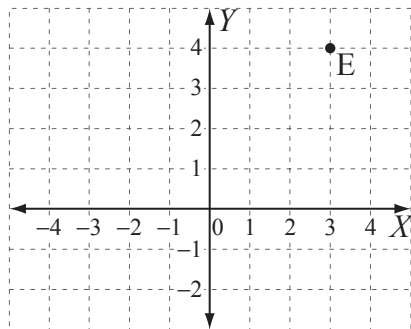
MM5.2 1 2 2 3 3 4 4  
MM10 1 1 2 2 3 3 4 4

- Move vertically from the point till you intersect the horizontal axis (x-axis).
- Read the number you find on the horizontal axis.
- Write this number as the x-coordinate of the point (x, ).
- Move horizontally from the point till you intersect the vertical axis (y-axis).
- Read the number you find on the vertical axis.
- Write this number as the y-coordinate of the point ( , y).

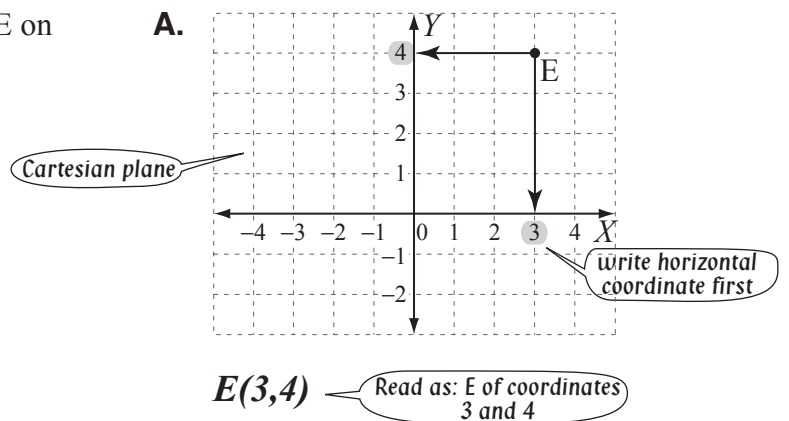
*Hints: Always write the x-coordinate first.*

*The coordinates of the origin O are (0,0).*

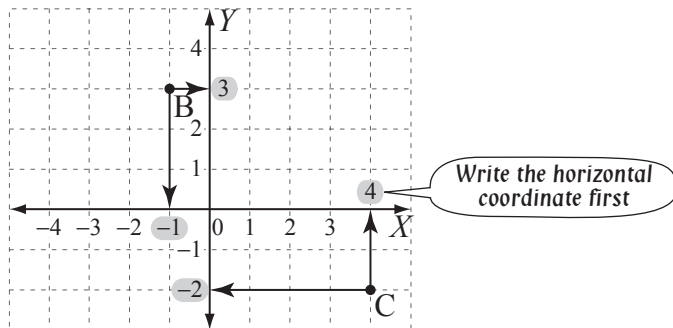
**Q.** What are the coordinates of the point E on this Cartesian plane?



**A.**

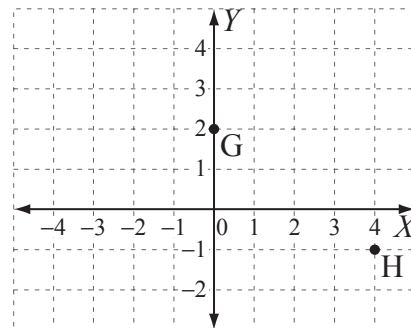


**a)** What are the coordinates of the points B and C on this Cartesian plane?



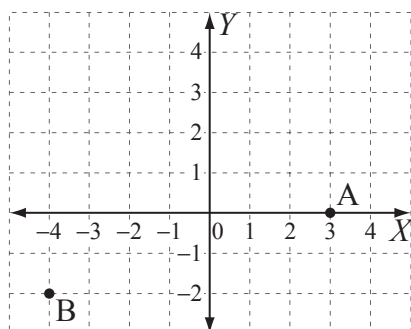
**B(-1, 3) C( , )**

**b)** What are the coordinates of the points G and H on this Cartesian plane?



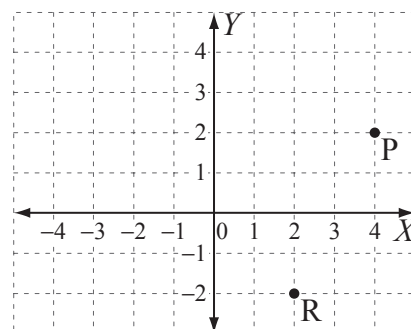
**G( , ) H( , )**

**c)** What are the coordinates of the points A and B on this Cartesian plane?



**A( , ) B( , )**

**d)** What are the coordinates of the points P and R on this Cartesian plane?



**P( , ) R( , )**

## Skill 21.2 Plotting points on a Cartesian plane.

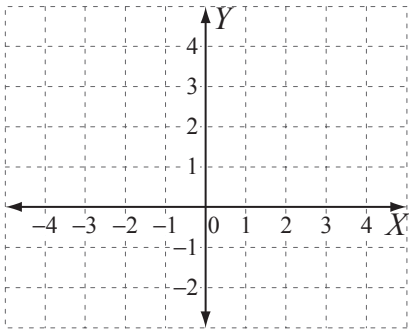
MM5.2 1 1 2 2 3 3 4 4  
MM10 1 1 2 2 3 3 4 4

- Start at the origin (0,0).
- Move across the  $x$ -axis by a number of units equal to the  $x$ -coordinate (move to the right if the coordinate is positive and to the left if the coordinate is negative).
- Draw a vertical line passing through this point.
- From the origin, move along the  $y$ -axis by the number of units equal to the  $y$ -coordinate (move up if the coordinate is positive and down if the coordinate is negative).
- Draw a horizontal line passing through this point.
- Mark the point at the intersection of these two lines.

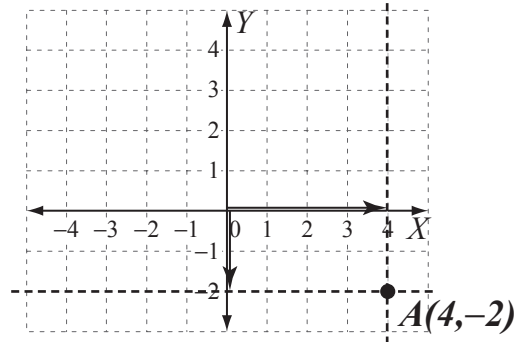
*Hints: Any point with the  $x$ -coordinate 0 lies on the  $y$ -axis.*

*Any point with the  $y$ -coordinate 0 lies on the  $x$ -axis.*

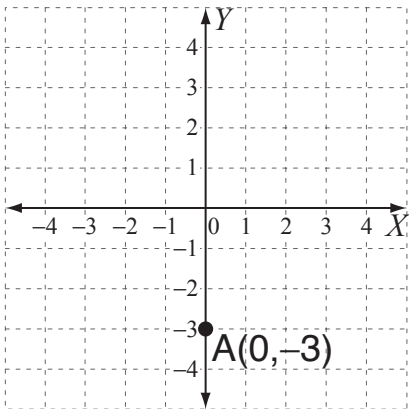
**Q.** Plot the point  $A(4,-2)$  on this number plane.



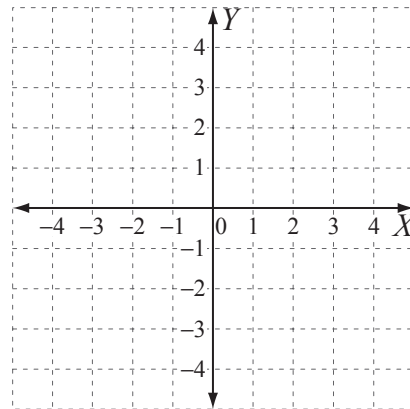
**A.**



**a)** Plot the points  $A(0,-3)$ ,  $B(4,1)$  and  $C(-3,1)$  on this number plane.

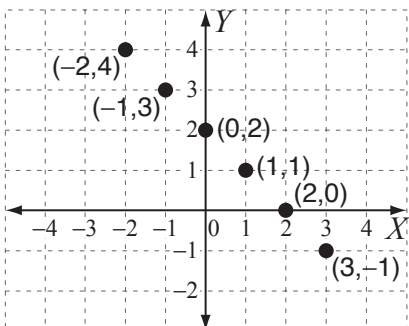


**b)** Plot the points  $C(-3,4)$ ,  $D(-4,-2)$  and  $E(1,-3)$  on this number plane.



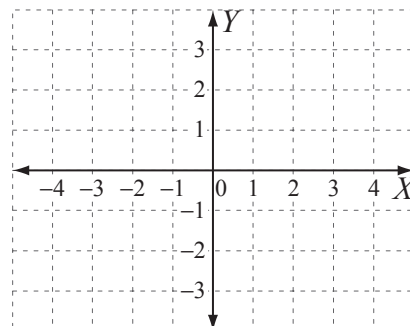
**c)** Using the table of values plot the points on the Cartesian plane.

|     |    |    |   |   |   |    |
|-----|----|----|---|---|---|----|
| $x$ | -2 | -1 | 0 | 1 | 2 | 3  |
| $y$ | 4  | 3  | 2 | 1 | 0 | -1 |



**d)** Using the table of values plot the points on the Cartesian plane.

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



### Skill 21.3 Completing a table of values for a linear rule or function.

MM5.2 1 2 2 3 3 4 4  
MM10 1 1 2 2 3 3 4 4

- Substitute the variable  $x$  with the given values.
- Solve the equation for  $y$ .
- Use the order of operations rules: Multiply ( $\times$ ) and/or divide ( $\div$ ) from left to right.  
Add ( $+$ ) and/or subtract ( $-$ ) from left to right.
- Use the sign rules:  $++=+$   $--=+$   $+-=-$   $-+=-$  (see skill 9.1, page 91)

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

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

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

| $x$             | $y = -4x + 2$              | $(x, y)$  |
|-----------------|----------------------------|-----------|
| 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 linear rule  $y = x - 1$

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

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

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

**c)** Complete this table of values for the linear rule  $y = x + 7$

| $x$ | $y = x + 7$     | $(x, y)$ |
|-----|-----------------|----------|
| 0   | $y = 0 + 7 = 7$ | $(0, 7)$ |
| 1   |                 |          |
| 2   |                 |          |

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

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

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

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

**f)** Complete this table of values for the linear rule  $y = -4x$

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

**g)** Complete this table of values for the linear rule  $y = 3x - 4$

| $x$ | $y = 3x - 4$              | $(x, y)$  |
|-----|---------------------------|-----------|
| 0   | $y = 3 \times 0 - 4 = -4$ | $(0, -4)$ |
| 1   |                           |           |
| 4   |                           |           |

**h)** Complete this table of values for the linear rule  $y = -5x + 1$

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

**Skill 21.4** Plotting linear graphs on a Cartesian plane of the type  $x = \text{constant}$  and  $y = \text{constant}$  (e.g.  $x = 1, y = 2$ ).

MM5.2 11 2 2 3 3 4 4  
MM10 1 1 2 2 3 3 4 4

- Complete the table of values for the rule. (see skill 21.3, page 221)
- Plot each point on the Cartesian plane. (see skill 21.2, page 220)
- Draw the line that joins these points.
- Label the line with the rule.

**Hints:** The graphs of the rules  $x = \text{constant}$  are vertical lines.

The graphs of the rules  $y = \text{constant}$  are horizontal lines.

**Q.** Plot the graph of the linear rule  $y = 4$  on the Cartesian plane below by first completing this table of values. [Label the graph with the rule.]

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

**A.**

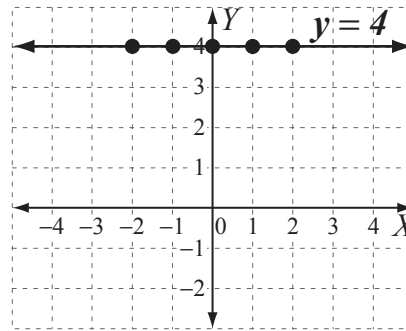
|         |        |        |       |       |       |
|---------|--------|--------|-------|-------|-------|
| $x$     | -2     | -1     | 0     | 1     | 2     |
| $y$     | 4      | 4      | 4     | 4     | 4     |
| $(x,y)$ | (-2,4) | (-1,4) | (0,4) | (1,4) | (2,4) |

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

Plot the points.

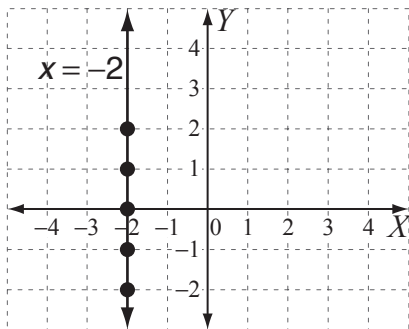
Join the points with a line.

Label the line with the rule  $y = 4$



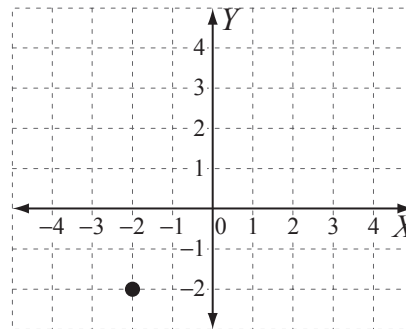
**a)** Plot the graph of the linear rule  $x = -2$  on the Cartesian plane below by first completing this table of values. [Label the graph with the rule.]

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



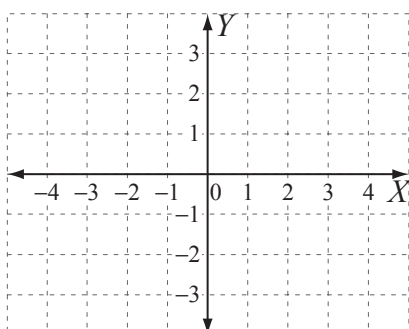
**b)** Plot the graph of the linear rule  $y = -2$  on the Cartesian plane below by first completing this table of values. [Label the graph with the rule.]

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



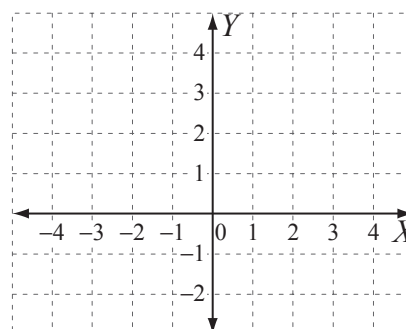
**c)** Plot the graph of the linear rule  $y = -3$  on the Cartesian plane below by first completing this table of values. [Label the graph with the rule.]

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



**d)** Plot the graph of the linear rule  $x = 3$  on the Cartesian plane below by first completing this table of values. [Label the graph with the rule.]

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



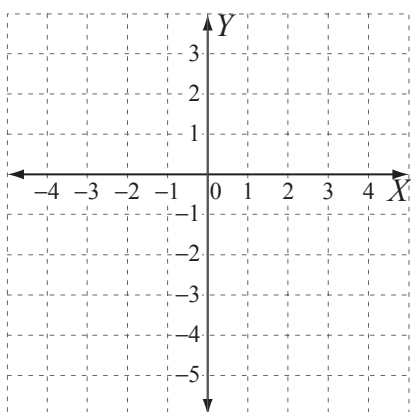
**Skill 21.5** Plotting linear graphs on a Cartesian plane of the type

$y = mx + c$  (e.g.  $y = 3x + 2$ ) (1).

- Complete the table of values for the rule. (see skill 21.3, page 221)
- Plot each point on the Cartesian plane. (see skill 21.2, page 220)
- Draw the line that joins these points.
- Label the line with the rule.

**Q.** Plot the graph of the linear rule  $y = -2x - 1$  on the number plane below by first completing this table of values. [Label the graph with the rule.]

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



**A.**  $y = -2x - 1 = -2 \times x - 1$   $2x = 2 \times x$

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

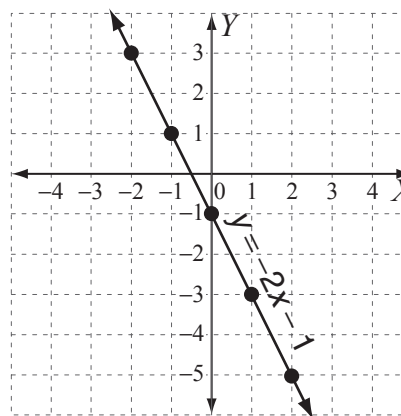
$x = 0 \Rightarrow y = -2 \times 0 - 1 = -1 \Rightarrow (0, -1)$

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

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

|         |        |        |        |        |        |
|---------|--------|--------|--------|--------|--------|
| $x$     | -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.



Plot the points.

Join the points with a line.

Label the line with the rule  $y = -2x - 1$

**a)** Plot the graph of the linear rule  $y = -x$  on the number plane below by first completing this table of values. [Label the graph with the rule.]

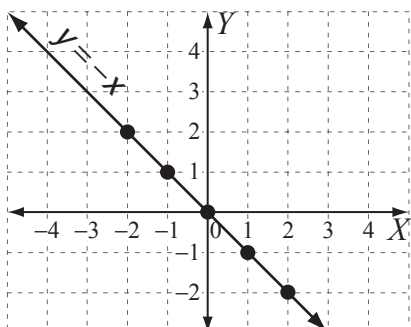
$x = -1 \Rightarrow y = -(-1) = 1 \Rightarrow (-1, 1)$

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

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

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

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



**b)** Plot the graph of the linear rule  $y = x - 4$  on the number plane below by first completing this table of values. [Label the graph with the rule.]

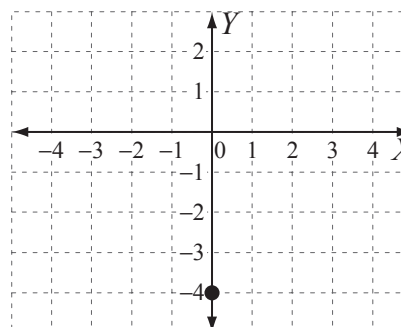
$x = 1 \Rightarrow y = 1 - 4 = -3 \Rightarrow (1, -3)$

$x = 2 \Rightarrow y = \Rightarrow$

$x = 3 \Rightarrow y = \Rightarrow$

$x = 4 \Rightarrow y = \Rightarrow$

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



### Skill 21.5 Plotting linear graphs on a Cartesian plane of the type $y = mx + c$ (e.g. $y = 3x + 2$ ) (2).

MM5.2 11 22 33 44  
MM10 11 22 33 44

- c)** Plot the graph of the linear rule  $y = 2x$  on the number plane below by first completing this table of values. [Label the graph with the rule.]

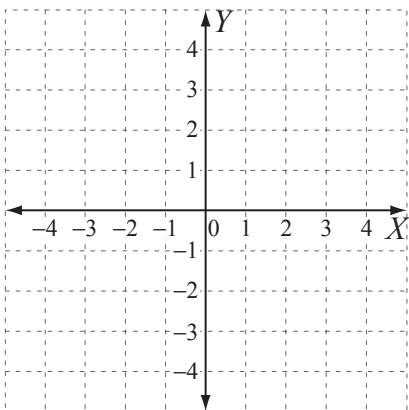
$$x = -1 \Rightarrow y = 2 \times -1 = -2 \Rightarrow (-1, -2)$$

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

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

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

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



- d)** Plot the graph of the linear rule  $y = -x + 5$  on the number plane below by first completing this table of values. [Label the graph with the rule.]

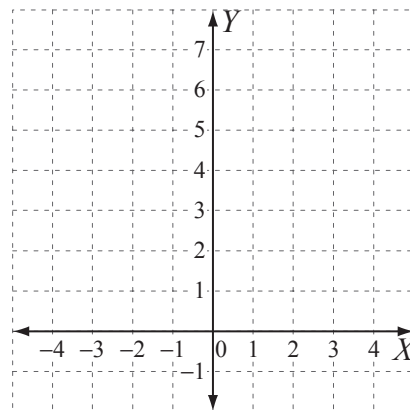
$$x = -1 \Rightarrow y = -(-1) + 5 = 6 \Rightarrow (-1, 6)$$

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

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

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

|     |    |    |   |   |   |
|-----|----|----|---|---|---|
| $x$ | -2 | -1 | 0 | 1 | 2 |
| $y$ | 7  |    |   |   |   |



- e)** Plot the graph of the linear rule  $y = 3x - 2$  on the number plane below by first completing this table of values. [Label the graph with the rule.]

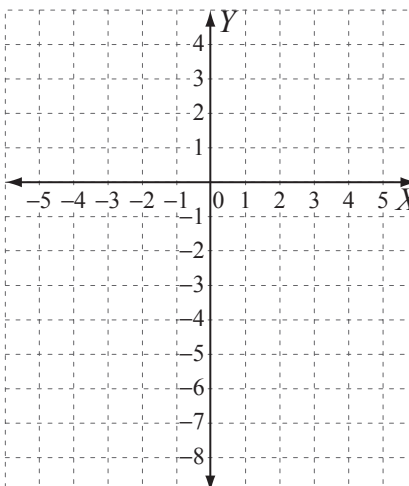
$$x = -1 \Rightarrow y = 3 \times -1 - 2 = -5 \Rightarrow (-1, -5)$$

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

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

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

|     |    |    |   |   |   |
|-----|----|----|---|---|---|
| $x$ | -2 | -1 | 0 | 1 | 2 |
| $y$ | -8 |    |   |   |   |



- f)** Plot the graph of the linear rule  $y = -2x - 3$  on the number plane below by first completing this table of values. [Label the graph with the rule.]

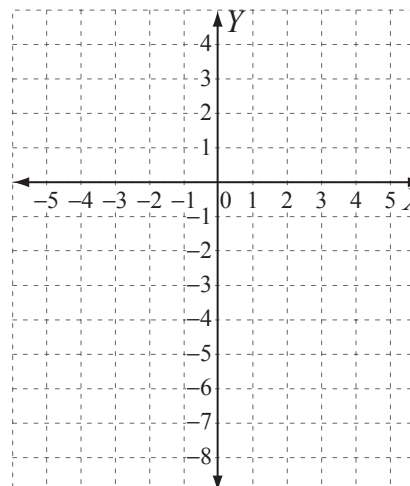
$$x = -1 \Rightarrow y = \quad \Rightarrow$$

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

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

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

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

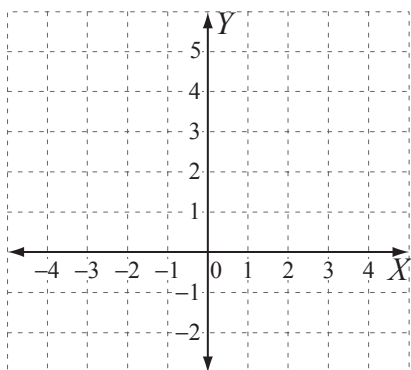


**Skill 21.6** Completing the missing coordinate of a point on a given line (1).

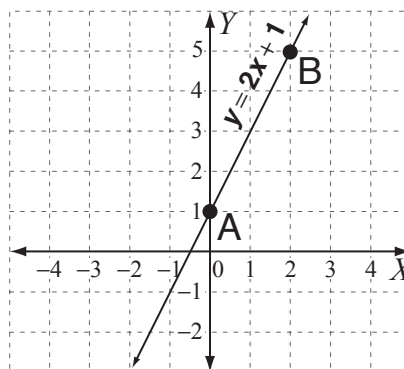
- Substitute the given value for  $x$  and solve the equation for  $y$ . (see skill 21.3, page 221)  
OR
- Substitute the given value for  $y$  into the rule and solve the equation for  $x$ .  
(see skill 20.9, page 215)
- Complete the missing coordinate.
- Plot the points on the graph.

**Q.** Complete the missing coordinates given that A and B lie on the line defined by the rule  $y = 2x + 1$ . Plot the points and draw the line.

A(0, ) , B(, 5)



**A.**  $y = 2x + 1 = 2 \times x + 1$   $2x = 2 \times x$   
 $x = 0 \Rightarrow y = 2 \times 0 + 1$       Substitute  $x = 0$   
 $y = 1$       into the rule.  
 $\Rightarrow A(0, 1)$   
 $y = 5 \Rightarrow 5 = 2 \times x + 1$       Substitute  $y = 5$   
 $5 - 1 = 2x + 1 - 1$       into the rule.  
 $2x = 4$   
 $2x \div 2 = 4 \div 2$       Solve for  $x$ .  
 $x = 2$   
 $\Rightarrow B(2, 5)$



Plot the points A and B. Draw the line by joining A and B.

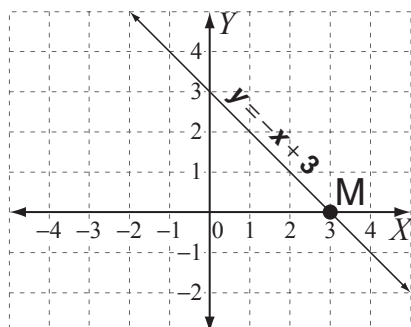
**a)** Complete the missing coordinates given that M, N and P lie on the line defined by the rule  $y = -x + 3$ . Plot the points and draw the line.

M(, 0), N(-1, ) , P(1, )

$y = 0 \Rightarrow -x + 3 = 0 \Rightarrow -x + 3 - 3 = 0 - 3$   
 $\Rightarrow -x = -3 \Rightarrow x = 3 \Rightarrow M(3, 0)$

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

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



**b)** Complete the missing coordinates given that D, E and F lie on the line defined by the rule  $y = 3x - 4$ . Plot the points and draw the line.

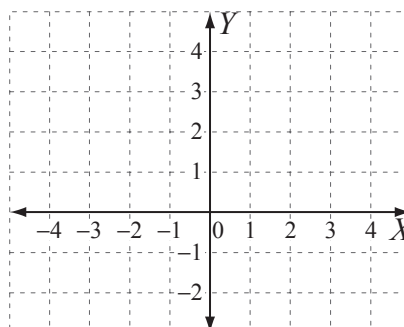
D(, 2), E(1, ) , F( $\frac{2}{3}$ , )

$y = 2 \Rightarrow$

$\Rightarrow$    $\Rightarrow$

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

$x = \frac{2}{3} \Rightarrow y =$    $\Rightarrow$

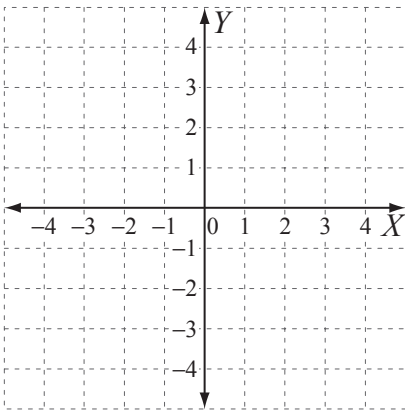


**Skill 21.6** Completing the missing coordinate of a point on a given line (2). MM5.2 1 1 2 2 3 3 4 4  
MM10 1 1 2 2 3 3 4 4

**c)** Complete the missing coordinates given that B, C and D lie on the line defined by the rule  $y = 4x - 5$ . Plot the points and draw the line.

B(0, ) , C(, 3), D(, 1)

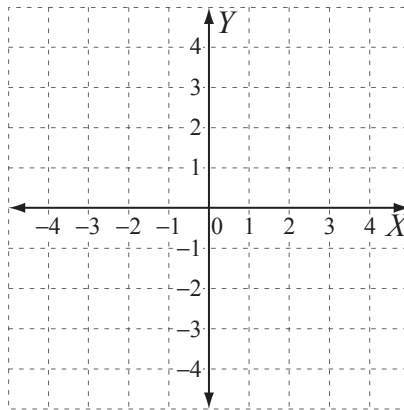
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**d)** Complete the missing coordinates given that S, T and U lie on the line defined by the rule  $y = x + 6$ . Plot the points and draw the line.

S(, 2), T(-2, ) , U(-1, )

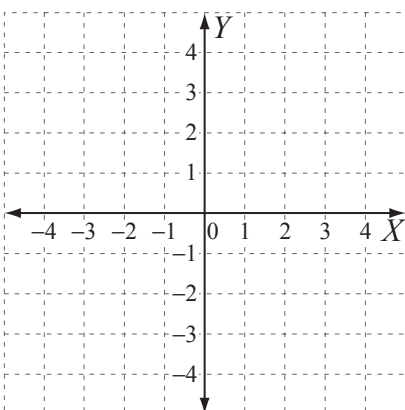
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**e)** Complete the missing coordinates given that G, H and I lie on the line defined by the rule  $y = \frac{1}{4}x + 2$ . Plot the points and draw the line.

G(0, ) , H(-4, ) , I(, 3)

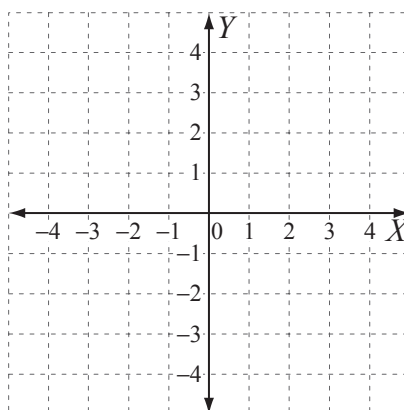
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 .....  
 .....



**f)** Complete the missing coordinates given that A, B and C lie on the line defined by the rule  $y = 2x - \frac{1}{2}$ . Plot the points and draw the line.

A(,  $\frac{3}{2}$ ) , B(2, ) , C(-1, )

.....  
 .....  
 .....



## Skill 21.7 Deciding if a point is on a line of a given rule.

MM5.2 1 1 2 2 3 3 4 4  
MM10 1 1 2 2 3 3 4 4

- Substitute the values of the coordinates  $x$  and  $y$  of the point into the given rule.
- 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 given rule.

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

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

**A.** A)  $y = x \Rightarrow -2 = 1$  (*false*)  
B)  $y = 2x - 3 \Rightarrow -2 = 2 \times 1 - 3$   
 $\Rightarrow -2 = -1$  (*false*)  
C)  $y = 6x - 8 \Rightarrow -2 = 6 \times 1 - 8$   
 $\Rightarrow -2 = -2$  (*true*)

Substitute  
 $x = 1$  and  
 $y = -2$   
into each  
rule.

The answer is **C**.

**a)** Which of these points lies on the line defined by the rule  $y = 4x + 3$ ?

- A  $(-3,0)$   
B  $(2,2)$   
C  $(-1,-1)$

A)  $x = -3, y = 0 \Rightarrow 0 = 4 \times -3 + 3$

$\Rightarrow 0 = -9$  (*false*)

B)  $x = 2, y = 2 \Rightarrow 2 = 4 \times 2 + 3$

$\Rightarrow 2 = 11$  (*false*)

C)  $x = -1, y = -1 \Rightarrow -1 = 4 \times -1 + 3$

$\Rightarrow -1 = -1$  (*true*)

**C**

**b)** Which of these points lies on the line defined by the rule  $y = -2x + 5$ ?

- A  $(3,-3)$   
B  $(-1,7)$   
C  $(0,-2)$

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

$\Rightarrow$

B)  $x = -1, y = 7 \Rightarrow$

$\Rightarrow$

C)  $x = 0, y = -2 \Rightarrow$

$\Rightarrow$

**c)** Which line does the point  $(2,-1)$  lie on?

- 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)** Which line does the point  $(-1,1)$  lie on?

- 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 21.8** Finding the  $x$ -intercept and the  $y$ -intercept of a linear graph (1).

MM5.2 11 22 3 44  
MM10 11 22 33 44

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

**Q.** Find the  $x$ -intercept and the  $y$ -intercept for the linear rule  $2x - 5y = 10$  [Hint: Let  $y = 0$  in the rule.]

**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 linear rule  $y = -3x + 6$   
 [Hint: Let  $y = 0$  in the rule.]

$y = 0 \Rightarrow 0 = -3x + 6$   
 .....  
 $0 - 6 = -3x + 6 - 6$   
 .....  
 $-3x = -6$   
 .....  
 $-3x \div -3 = -6 \div -3$   
 .....  
 $x = 2 \Rightarrow x$ -intercept is **(2,0)**

**b)** Find the  $x$ -intercept of the graph defined by the linear rule  $y = 2x + 8$   
 [Hint: Let  $y = 0$  in the rule.]

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

**c)** Find the  $y$ -intercept of the graph defined by the linear rule  $y = 7x - 3$   
 [Hint: Let  $x = 0$  in the rule.]

$x = 0 \Rightarrow y = 0 - 3$   
 .....  
 $\Rightarrow y = -3 \Rightarrow y$ -intercept is

**d)** Find the  $y$ -intercept of the graph defined by the linear rule  $y = -5x + 4$   
 [Hint: Let  $x = 0$  in the rule.]

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

**e)** Find the  $x$ -intercept for the linear rule  $3x - 2y = -12$   
 .....  
 .....  
 .....  
 $\Rightarrow x$ -intercept is

**f)** Find the  $y$ -intercept for the linear rule  $4y - x = 16$   
 .....  
 .....  
 .....  
 $\Rightarrow y$ -intercept is

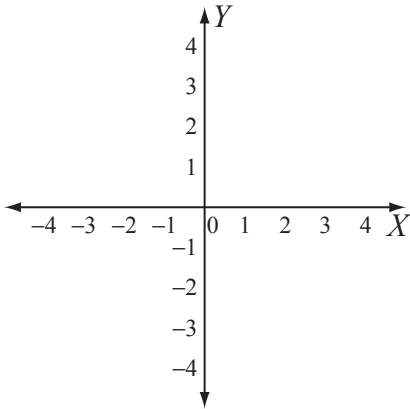


**Skill 21.9** Sketching a linear graph by finding the  $x$ -intercept and the  $y$ -intercept (1).

MM5.2 11 22 33 44  
MM10 11 22 33 44

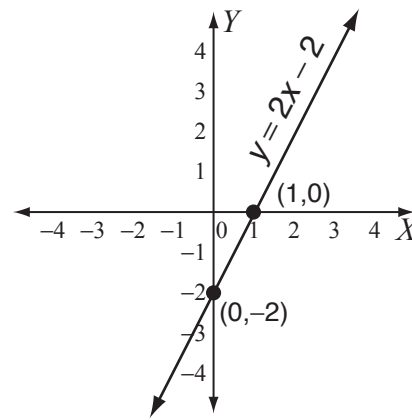
- Find the  $x$ -intercept and the  $y$ -intercept. (see skill 21.8, page 228)
- Mark each intercept point on the Cartesian plane. (see skill 21.2, page 220)
- Draw the line that joins these points.
- Label the line with the rule.

**Q.** Sketch the graph of the linear rule  $y = 2x - 2$  by first finding the  $x$ -intercept and the  $y$ -intercept on this Cartesian plane.  
[Label the graph with the rule.]



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

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



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

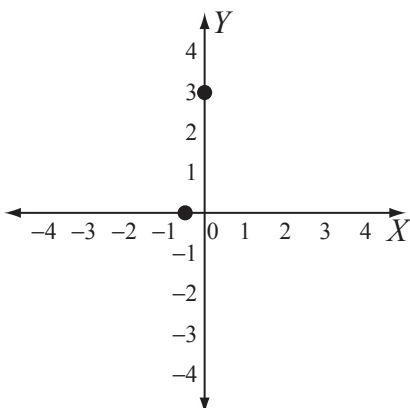
**a)** Sketch the graph of the linear rule  $y = 6x + 3$  by first finding the  $x$ -intercept and the  $y$ -intercept on this Cartesian plane.  
[Label the graph with the rule.]

$y = 0 \Rightarrow 6x + 3 = 0 \Rightarrow 6x = -3 \Rightarrow x = -\frac{1}{2}$

$\Rightarrow x$ -intercept is  $(-\frac{1}{2}, 0)$

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

$\Rightarrow y$ -intercept is  $(0, 3)$



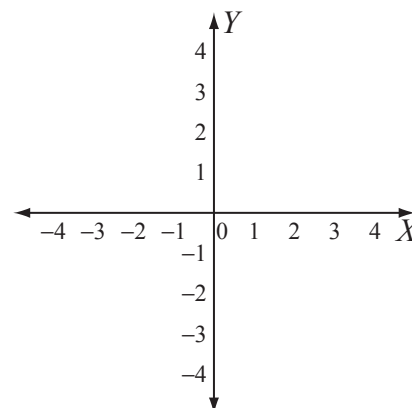
**b)** Sketch the graph of the linear rule  $y = -3x + 4$  by first finding the  $x$ -intercept and the  $y$ -intercept on this Cartesian plane.  
[Label the graph with the rule.]

$y = 0 \Rightarrow$

$\Rightarrow x$ -intercept is

$x = 0 \Rightarrow$

$\Rightarrow y$ -intercept is



**Skill 21.9** Sketching a linear graph by finding the  $x$ -intercept and the  $y$ -intercept (2).

- c)** Sketch the graph of the linear rule  $y = -x - 5$  by first finding the  $x$ -intercept and the  $y$ -intercept on this Cartesian plane.

$$y = 0 \Rightarrow$$

.....

$\Rightarrow x$ -intercept is

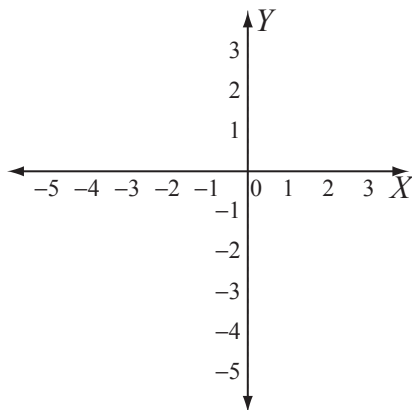
.....

$$x = 0 \Rightarrow$$

.....

$\Rightarrow y$ -intercept is

.....



- d)** Sketch the graph of the linear rule  $y = 9x - 3$  by first finding the  $x$ -intercept and the  $y$ -intercept on this Cartesian plane.

$$y = 0 \Rightarrow$$

.....

$\Rightarrow x$ -intercept is

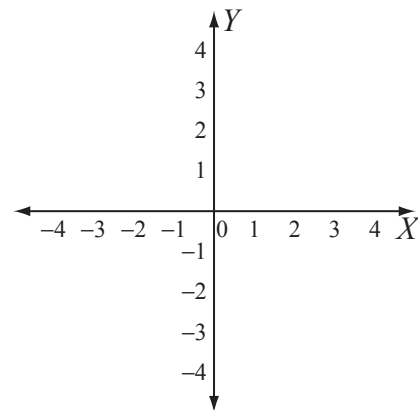
.....

$$x = 0 \Rightarrow$$

.....

$\Rightarrow y$ -intercept is

.....



- e)** Sketch the graph of the linear rule  $y = -4x - 2$  by first finding the  $x$ -intercept and the  $y$ -intercept on this Cartesian plane.

$$y = 0 \Rightarrow$$

.....

$\Rightarrow x$ -intercept is

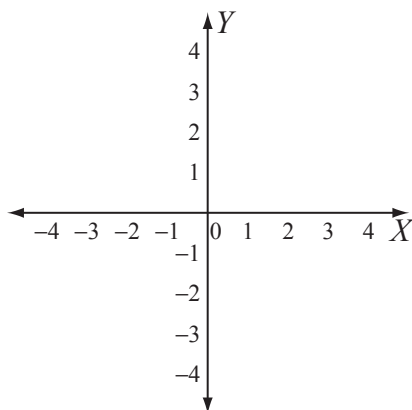
.....

$$x = 0 \Rightarrow$$

.....

$\Rightarrow y$ -intercept is

.....



- f)** Sketch the graph of the linear rule  $y = -2x + 4$  by first finding the  $x$ -intercept and the  $y$ -intercept on this Cartesian plane.

$$y = 0 \Rightarrow$$

.....

$\Rightarrow x$ -intercept is

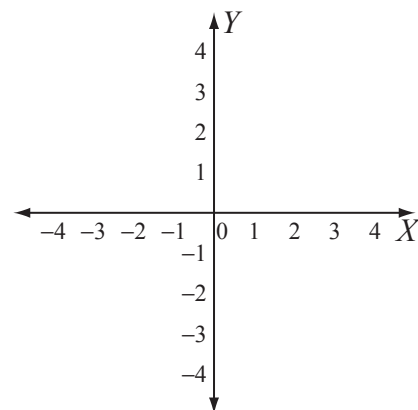
.....

$$x = 0 \Rightarrow$$

.....

$\Rightarrow y$ -intercept is

.....

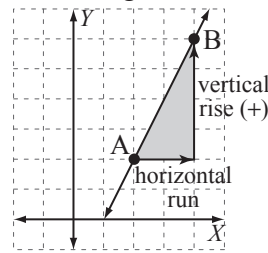


**Skill 21.10** Finding the gradient of a linear graph (1).

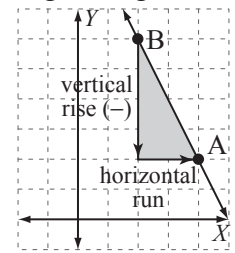
MM5.2 11 22 33 44  
MM10 11 22 33 44

- Choose two convenient points on the graph and draw a right-angled 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.

Positive gradient



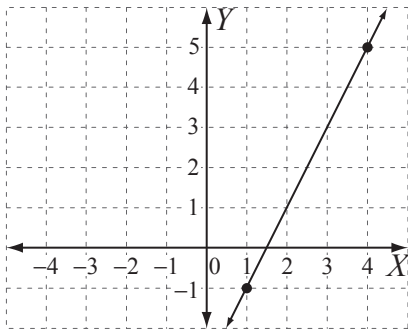
Negative gradient



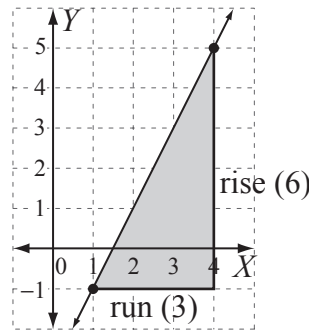
**Hints:** The gradient gives an indication of how steep a line is.  
The gradient is positive if the graph rises from left to right.  
The gradient is negative if the graph falls from left to right.

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

**Q.** Find the gradient of the graph by measuring the vertical rise and the horizontal run.



**A.**



Draw a right-angled triangle.

Measure the rise and run.

$$\begin{aligned} \text{rise} &= 6 \\ \text{run} &= 3 \\ \text{gradient} &= \frac{\text{rise}}{\text{run}} = \frac{6}{3} = 2 \end{aligned}$$

**a)** Find the gradient of the graph by measuring the vertical rise and the horizontal run.

rise = -8

run = 2

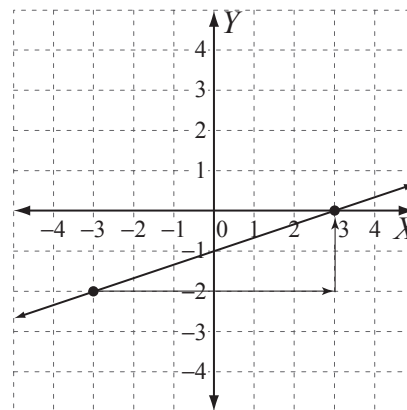
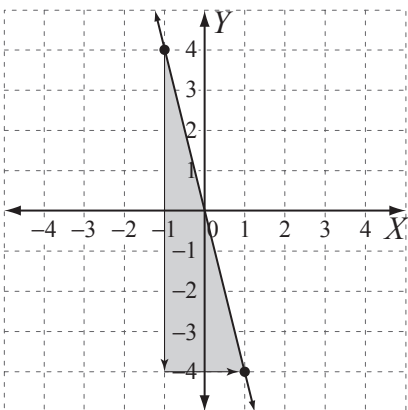
gradient =  $\frac{\text{rise}}{\text{run}} = -\frac{8}{2} =$

**b)** Find the gradient of the graph by measuring the vertical rise and the horizontal run.

rise = 2

run = 6

gradient =  $\frac{\text{rise}}{\text{run}} =$   =

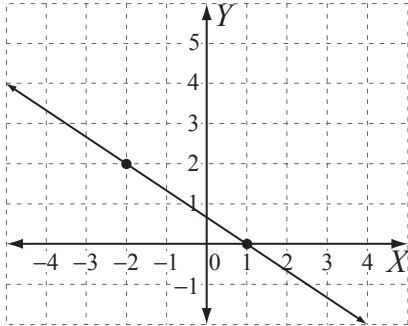


**Skill 21.10** Finding the gradient of a linear graph (2).

- c)** Find the gradient of the graph by measuring the vertical rise and the horizontal run.

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

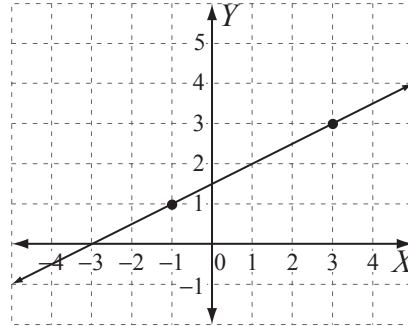
$gradient = \frac{rise}{run} = \frac{\quad}{\quad} = \boxed{\quad}$



- d)** Find the gradient of the graph by measuring the vertical rise and the horizontal run.

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

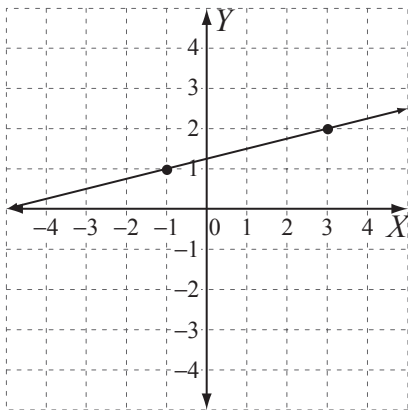
$gradient = \frac{rise}{run} = \frac{\quad}{\quad} = \boxed{\quad}$



- e)** Find the gradient of the graph by measuring the vertical rise and the horizontal run.

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

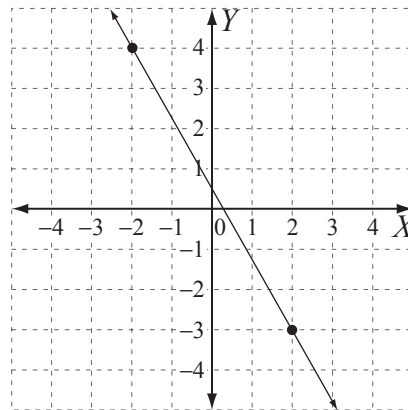
$gradient = \frac{rise}{run} = \frac{\quad}{\quad} = \boxed{\quad}$



- f)** Find the gradient of the graph by measuring the vertical rise and the horizontal run.

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

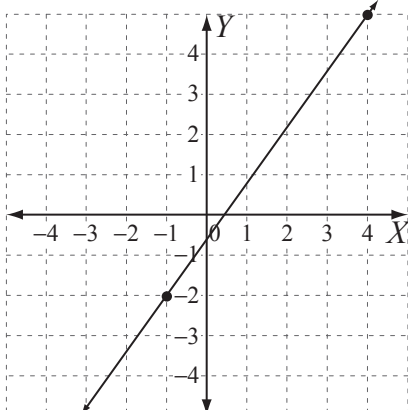
$gradient = \frac{rise}{run} = \frac{\quad}{\quad} = \boxed{\quad}$



- g)** Find the gradient of the graph by measuring the vertical rise and the horizontal run.

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

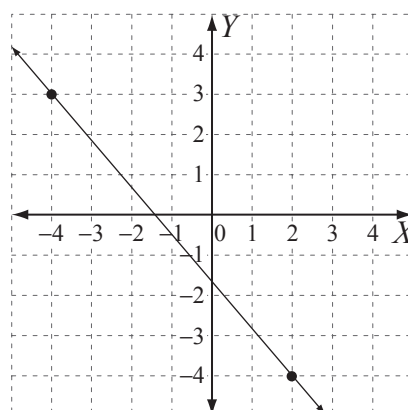
$gradient = \frac{rise}{run} = \frac{\quad}{\quad} = \boxed{\quad}$



- h)** Find the gradient of the graph by measuring the vertical rise and the horizontal run.

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

$gradient = \frac{rise}{run} = \frac{\quad}{\quad} = \boxed{\quad}$



**Skill 21.11** Rewriting a linear function in the general form  $y = mx + c$ , where  $m$  is the gradient and  $c$  is the  $y$ -intercept of the graph.

- 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 general form of a linear function (rule) is  $y = mx + c$

The coefficient of  $x$  is the gradient of the graph ( $m$ ).

The number that is not attached to either  $x$  or  $y$  is the  $y$ -intercept ( $c$ ).

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

**A.**  $-x + 2y = -3$

$$-x + x + 2y = -3 + x$$

$$2y = x - 3$$

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

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

**a)** Rewrite the linear function  $5 - y = 4x$  in the general form  $y = mx + c$ , where  $m$  represents the gradient and  $c$  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 function  $x - 5y = 5$  in the general form  $y = mx + c$ , where  $m$  represents the gradient and  $c$  the  $y$ -intercept.

$$\boxed{y =}$$

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

$$\boxed{y =}$$

**d)** Rewrite the linear function  $4x - 2y = 3$  in the general form  $y = mx + c$ , where  $m$  represents the gradient and  $c$  the  $y$ -intercept.

$$\boxed{y =}$$

**e)** Rewrite the linear function  $-2x - y = 6$  in the general form  $y = mx + c$ , where  $m$  represents the gradient and  $c$  the  $y$ -intercept.

$$\boxed{y =}$$

**f)** Rewrite the linear function  $3x + 4y = 12$  in the general form  $y = mx + c$ , where  $m$  represents the gradient and  $c$  the  $y$ -intercept.

$$\boxed{y =}$$

**Skill 21.12** Finding the gradient, the x-intercept and the y-intercept of a linear function written in the general form  $y = mx + c$  (1).

- Make sure the linear function in the table is written in general form  $y = mx + c$  (see skill 21.11, page 234)
- Identify the gradient ( $m$ ) of the linear function as the coefficient of  $x$ .
- Identify the y-intercept of the linear function as the constant ( $c$ ).
- Find the x-intercept of the function. (see skill 21.8, page 228)
- Fill in the table.

**Q.** Complete the following table:

| function       | gradient ( $m$ ) | x-intercept | y-intercept ( $c$ ) |
|----------------|------------------|-------------|---------------------|
| $y = -2x - 10$ |                  |             |                     |

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

$$y = -2x - 10$$

$$y = mx + c \Rightarrow m = -2 \text{ (gradient)}$$

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

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  $(-5, 0)$

| function       | gradient ( $m$ ) | x-intercept | y-intercept ( $c$ ) |
|----------------|------------------|-------------|---------------------|
| $y = -2x - 10$ | -2               | $(-5, 0)$   | $(0, -10)$          |

**a)** Complete the following table:

| function     | gradient ( $m$ ) | x-intercept | y-intercept ( $c$ ) |
|--------------|------------------|-------------|---------------------|
| $y = 2x - 6$ | 2                | $(3, 0)$    | $(0, -6)$           |

$$y = 2x - 6$$

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

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

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

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

$$2x = 6$$

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

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

**b)** Complete the following table:

| function     | gradient ( $m$ ) | x-intercept | y-intercept ( $c$ ) |
|--------------|------------------|-------------|---------------------|
| $y = -x + 5$ |                  |             |                     |

$$y = -x + 5$$

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

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

$$y = 0 \Rightarrow$$

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

**Skill 21.12** Finding the gradient, the  $x$ -intercept and the  $y$ -intercept of a linear function written in the general form  $y = mx + c$  (2).

 MM5.2 11 22 33 44  
 MM10 11 22 33 44

**c)** Complete the following table:

| function               | gradient ( $m$ ) | $x$ -intercept | $y$ -intercept ( $c$ ) |
|------------------------|------------------|----------------|------------------------|
| $y = \frac{1}{3}x - 2$ |                  |                |                        |

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

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

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

$$y = 0 \Rightarrow$$

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

**d)** Complete the following table:

| function               | gradient ( $m$ ) | $x$ -intercept | $y$ -intercept ( $c$ ) |
|------------------------|------------------|----------------|------------------------|
| $y = \frac{2}{5}x + 4$ |                  |                |                        |

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

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

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

$$y = 0 \Rightarrow$$

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

**e)** Complete the following table:

| function     | gradient ( $m$ ) | $x$ -intercept | $y$ -intercept ( $c$ ) |
|--------------|------------------|----------------|------------------------|
| $y = 5x + 3$ |                  |                |                        |

$$y = 5x + 3$$

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

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

$$y = 0 \Rightarrow$$

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

**f)** Complete the following table:

| function      | gradient ( $m$ ) | $x$ -intercept | $y$ -intercept ( $c$ ) |
|---------------|------------------|----------------|------------------------|
| $y = -2x + 1$ |                  |                |                        |

$$y = -2x + 1$$

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

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

$$y = 0 \Rightarrow$$

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

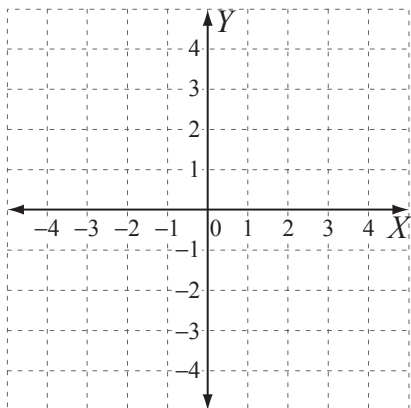
**Skill 21.13** Solving simultaneous linear equations by sketching the graphs of both equations on a Cartesian plane (1).

- Sketch the linear equations by finding the x-intercept and the y-intercept on the same Cartesian plane. (see skill 21.9, page 230)

OR

- Sketch the linear equations by finding two convenient points that belong to each equation.
- Mark the solution of the simultaneous equations as the intersection point of the two graphs.

**Q.** Solve the simultaneous equations  $3x + 4y = -10$  and  $5x - 2y = 18$  by sketching their graphs on this Cartesian plane.



**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

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

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

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

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

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

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

$$y = -9$$

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

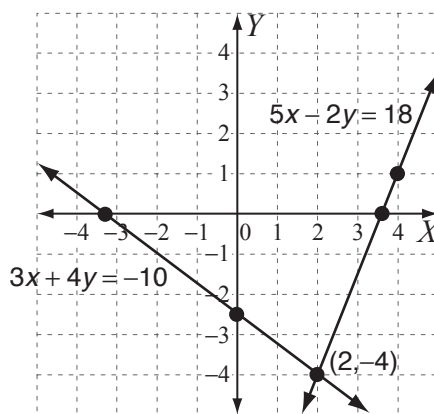
*-9 is too big, so choose a different point:*

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

$$-2y \div -2 = -2 \div -2$$

$$y = 1$$

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



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

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

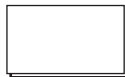
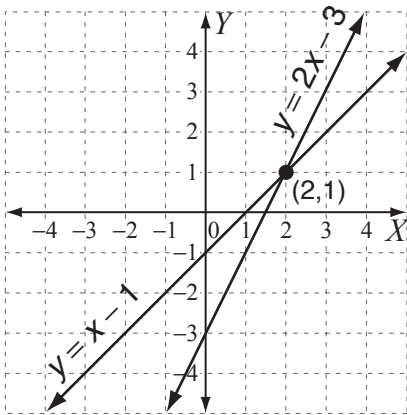
**Skill 21.13** Solving simultaneous linear equations by sketching the graphs of both equations on a Cartesian plane (2).

MM5.2 11 22 33 44  
MM10 11 22 33 44

**a)** Solve the simultaneous equations  $y = x - 1$  and  $y = 2x - 3$  by sketching their graphs on this Cartesian plane.

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

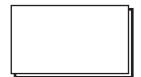
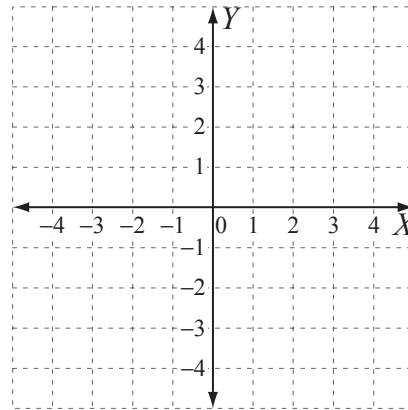
Equation 2  $y = 0 \Rightarrow 2x - 3 = 0 \Rightarrow x = \frac{3}{2} \Rightarrow (\frac{3}{2}, 0)$   
 $x = 0 \Rightarrow y = 0 - 3 = -3 \Rightarrow (0, -3)$



**b)** Solve the simultaneous equations  $y = 3x + 1$  and  $x + 1 = 0$  by sketching their graphs on this Cartesian plane.

Equation 1  $y = 0 \Rightarrow$   
 $x = 0 \Rightarrow$

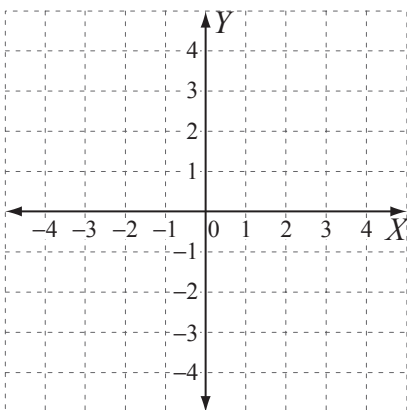
Equation 2  $\Rightarrow$   
 $\Rightarrow$



**c)** Solve the simultaneous equations  $x + y = 4$  and  $2x + y = 6$  by sketching their graphs on this Cartesian plane.

Equation 1  $\Rightarrow$   
 $\Rightarrow$

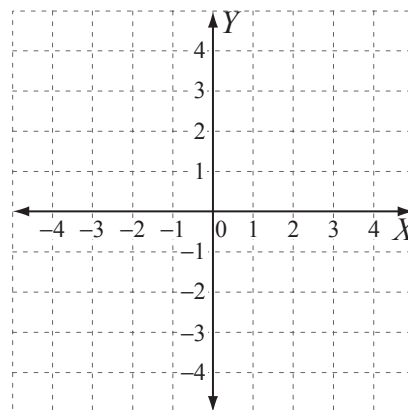
Equation 2  $\Rightarrow$   
 $\Rightarrow$



**d)** Solve the simultaneous equations  $2x + y = 3$  and  $x - 2y = 4$  by sketching their graphs on this Cartesian plane.

Equation 1  $\Rightarrow$   
 $\Rightarrow$

Equation 2  $\Rightarrow$   
 $\Rightarrow$



**Skill 21.14** Finding the gradient 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 gradient of a linear graph.
- Substitute the values of  $x_1$ ,  $x_2$ ,  $y_1$  and  $y_2$  into the formula.
- Simplify and evaluate the value of  $m$ .

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

**Q.** Use the formula  $m = \frac{y_2 - y_1}{x_2 - x_1}$  to find the gradient of the line joining the points  $(6, -2)$  and  $(-2, 4)$ .

**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  $y_2 = 4$

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{4 - (-2)}{-2 - 6} = \frac{4 - (-2)}{-2 - 6} = \frac{6}{-8} = -\frac{3}{4}$$

Simplify:  $\div 2$

**a)** Use the formula  $m = \frac{y_2 - y_1}{x_2 - x_1}$  to find the gradient of the line joining the points  $(-1, 3)$  and  $(2, 0)$ .

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

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

**b)** Use the formula  $m = \frac{y_2 - y_1}{x_2 - x_1}$  to find the gradient of the line joining the points  $(2, 1)$  and  $(-2, -7)$ .

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

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

**c)** Use the formula  $m = \frac{y_2 - y_1}{x_2 - x_1}$  to find the gradient of the line joining the points  $(1, -1)$  and  $(3, 3)$ .

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

**d)** Use the formula  $m = \frac{y_2 - y_1}{x_2 - x_1}$  to find the gradient of the line joining the points  $(3, -1)$  and  $(-1, -2)$ .

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

**e)** Use the formula  $m = \frac{y_2 - y_1}{x_2 - x_1}$  to find the gradient of the line joining the points  $(0, 3)$  and  $(-6, 0)$ .

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

**f)** Use the formula  $m = \frac{y_2 - y_1}{x_2 - x_1}$  to find the gradient of the line joining the points  $(-4, 1)$  and  $(2, -1)$ .

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

**g)** Use the formula  $m = \frac{y_2 - y_1}{x_2 - x_1}$  to find the gradient of the line joining the points  $(3, -1)$  and  $(1, 2)$ .

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

**h)** Use the formula  $m = \frac{y_2 - y_1}{x_2 - x_1}$  to find the gradient of the line joining the points  $(-4, 0)$  and  $(-1, 5)$ .

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

**Skill 21.15** Writing the equation of a straight line when two points are given (1).

MM5.2 11 22 33 44  
MM10 11 22 33 44

- Identify  $(x_1, y_1)$  and  $(x_2, y_2)$  as the coordinates of the given points.
- Find the gradient of the line joining the two points. (see skill 21.14, page 239)
- Write the equation  $y - y_1 = m(x - x_1)$  of a straight line.
- 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

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

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

**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  $y_2 = -1$

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

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

$$= \frac{-3}{7}$$

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

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

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

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

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

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

**a)** Find the equation of the line joining the points  $(7, 0)$  and  $(-1, 8)$  using the formula

$$y - y_1 = m(x - x_1) \text{ where } m = \frac{y_2 - y_1}{x_2 - x_1}$$

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

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

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

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

$$y = -1 \times x - 1 \times 7$$

$$y = -x + 7$$

**b)** Find the equation of the line joining the points  $(-4, 5)$  and  $(-3, 7)$  using the formula

$$y - y_1 = m(x - x_1) \text{ where } m = \frac{y_2 - y_1}{x_2 - x_1}$$

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

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

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

$$y =$$

**Skill 21.15** Writing the equation of a straight line when two points are given (2).

- c)**
- Find the equation of the line joining the points (1,5) and (3,11) using the formula

$$y - y_1 = m(x - x_1) \text{ where } m = \frac{y_2 - y_1}{x_2 - x_1}$$

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

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

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

$$y =$$

- d)**
- Find the equation of the line joining the points (1,-3) and (-4,-2) using the formula

$$y - y_1 = m(x - x_1) \text{ where } m = \frac{y_2 - y_1}{x_2 - x_1}$$

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

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

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

$$y =$$

- e)**
- Find the equation of the line joining the points (4,-3) and (-4,5) using the formula

$$y - y_1 = m(x - x_1) \text{ where } m = \frac{y_2 - y_1}{x_2 - x_1}$$

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

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

$$y =$$

- f)**
- Find the equation of the line joining the points (-6,2) and (-2,-2) using the formula

$$y - y_1 = m(x - x_1) \text{ where } m = \frac{y_2 - y_1}{x_2 - x_1}$$

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

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

$$y =$$

- g)**
- Find the equation of the line joining the points (3,0) and (-1,5) using the formula

$$y - y_1 = m(x - x_1) \text{ where } m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$x_1 = \quad$$

$$y =$$

- h)**
- Find the equation of the line joining the points (2,-4) and (0,-1) using the formula

$$y - y_1 = m(x - x_1) \text{ where } m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$x_1 = \quad$$

$$y =$$

**Skill 21.16** Completing a table of values for a non-linear function.

MM5.2 11 22 33 44  
MM10 11 22 33 44

- Substitute the variable  $x$  with the given values.
- Solve the equation for  $y$ .
- Use the order of operations rules: Multiply ( $\times$ ) and/or divide ( $\div$ ) from left to right.  
Add ( $+$ ) and/or subtract ( $-$ ) from left to right.
- Use the sign rules:  $++=+$   $--=+$   $+--=-$   $-+-=-$  (see skill 9.1, page 91)
- Complete the table of values for the non-linear function.

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

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

**A.**  $y = x^2 - 3 = x \times x - 3$

$x^2 = x \times x$

$x = -1 \Rightarrow y = -1 \times -1 - 3 = 1 - 3 \Rightarrow y = -2$

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

$x = 1 \Rightarrow y = 1 \times 1 - 3 = 1 - 3 \Rightarrow y = -2$

$x = 2 \Rightarrow y = 2 \times 2 - 3 = 4 - 3 \Rightarrow y = 1$

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

Complete the table of values.

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

$x = -1 \Rightarrow y = 2 \times -1 \times -1 = -2 \times -1 \Rightarrow y = 2$

$x = 0 \Rightarrow y = 2 \times 0 \times 0 = 2 \times 0 \Rightarrow y = 0$

$x = 1 \Rightarrow y = 2 \times 1 \times 1 = 2 \times 1 \Rightarrow y = 2$

$x = 2 \Rightarrow y = 2 \times 2 \times 2 = 4 \times 2 \Rightarrow y = 8$

|         |        |       |       |       |       |
|---------|--------|-------|-------|-------|-------|
| $x$     | -2     | -1    | 0     | 1     | 2     |
| $y$     | 8      |       |       |       |       |
| $(x,y)$ | (-2,8) | ( , ) | ( , ) | ( , ) | ( , ) |

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

$x = -1 \Rightarrow y = -1 \times -1 + 4 = 1 + 4 \Rightarrow y = 5$

$x = 0 \Rightarrow y = \Rightarrow$

$x = 1 \Rightarrow y = \Rightarrow$

$x = 2 \Rightarrow y = \Rightarrow$

|         |        |       |       |       |       |
|---------|--------|-------|-------|-------|-------|
| $x$     | -2     | -1    | 0     | 1     | 2     |
| $y$     | 8      |       |       |       |       |
| $(x,y)$ | (-2,8) | ( , ) | ( , ) | ( , ) | ( , ) |

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

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

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

$x = 1 \Rightarrow y = \Rightarrow$

$x = 2 \Rightarrow y = \Rightarrow$

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

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

$x = -1 \Rightarrow y = 5^{-1} \Rightarrow y = \frac{1}{5}$

$x = 0 \Rightarrow y = \Rightarrow$

$x = 1 \Rightarrow y = \Rightarrow$

$x = 2 \Rightarrow y = \Rightarrow$

|     |                |    |   |   |   |
|-----|----------------|----|---|---|---|
| $x$ | -2             | -1 | 0 | 1 | 2 |
| $y$ | $\frac{1}{25}$ |    |   |   |   |