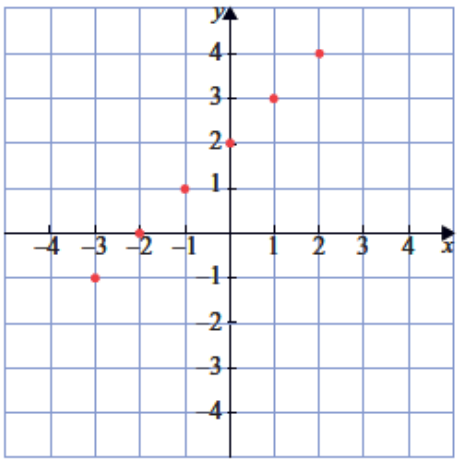
in english, please !

Sets or groups of points often have rules that relate the x and y values in each coordinate pair (x, y).

Example

List the coordinates of each of the plotted points and then write down the rule that relates y to x:

a



Solution

The coordinates of the plotted points are $(-3, -1)$, $(-2, 0)$, $(-1, 1)$, $(0, 2)$, $(1, 3)$, $(2, 4)$.

In each pair (x, y), the y value is 2 more than the x value, so we write $y = x + 2$. This is the rule for working out the y value in each pair, given the x value.

A **linear relation** is a set of points that when plotted fall on a straight line.

Often the graph of a linear relation is drawn starting from the rule that relates the x and y values in each coordinate pair.

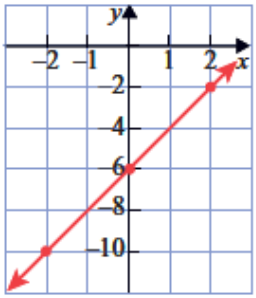
Example

Plot the graph of:

a $y = 2x - 6$ b $y = -3x + 5$

Solution

a



$y = 2x - 6$

We need to determine the coordinates of a few points—at least two in order to draw the line accurately.

Choosing $x = -2, 0, 2$, for example, we find the corresponding y values:

$x = -2$ $y = 2 \times -2 - 6 = -4 - 6 = -10$
Plot $(-2, 10)$.

$x = 0$ $y = 2 \times 0 - 6 = 0 - 6 = -6$
Plot $(0, -6)$.

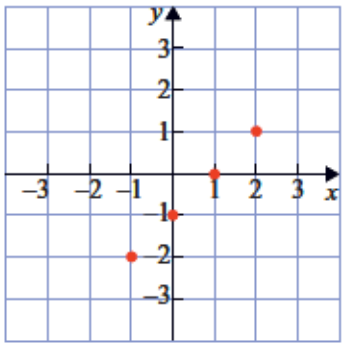
$x = 2$ $y = 2 \times 2 - 6 = 4 - 6 = -2$
Plot $(2, -2)$.

We draw a line through the points and extend it in both directions, with arrows at the ends to show the line can continue.

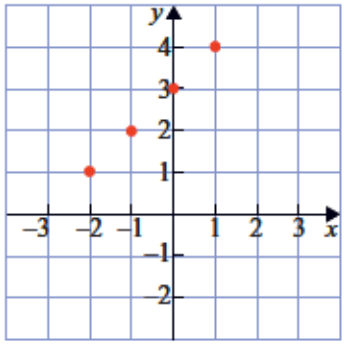
A. exercises

1 List the coordinates of each of the plotted points and then write down the rule that relates y to x:

a

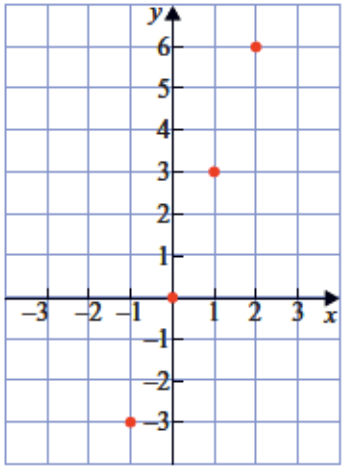


b

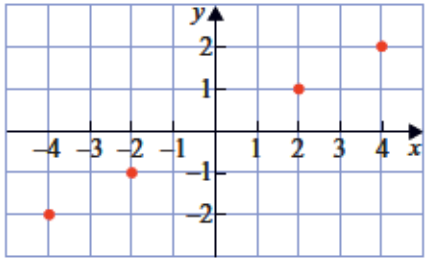


2 List the coordinates of each of the plotted points and then write down the rule that relates y to x:

a

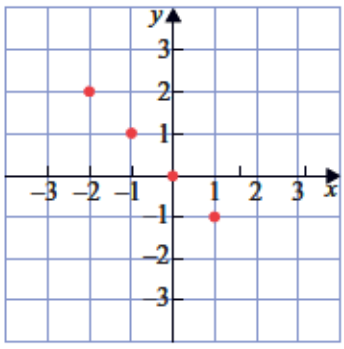


b

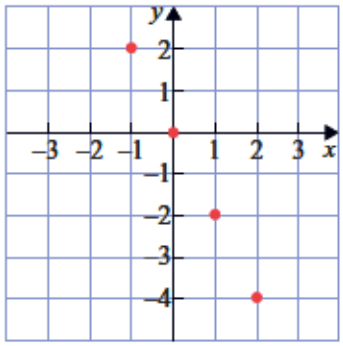


3 List the coordinates of each of the plotted points and then write down the rule that relates y to x:

a



b



B. EXERCISES

Complete the following tables using the given rules, then plot the points on a Cartesian plane and join the plots with a straight line, extending the line in each direction:

a $y = 2x + 4$

x	-1	0	1	2
y				

b $y = 3x - 2$

x	-1	0	1	2
y				

c $y = -x + 3$

x	-2	-1	0	1
y				

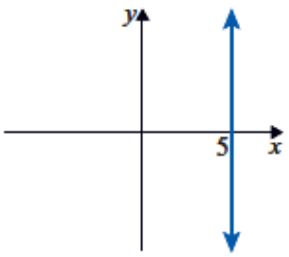
d $y = -2x - 5$

x	-1	0	1	2
y				

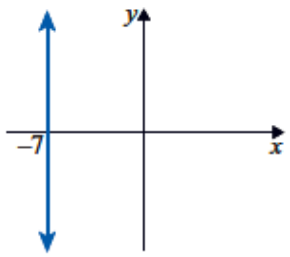
C. EXERCISES

1 Write down the equations for each of the following lines:

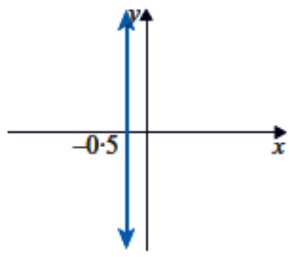
a



b

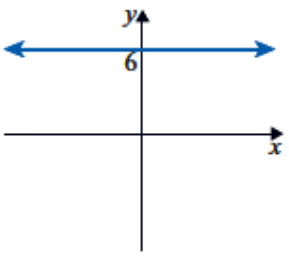


c

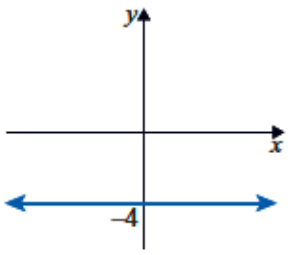


2 Write down the equations for each of the following lines:

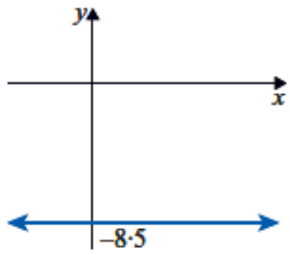
a



b



c



3 On a set of axes of your own, sketch the graphs of the straight lines with equations:

a $x = 10$ **b** $x = -2$ **c** $x = 0{\cdot}25$ **d** $x = 0$

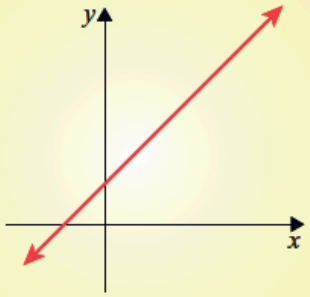
4 On a set of axes of your own, sketch the graphs of the straight lines with equations:

a $y = 8$ **b** $y = -4$ **c** $y = -0{\cdot}25$ **d** $y = 0$

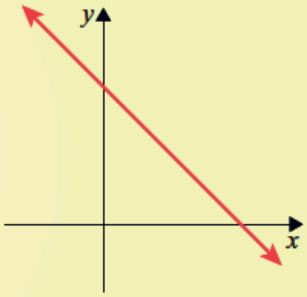
The **gradient** or steepness of a straight line is the rate at which the line rises or falls. It can be calculated by dividing the **rise** (the difference in y values) by the **run** (the difference in x values) between two convenient points on the line. The symbol m is commonly used to represent the gradient of a straight line.

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

$$m = \frac{\text{difference in } y \text{ values}}{\text{difference in } x \text{ values}}$$



gradient is positive

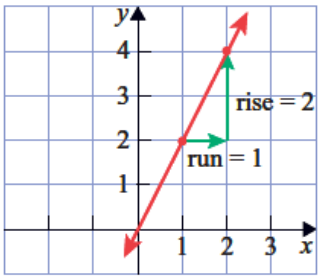


gradient is negative

Example

1 Find the gradient of the line passing through the points (1, 2) and (2, 4).

Solution



The gradient is m.

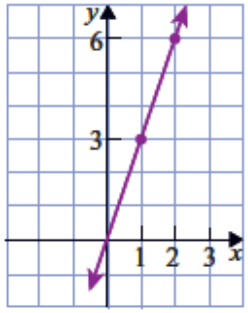
$$m = \frac{\text{rise}}{\text{run}} = \frac{2}{1} = 2$$

Note that the gradient is positive, as the line slopes 'uphill' to the right.

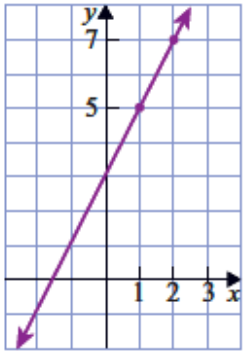
D. EXERCISE

1 Find the gradients of the following lines:

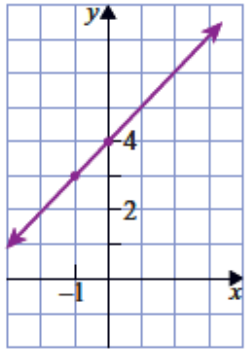
a



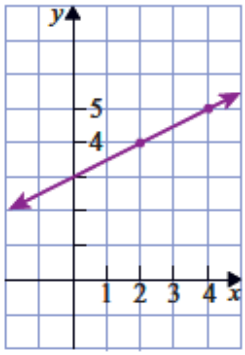
b



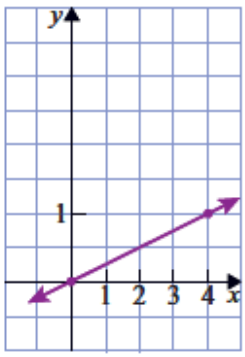
c



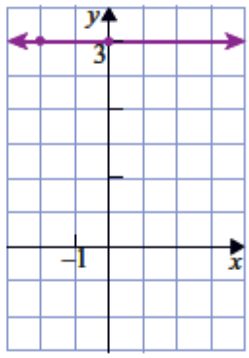
d



e

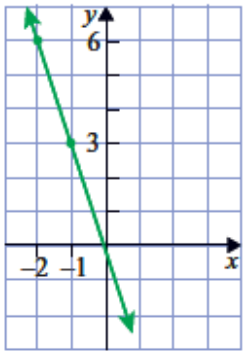


f

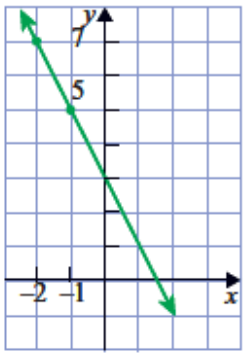


2 Find the gradients of the following lines:

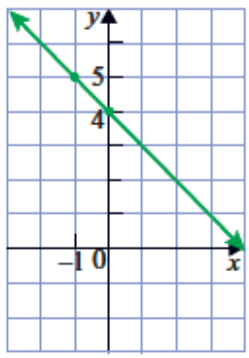
a



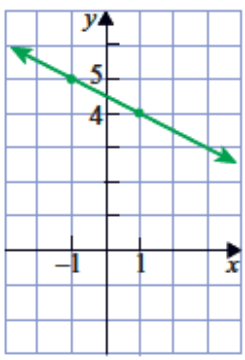
b



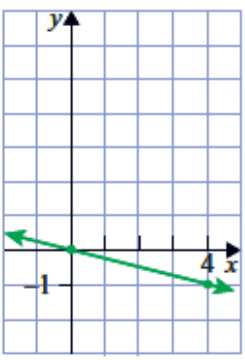
c



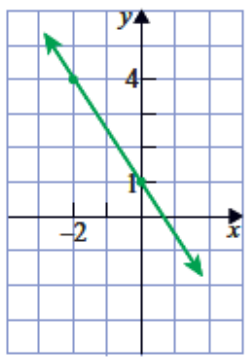
d



e



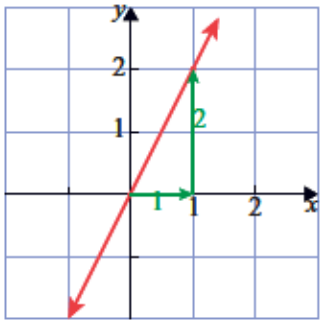
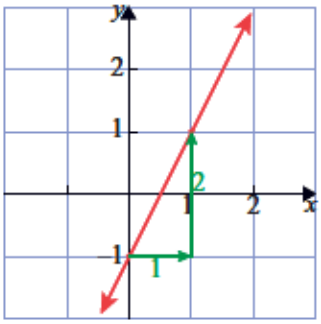
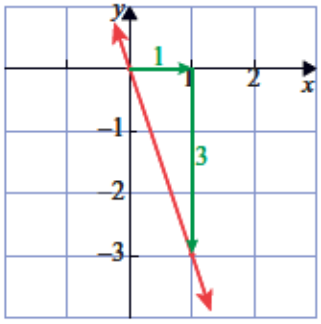
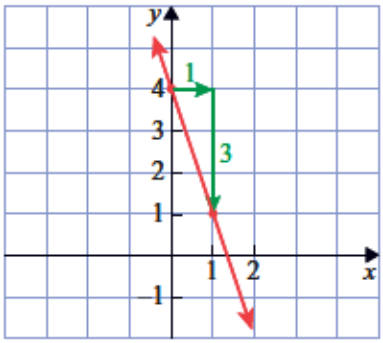
f



The general equation for a straight line is $y = mx + c$.

- m is the gradient of the line.
- c is the y-intercept.

Lines in the form of $y = mx + c$ can be sketched using the gradient and y-intercept method.

Example	Solution
1 Sketch $y = 2x$.	$m = 2$ and $c = 0$ To graph the line, start at zero on the y-axis (because $c = 0$), run forward one step, rise two steps, (because $m = 2$) and then draw a line through the two coordinate points. 
2 Sketch $y = 2x - 1$.	$m = 2$ and $c = -1$ To graph the line, start at -1 on the y-axis, run forward one step, rise two steps and then draw a line through the two coordinate points. 
3 Sketch $y = -3x$.	$m = -3$ and $c = 0$ To graph the line, start at zero on the y-axis, run forward one step, drop three steps and then draw a line through the two coordinate points. 
4 Sketch $y = -3x + 4$.	$m = -3$ and $c = 4$ To graph the line, start at 4 on the y-axis, run forward one step, drop three steps and then draw a line through the two coordinate points. 

E. EXERCISES

Sketch the line that has:

a a gradient of 4 and a y-intercept of -1

b a gradient of -1 and a y-intercept of 2

c a gradient of 7 and a y-intercept of zero

d a gradient of -3 and a y-intercept of -1

State the gradient, m, and the y-intercept, c, and then sketch each line:

a $y = 2x - 9$ **b** $y = 5x + 9$ **c** $y = x - 3$

d $y = -3x + 8$ **e** $y = -7x$ **f** $y = 5 - 2x$

g $y = 4 - 8x$ **h** $y = 6 + 3x$ **i** $y = 4 - x$

j $y = 1 - x$ **k** $y = \frac{3}{4}x + 2$ **l** $y = -\frac{1}{2}x + 2$

m $y = 6 - x$ **n** $y = \frac{3}{2}x + 2$ **o** $y = \frac{1}{4}x + 1$

p $y = \frac{1}{2}x - 2$ **q** $y = \frac{1}{3}x - 5$ **r** $y = 6 - \frac{3}{2}x$