

Straight Line Graphs

Exercise A

- 1** Work out the gradient of the line joining these pairs of points:
- | | |
|---------------------------|----------------------------|
| a (4, 2), (6, 3) | b (-1, 3), (5, 4) |
| c (-4, 5), (1, 2) | d (2, -3), (6, 5) |
| e (-3, 4), (7, -6) | f (-12, 3), (-2, 8) |
- 2** The line joining (3, -5) to (6, a) has gradient 4. Work out the value of a .
- 3** The line joining (5, b) to (8, 3) has gradient -3. Work out the value of b .
- 4** The line joining (c , 4) to (7, 6) has gradient $\frac{3}{4}$. Work out the value of c .
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Exercise B

1. Find the gradient and y-intercept of each of the following lines.

a $y = -x + 4$

b $y = 2x - 5$

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

d $y = -3x$

e $y = \frac{6}{7}x + \frac{7}{5}$

f $y = 2 - 7x$

g $3x - 4y + 8 = 0$

h $4x - 5y - 10 = 0$

i $-2x + y - 9 = 0$

j $7x + 4y + 12 = 0$

k $7x - 2y + 3 = 0$

l $-5x + 4y + 2 = 0$

- 2.

Write these lines in the form $ax + by + c = 0$.

a $y = 4x + 3$

b $y = -3x - 2$

c $y = -6x + 7$

d $y = \frac{4}{5}x - 6$

e $y = \frac{5}{3}x + 2$

f $y = \frac{7}{3}x$

g $y = 2x - \frac{4}{7}$

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

i $y = -6x - \frac{2}{3}$

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

k $y = \frac{2}{3}x + \frac{5}{6}$

l $y = \frac{3}{5}x + \frac{1}{2}$

- 3.

A line is parallel to the line $3x + 6y + 11 = 0$ and its intercept on the y-axis is (0, 7). Write down the equation of the line.

- 4.

The line $3x + 2y - 5 = 0$ meets the x-axis at the point R . Work out the coordinates of R .

- 5.

The line $5x - 4y + 20 = 0$ meets the y-axis at the point A and the x-axis at the point B . Work out the coordinates of the points A and B .

Exercise C

- 1** Find the equation of the line with gradient m that passes through the point (x_1, y_1) when:
- | | |
|--|--|
| a $m = 2$ and $(x_1, y_1) = (2, 5)$ | b $m = 3$ and $(x_1, y_1) = (-2, 1)$ |
| c $m = -1$ and $(x_1, y_1) = (3, -6)$ | d $m = -4$ and $(x_1, y_1) = (-2, -3)$ |
| e $m = \frac{1}{2}$ and $(x_1, y_1) = (-4, 10)$ | f $m = -\frac{2}{3}$ and $(x_1, y_1) = (-6, -1)$ |
| g $m = 2$ and $(x_1, y_1) = (a, 2a)$ | h $m = -\frac{1}{2}$ and $(x_1, y_1) = (-2b, 3b)$ |
- 2** The line $y = 4x - 8$ meets the x -axis at the point A . Find the equation of the line with gradient 3 that passes through the point A .
- 3** The line $y = -2x + 8$ meets the y -axis at the point B . Find the equation of the line with gradient 2 that passes through the point B .
- 4** The line $y = \frac{1}{2}x + 6$ meets the x -axis at the point C . Find the equation of the line with gradient $\frac{2}{3}$ that passes through the point C . Write your answer in the form $ax + by + c = 0$, where a , b and c are integers.
- 5** The line $y = \frac{1}{4}x + 2$ meets the y -axis at the point B . The point C has coordinates $(-5, 3)$. Find the gradient of the line joining the points B and C .
- 6** The lines $y = x$ and $y = 2x - 5$ intersect at the point A . Find the equation of the line with gradient $\frac{2}{5}$ that passes through the point A . (Hint: Solve $y = x$ and $y = 2x - 5$ simultaneously.)
- 7** The lines $y = 4x - 10$ and $y = x - 1$ intersect at the point T . Find the equation of the line with gradient $-\frac{2}{3}$ that passes through the point T . Write your answer in the form $ax + by + c = 0$, where a , b and c are integers.
- 8** The line p has gradient $\frac{2}{3}$ and passes through the point $(6, -12)$. The line q has gradient -1 and passes through the point $(5, 5)$. The line p meets the y -axis at A and the line q meets the x -axis at B . Work out the gradient of the line joining the points A and B .

Exercise D

- 1** Find the equation of the line that passes through these pairs of points:
- | |
|---------------------------------|
| a $(2, 4)$ and $(3, 8)$ |
| b $(0, 2)$ and $(3, 5)$ |
| c $(-2, 0)$ and $(2, 8)$ |
| d $(5, -3)$ and $(7, 5)$ |
- 2** The line that passes through the points $(2, -5)$ and $(-7, 4)$ meets the x -axis at the point P . Work out the coordinates of the point P .
- 3** The line that passes through the points $(-3, -5)$ and $(4, 9)$ meets the y -axis at the point G . Work out the coordinates of the point G .
- 4** The line that passes through the points $(3, 2\frac{1}{2})$ and $(-1\frac{1}{2}, 4)$ meets the y -axis at the point J . Work out the coordinates of the point J .
- 5** The line $y = 2x - 10$ meets the x -axis at the point A . The line $y = -2x + 4$ meets the y -axis at the point B . Find the equation of the line joining the points A and B . (Hint: First work out the coordinates of the points A and B .)

- 6** The line $y = 4x + 5$ meets the y -axis at the point C . The line $y = -3x - 15$ meets the x -axis at the point D . Find the equation of the line joining the points C and D . Write your answer in the form $ax + by + c = 0$, where a , b and c are integers.
- 7** The lines $y = x - 5$ and $y = 3x - 13$ intersect at the point S . The point T has coordinates $(-4, 2)$. Find the equation of the line that passes through the points S and T .
- 8** The lines $y = -2x + 1$ and $y = x + 7$ intersect at the point L . The point M has coordinates $(-3, 1)$. Find the equation of the line that passes through the points L and M .
- 9** The vertices of the triangle ABC have coordinates $A(3, 5)$, $B(-2, 0)$ and $C(4, -1)$. Find the equations of the sides of the triangle.
- 10** The line V passes through the points $(-5, 3)$ and $(7, -3)$ and the line W passes through the points $(2, -4)$ and $(4, 2)$. The lines V and W intersect at the point A . Work out the coordinates of the point A .
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Exercise E

1.

Find an equation of the line:

- a** parallel to the line $y = -2x - 5$, passing through $(-\frac{1}{2}, \frac{3}{2})$
- b** parallel to the line $x - 2y - 1 = 0$, passing through $(0, 0)$
- c** perpendicular to the line $y = x - 4$, passing through $(-1, -2)$
- d** perpendicular to the line $2x + y - 9 = 0$, passing through $(4, -6)$.

2.

Find an equation of the line:

- a** parallel to the line $y = 3x + 6$, passing through $(-2, 5)$
- b** perpendicular to the line $y = 3x + 6$, passing through $(-2, 5)$
- c** parallel to the line $4x - 6y + 7 = 0$, passing through $(3, 4)$
- d** perpendicular to the line $4x - 6y + 7 = 0$, passing through $(3, 4)$.

3.

The line r passes through the points $(1, 4)$ and $(6, 8)$ and the line s passes through the points $(5, -3)$ and $(20, 9)$. Show that the lines r and s are parallel.

4.

The vertices of a quadrilateral $ABCD$ has coordinates $A(-1, 5)$, $B(7, 1)$, $C(5, -3)$, $D(-3, 1)$. Show that the quadrilateral is a rectangle.

Exercise F

- 1** The points A and B have coordinates $(-4, 6)$ and $(2, 8)$ respectively. A line p is drawn through B perpendicular to AB to meet the y -axis at the point C .
- Find an equation of the line p .
 - Determine the coordinates of C . E
- 2** The line l has equation $2x - y - 1 = 0$.
The line m passes through the point $A(0, 4)$ and is perpendicular to the line l .
- Find an equation of m and show that the lines l and m intersect at the point $P(2, 3)$.
The line n passes through the point $B(3, 0)$ and is parallel to the line m .
 - Find an equation of n and hence find the coordinates of the point Q where the lines l and n intersect. E
- 3** The line L_1 has gradient $\frac{1}{7}$ and passes through the point $A(2, 2)$. The line L_2 has gradient -1 and passes through the point $B(4, 8)$. The lines L_1 and L_2 intersect at the point C .
- Find an equation for L_1 and an equation for L_2 .
 - Determine the coordinates of C . E
- 4** The straight line passing through the point $P(2, 1)$ and the point $Q(k, 11)$ has gradient $-\frac{5}{12}$.
- Find the equation of the line in terms of x and y only.
 - Determine the value of k . E
- 5** **a** Find an equation of the line l which passes through the points $A(1, 0)$ and $B(5, 6)$.
The line m with equation $2x + 3y = 15$ meets l at the point C .
- Determine the coordinates of the point C . E
- 6** The line L passes through the points $A(1, 3)$ and $B(-19, -19)$.
Find an equation of L in the form $ax + by + c = 0$, where a , b and c are integers. E
- 7** The straight line l_1 passes through the points A and B with coordinates $(2, 2)$ and $(6, 0)$ respectively.
- Find an equation of l_1 .
The straight line l_2 passes through the point C with coordinates $(-9, 0)$ and has gradient $\frac{1}{4}$.
 - Find an equation of l_2 . E
- 8** The straight line l_1 passes through the points A and B with coordinates $(0, -2)$ and $(6, 7)$ respectively.
- Find the equation of l_1 in the form $y = mx + c$.
The straight line l_2 with equation $x + y = 8$ cuts the y -axis at the point C . The lines l_1 and l_2 intersect at the point D .
 - Calculate the coordinates of the point D .
 - Calculate the area of $\triangle ACD$. E

- 9 The points A and B have coordinates $(2, 16)$ and $(12, -4)$ respectively. A straight line l_1 passes through A and B .
- a** Find an equation for l_1 in the form $ax + by = c$.
- The line l_2 passes through the point C with coordinates $(-1, 1)$ and has gradient $\frac{1}{3}$.
- b** Find an equation for l_2 . E
- 10 The points $A(-1, -2)$, $B(7, 2)$ and $C(k, 4)$, where k is a constant, are the vertices of $\triangle ABC$. Angle ABC is a right angle.
- a** Find the gradient of AB .
- b** Calculate the value of k .
- c** Find an equation of the straight line passing through B and C . Give your answer in the form $ax + by + c = 0$, where a , b and c are integers. E
- 11 The straight line l passes through $A(1, 3\sqrt{3})$ and $B(2 + \sqrt{3}, 3 + 4\sqrt{3})$.
- a** Calculate the gradient of l giving your answer as a surd in its simplest form.
- b** Give the equation of l in the form $y = mx + c$, where constants m and c are surds given in their simplest form.
- c** Show that l meets the x -axis at the point $C(-2, 0)$. E
- 12 **a** Find an equation of the straight line passing through the points with coordinates $(-1, 5)$ and $(4, -2)$, giving your answer in the form $ax + by + c = 0$, where a , b and c are integers. The line crosses the x -axis at the point A and the y -axis at the point B , and O is the origin.
- b** Find the area of $\triangle OAB$. E
- 13 The points A and B have coordinates $(k, 1)$ and $(8, 2k - 1)$ respectively, where k is a constant. Given that the gradient of AB is $\frac{1}{3}$:
- a** show that $k = 2$
- b** find an equation for the line through A and B . E
- 14 The straight line l_1 has equation $4y + x = 0$.
The straight line l_2 has equation $y = 2x - 3$.
- a** On the same axes, sketch the graphs of l_1 and l_2 . Show clearly the coordinates of all points at which the graphs meet the coordinate axes.
The lines l_1 and l_2 intersect at the point A .
- b** Calculate, as exact fractions, the coordinates of A .
- c** Find an equation of the line through A which is perpendicular to l_1 . Give your answer in the form $ax + by + c = 0$, where a , b and c are integers. E
- 15 The points A and B have coordinates $(4, 6)$ and $(12, 2)$ respectively.
The straight line l_1 passes through A and B .
- a** Find an equation for l_1 in the form $ax + by + c = 0$, where a , b and c are integers.
The straight line l_2 passes through the origin and has gradient -4 .
- b** Write down an equation for l_2 .
The lines l_1 and l_2 intersect at the point C .
- c** Find the coordinates of C . E