

Equation of a Straight Line

Solutions

For AQA GCSE Mathematics (8300) • Higher tier

Each question is shown in grey, followed by the working, one step per line. The final answer is in a box. *Marks* shows how the marks are usually given in the exam, and **Tip** points out a common mistake.

1 (1 mark)

Circle the gradient of the line $3y = 6x - 4$

Options: -4 , 2 , 3 , 6

Rearrange into the form $y = mx + c$ first.

Divide every term by 3: $y = 2x - \frac{4}{3}$

The gradient is the number in front of x .

Answer: 2

Tip: You can only read off the gradient when the equation starts " $y =$ ". Here the answer is not 6.

2 (1 mark)

The line $y = 3x + c$ crosses the x -axis at $(4, 0)$

Circle the value of c .

Options: -12 , -4 , 4 , 12

The point $(4, 0)$ is on the line, so substitute $x = 4$ and $y = 0$.

$$0 = 3 \times 4 + c$$

$$0 = 12 + c, \text{ so } c = -12$$

Answer: -12

Tip: On the x -axis, $y = 0$. Substitute both coordinates: $x = 4$ and $y = 0$.

3 (3 marks)

A straight line has gradient 3

The point $(4, 6)$ lies on the line.

Work out the coordinates of the points where the line crosses the x -axis and the y -axis.

The gradient is 3, so the line is $y = 3x + c$

Substitute the point $x = 4, y = 6$: $6 = 3 \times 4 + c$

$$6 = 12 + c, \text{ so } c = -6$$

The equation is $y = 3x - 6$

It crosses the y -axis where $x = 0$: $y = -6$, so at $(0, -6)$

It crosses the x -axis where $y = 0$: $0 = 3x - 6$, so $x = 2$, at $(2, 0)$

Answer: x -axis $(2, 0)$, y -axis $(0, -6)$

Tip: The coordinates $(4, 6)$ are not m and c . Substitute them into $y = 3x + c$ to find c first.

Marks: 1 mark for substituting $(4, 6)$ into $y = 3x + c$. 1 mark for $(0, -6)$. 1 mark for $(2, 0)$.

4 (3 marks)

Work out the equation of the line through $(-1, 1)$ and $(3, 9)$

$$\text{Gradient} = \frac{\text{change in } y}{\text{change in } x} = \frac{9 - 1}{3 - (-1)} = \frac{8}{4} = 2$$

So the line is $y = 2x + c$

Substitute $(3, 9)$: $9 = 2 \times 3 + c$

$$\text{So } c = 3$$

Check with $(-1, 1)$: $2 \times (-1) + 3 = 1$ ✓

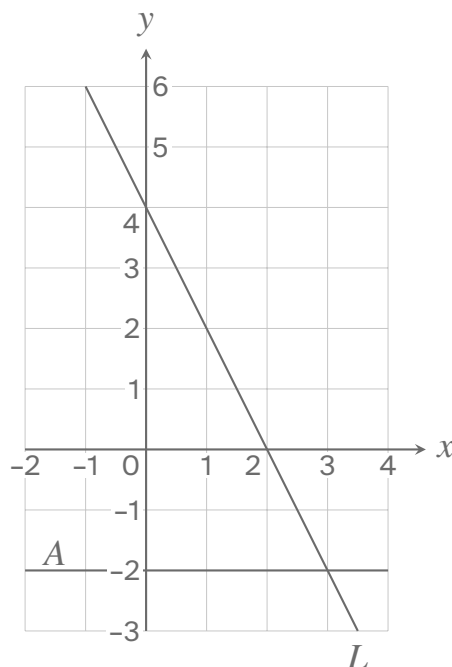
Answer: $y = 2x + 3$

Tip: Gradient is change in y divided by change in x — not the other way up. Take care with $3 - (-1) = 4$.

Marks: 1 mark for the gradient. 1 mark for substituting a point. 1 mark for $y = 2x + 3$.

5 (4 marks)

Lines A and L are drawn on the grid.



- (a) Write down the equation of line A .

Line A is horizontal.

Every point on line A has y -coordinate -2 .

Answer: $y = -2$

- (b) Work out the equation of line L .

L crosses the y -axis at $(0, 4)$, so $c = 4$.

L also passes through $(2, 0)$.

$$\text{Gradient} = \frac{0 - 4}{2 - 0} = \frac{-4}{2} = -2$$

The line slopes downwards, so a negative gradient makes sense.

Answer: $y = -2x + 4$

Marks: 1 mark for the y -intercept 4. 1 mark for the gradient -2 . 1 mark for $y = -2x + 4$.

6 (3 marks)

Line M passes through the points $(-4, 4)$ and $(6, -1)$

Work out the equation of line M .

Give your answer in the form $ax + by = c$ where a , b and c are integers.

$$\text{Gradient} = \frac{-1 - 4}{6 - (-4)} = \frac{-5}{10} = -\frac{1}{2}$$

The line is $y = -\frac{1}{2}x + c$

Substitute $(6, -1)$: $-1 = -\frac{1}{2} \times 6 + c$

$$-1 = -3 + c, \text{ so } c = 2$$

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

Multiply every term by 2 to clear the fraction: $2y = -x + 4$

Add x to both sides: $x + 2y = 4$

Check with $(-4, 4)$: $-4 + 2 \times 4 = 4$ ✓

Answer: $x + 2y = 4$

Tip: Clear the fraction by multiplying **every** term by 2, then collect the x and y terms on one side.

Marks: 1 mark for the gradient $-\frac{1}{2}$. 1 mark for $c = 2$. 1 mark for $x + 2y = 4$ (or any correct form with integers).

7 (2 marks)

The points $A(2, 3)$, $B(5, 9)$ and $C(8, k)$ lie on a straight line.
Work out the value of k .

$$\text{Gradient of } AB = \frac{9 - 3}{5 - 2} = \frac{6}{3} = 2$$

From B to C , x goes up by $8 - 5 = 3$.

So y goes up by $3 \times 2 = 6$.

$$k = 9 + 6 = 15$$

Answer: 15

Marks: 1 mark for the gradient 2 (or an equivalent method). 1 mark for 15.

8 (3 marks)

Line N is parallel to the line $3x + 4y = 20$

N passes through the point $(-4, 7)$

Work out the equation of line N .

Give your answer in the form $y = mx + c$

First find the gradient of $3x + 4y = 20$ by rearranging it into the form $y = mx + c$.

Subtract $3x$ from both sides: $4y = -3x + 20$

Divide every term by 4: $y = -\frac{3}{4}x + 5$

So the gradient is $-\frac{3}{4}$

Parallel lines have the same gradient, so N is $y = -\frac{3}{4}x + c$

Substitute $(-4, 7)$: $7 = -\frac{3}{4} \times (-4) + c$

$$7 = 3 + c, \text{ so } c = 4$$

Answer: $y = -\frac{3}{4}x + 4$

Tip: The gradient of $3x + 4y = 20$ is not 3 or -3 . Rearrange to “ $y =$ ” first. Take care with the signs when you substitute: $-\frac{3}{4} \times (-4) = +3$.

Marks: 1 mark for the gradient $-\frac{3}{4}$. 1 mark for substituting $(-4, 7)$ into $y = -\frac{3}{4}x + c$. 1 mark for $y = -\frac{3}{4}x + 4$.

9 (3 marks)

The line $5x + 2y = 20$ crosses the x -axis at A and the y -axis at B .
 O is the origin.

Work out the area of triangle OAB .

At A (on the x -axis), $y = 0$: $5x = 20$, so $x = 4$

A is $(4, 0)$

At B (on the y -axis), $x = 0$: $2y = 20$, so $y = 10$

B is $(0, 10)$

Triangle OAB is right-angled at O , with base 4 and height 10.

$$\text{Area} = \frac{1}{2} \times 4 \times 10 = 20$$

Answer: 20 units²

Marks: 1 mark for $(4, 0)$. 1 mark for $(0, 10)$. 1 mark for 20 (using your points).
