

Gradients and $y = mx + c$

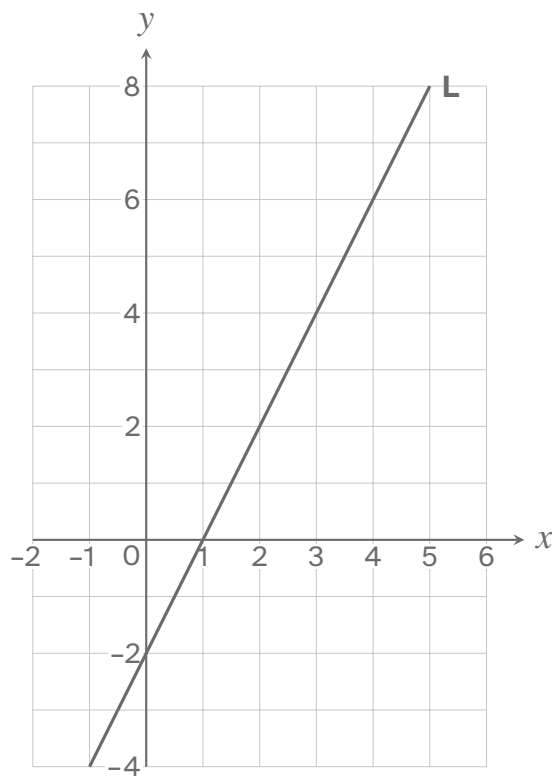
Solutions

For Pearson Edexcel GCSE Mathematics (1MA1) • Foundation 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 (2 marks)

Line **L** is drawn on the grid.



Find the gradient of line **L**.

Choose two points on the line where it crosses grid lines, e.g. $(0, -2)$ and $(3, 4)$.

From $(0, -2)$ to $(3, 4)$ the line goes up 6 and across 3.

$$\text{Gradient} = \frac{\text{up}}{\text{across}} = \frac{6}{3} = 2$$

Answer: 2

Tip: Use points where the line passes exactly through a grid corner, and read their coordinates from the axes. Gradient is up $\div$ across: $\frac{3}{6} = \frac{1}{2}$ (across $\div$ up) is a common mistake.

Marks: 1 mark for a correct method, e.g. $\frac{6}{3}$. 1 mark for 2.

2 (2 marks)

- (a) Write down the gradient of the line with equation $y = 5x + 3$

In $y = mx + c$, the gradient is m , the number in front of x .

Here $m = 5$.

Answer: 5

- (b) Write down the y -intercept of the line with equation $y = 7 - 2x$

$y = 7 - 2x$ is the same as $y = -2x + 7$.

In $y = mx + c$, the y -intercept is c .

So the y -intercept is 7, the point $(0, 7)$.

Answer: 7 (or $(0, 7)$)

Tip: The order of the terms doesn't matter. In $y = 7 - 2x$ the gradient is -2 and the y -intercept is 7.

3 (2 marks)

Find an equation of the line that has gradient -3 and passes through the point $(0, 5)$.

The gradient is -3 , so $m = -3$.

$(0, 5)$ is on the y -axis, so the y -intercept is 5 and $c = 5$.

Put these into $y = mx + c$: $y = -3x + 5$

Answer: $y = -3x + 5$

Marks: 2 marks for $y = -3x + 5$. 1 mark for $y = -3x + c$ or $y = mx + 5$.

4 (2 marks)

Find the gradient of the straight line that passes through the points $A(1, 2)$ and $B(4, 17)$.

$$\text{Gradient} = \frac{\text{change in } y}{\text{change in } x}$$

$$\text{Change in } y: 17 - 2 = 15$$

$$\text{Change in } x: 4 - 1 = 3$$

$$\text{Gradient} = \frac{15}{3} = 5$$

Answer: 5

Tip: Change in y goes on top. $\frac{3}{15}$ is upside down.

Marks: 1 mark for $\frac{15}{3}$. 1 mark for 5.

5 (3 marks)

Find an equation of the straight line that passes through the points $(0, -1)$ and $(2, 7)$.

$$\text{Gradient} = \frac{7 - (-1)}{2 - 0} = \frac{8}{2} = 4$$

$(0, -1)$ is on the y -axis, so the y -intercept is -1 .

So $m = 4$ and $c = -1$.

The equation is $y = 4x - 1$.

Check with (2,7): $4 \times 2 - 1 = 7$ ✓

Answer: $y = 4x - 1$

Marks: 1 mark for a method to find the gradient. 1 mark for a gradient of 4. 1 mark for $y = 4x - 1$.

6 (2 marks)

The equation of the line **M** is $y = 2x - 4$

Find an equation of the straight line that is parallel to **M** and passes through (0, 3).

Parallel lines have the same gradient.

M is $y = 2x - 4$, so its gradient is 2.

The new line also has gradient 2.

It passes through (0, 3), so its y -intercept is 3.

The equation is $y = 2x + 3$.

Answer: $y = 2x + 3$

Marks: 2 marks for $y = 2x + 3$. 1 mark for a line with gradient 2.

7 (2 marks)

Here are the equations of two straight lines.

$$y = 5x + 2$$

$$4y = 20x - 7$$

Show that these two lines are parallel.

Parallel lines have the same gradient.

$y = 5x + 2$ is already in the form $y = mx + c$, so its gradient is 5.

Divide every term of $4y = 20x - 7$ by 4: $y = 5x - \frac{7}{4}$

So the gradient of the second line is also 5.

Both lines have gradient 5, so they are parallel.

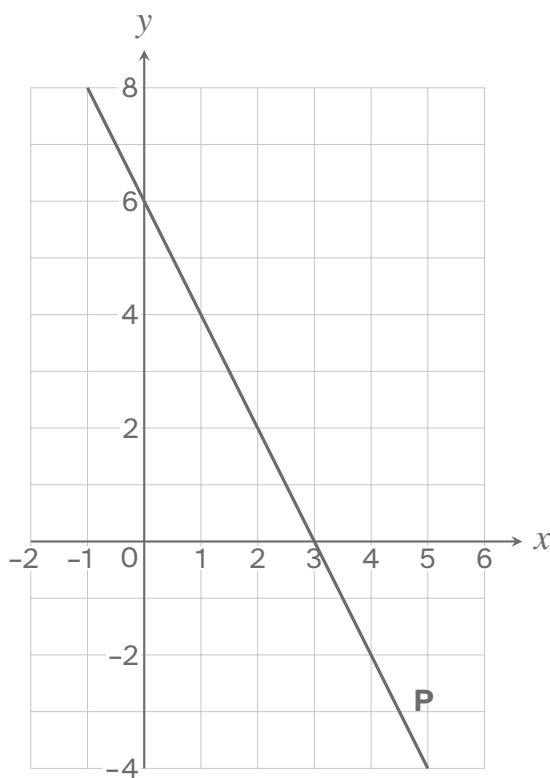
Answer: Both gradients are 5, so the lines are parallel

Tip: The gradient of $4y = 20x - 7$ is not 20. Get y on its own first by dividing **every** term by 4.

Marks: 1 mark for $y = 5x - \frac{7}{4}$ (or gradient 5 for $4y = 20x - 7$). 1 mark for showing both gradients are 5 and saying the lines are parallel.

8 (3 marks)

Line **P** is drawn on the grid.



Find an equation for line **P**.

The line crosses the y -axis at 6, so $c = 6$.

Find the gradient using $(0, 6)$ and $(3, 0)$.

From $(0, 6)$ to $(3, 0)$ the line goes **down** 6 and across 3.

$$\text{Gradient} = \frac{-6}{3} = -2$$

The equation is $y = -2x + 6$.

Answer: $y = -2x + 6$

Tip: The line slopes down from left to right, so the gradient must be negative. Don't forget the minus sign.

Marks: 1 mark for a method to find the gradient. 1 mark for $y = mx + 6$ or a gradient of -2 . 1 mark for $y = -2x + 6$.

9 (1 mark)

Sam says,

'The lines $y = 4x + 1$ and $y = 1 + 2x$ are parallel because they both have $+1$.'

Is Sam correct?

You must give a reason for your answer.

Parallel lines must have the same gradient.

$y = 4x + 1$ has gradient 4.

$y = 1 + 2x$ has gradient 2.

The gradients are different, so the lines are not parallel.

(The $+1$ only tells you both lines cross the y -axis at the same point.)

Answer: No, the gradients are 4 and 2

10 (3 marks)

The straight line **T** passes through the points $(-2, 3)$ and $(4, 15)$

The point $(6, k)$ also lies on **T**.

Find the value of k .

$$\text{Gradient of T} = \frac{15 - 3}{4 - (-2)} = \frac{12}{6} = 2$$

From $(4, 15)$ to $(6, k)$, the change in x is $6 - 4 = 2$.

Change in $y = \text{gradient} \times \text{change in } x = 2 \times 2 = 4$

$$k = 15 + 4 = 19$$

Check with the equation: $y = 2x + c$ through $(4, 15)$ gives $c = 7$, and $2 \times 6 + 7 = 19$ ✓

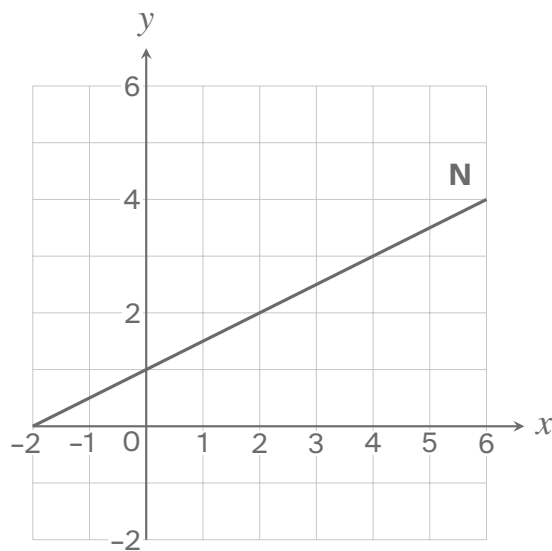
Answer: $k = 19$

Tip: Take care with the negative coordinate: the change in x from -2 to 4 is 6 , not 2 .

Marks: 1 mark for a gradient of 2 . 1 mark for a method to use the gradient with $(6, k)$, e.g. $y = 2x + 7$ or $15 + 2 \times 2$. 1 mark for 19 .

11 (3 marks)

Line **N** is drawn on the grid.



Find an equation for line **N**.

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

The line crosses the y -axis at 1 , so $c = 1$.

Find the gradient using $(0, 1)$ and $(4, 3)$.

From $(0, 1)$ to $(4, 3)$ the line goes up 2 and across 4 .

$$\text{Gradient} = \frac{2}{4} = \frac{1}{2}$$

The equation is $y = \frac{1}{2}x + 1$.

Answer: $y = \frac{1}{2}x + 1$

Marks: 1 mark for a method to find the gradient. 1 mark for $y = mx + 1$ or a gradient of $\frac{1}{2}$. 1 mark for $y = \frac{1}{2}x + 1$.
