

The Straight Line

You should be able to:

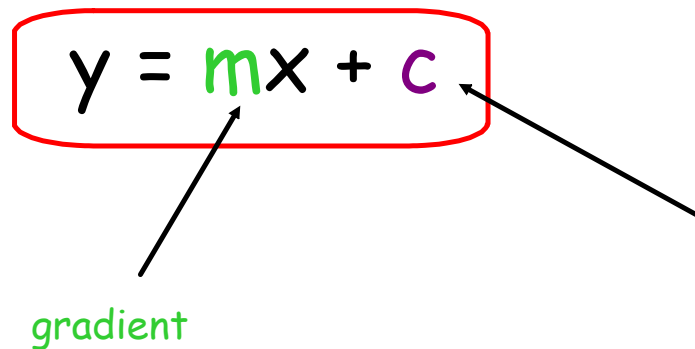
- determine the gradient of a straight line;
- determine the equation of a straight line;
- identify the gradient and y -intercept from the equation of a straight line;

Key Facts and Formulae

- The formula for the gradient of a straight line requires two points (x_1, y_1) and (x_2, y_2) . The formula is $m = \frac{y_2 - y_1}{x_2 - x_1}$.
- A **horizontal** straight line has gradient 0.
- A **vertical** straight line has gradient undefined.
- Parallel lines have the same gradient.
- The equation of a straight line with gradient m and y -intercept $(0, c)$ is $y = mx + c$.
- The equation of a horizontal straight line with y -intercept $(0, c)$ is $y = c$.
- The equation of a vertical straight line with x -intercept $(k, 0)$ is $x = k$.
- The equation of a straight line with gradient m and passes through the point (a, b) is $y - b = m(x - a)$.
- To be able to identify the gradient or y -intercept, the equation of a straight line must be in the form $y = mx + c$. If the equation is not in that form it must be re-arranged.

The Equation of a Straight Line

The general equation of a straight line is:



The diagram shows the general equation of a straight line, $y = mx + c$, enclosed in a red rounded rectangle. The letter 'm' is colored green, and the letter 'c' is colored purple. A black arrow points from the word 'gradient' (written in green) below to the 'm'. Another black arrow points from the right side of the diagram to the 'c'.

$$y = mx + c$$

gradient

Example 1

State the gradient and y-intercept of the line with equation

$$y = 3x - 4$$

Finding the Equation of a Straight Line

The equation of the line $y = mx + c$ can be rewritten as

$$y - b = m(x - a).$$

This can be used when you know the **gradient** of the line and **one point** on the line.

Example 2

A straight line has gradient 2 and passes through the point (6, 3).
Write down the equation of the line.

Example 3

A straight line passes through the points $(3, -5)$ and $(-1, 7)$.

Find the equation of the line and express it in the form $y = mx + c$.

Example 4

Find the equation of the straight line passing through the point $(-3, 2)$ that is parallel to the line $2x + y = 4$

Example 5

Find where the straight line $3x - 5y = 2$ cuts the x-axis.

Practice Questions

Q1: Calculate the gradient of the line which passes through $G(-2,8)$ and $H(10,-2)$.

.....

Q2: Calculate the gradient of the line which passes through $K(-1,7)$ and $L(-1,-7)$.

.....

Q3: Calculate the gradient of the line which passes through $P(3,-5)$ and $(-7,-5)$.

.....

Q4: Is the line GH parallel to the line KL ? (answer yes or no)

.....

Gradients and y-intercepts

Q10: What is the gradient of the line with equation $y = 7x - 3$?

.....

Q11: What are the coordinates of the y -intercept of the line with equation $2y = 5x - 8$?

.....

Q12: What is the gradient of the line with equation $4y - 3x + 7 = 0$?

.....

Equations of straight lines

Q13: Find the equation of the straight line passing through $(3,-1)$ which is parallel to the line with equation $y = 4x - 3$.

.....

Q14: Find the equation of the straight line passing through $(5,6)$ which is parallel to the line with equation $3y - 9x + 5 = 0$.

.....

Answers

Q1: $-\frac{5}{6}$

Q2: undefined

Q3: 0

Q4: no (because the gradients are not equal)

Q10: 7

Q11: (0,-4)

Q12: $\frac{3}{4}$

Q13:

Steps:

- What is the gradient of the line with equation $y = 4x - 3$? 4
- Use the gradient and the point (3,-1) to find the equation of the line.

Answer: $y = 4x - 13$

Q14:

Steps:

- What is the equation of the $3y - 9x + 5 = 0$ when rearranged into the form $y = mx + c$? $y = 3x - \frac{5}{3}$
- What is the gradient of the line with equation $3y - 9x + 5 = 0$? 3
- Use the gradient and the point (5,6) to find the equation of the line.

2015 N5 Past Paper P1, Q8

1. Find the equation of the line joining up $(-2, 5)$ and $(3, 15)$.

Give the equation in its simplest form.

(3 marks)

Question	Expected Answer(s) Give one mark for each •	Max Mark	Illustrations of evidence for awarding a mark at each •
8.	<p>Ans: $y = 2x + 9$</p> <ul style="list-style-type: none"> •¹ find gradient •² substitute gradient and a point into $y - b = m(x - a)$ or $y = mx + c$ •³ state equation of the line in terms of y and x in its simplest form. 	3	<ul style="list-style-type: none"> •¹ $\frac{10}{5}$ •² e.g. $y - 15 = \frac{10}{5}(x - 3)$ or $15 = \frac{10}{5} \times 3 + c$ •³ $y = 2x + 9$
<p>Notes:</p> <ol style="list-style-type: none"> 1. Correct answer without working award 3/3 2. For a final answer of $y = \frac{2}{1}x + 9$ award 2/3 ✓✓x 			

