

Linear Graphs

Answer the questions below:

1. What are the names of the two axes on a graph?

The x axis and the y axis.

2. Which is the horizontal axis and which is the vertical axis?

The horizontal axis is the x axis and the vertical axis is the y axis.

3. When writing the coordinates of a point, which axis value is given first?

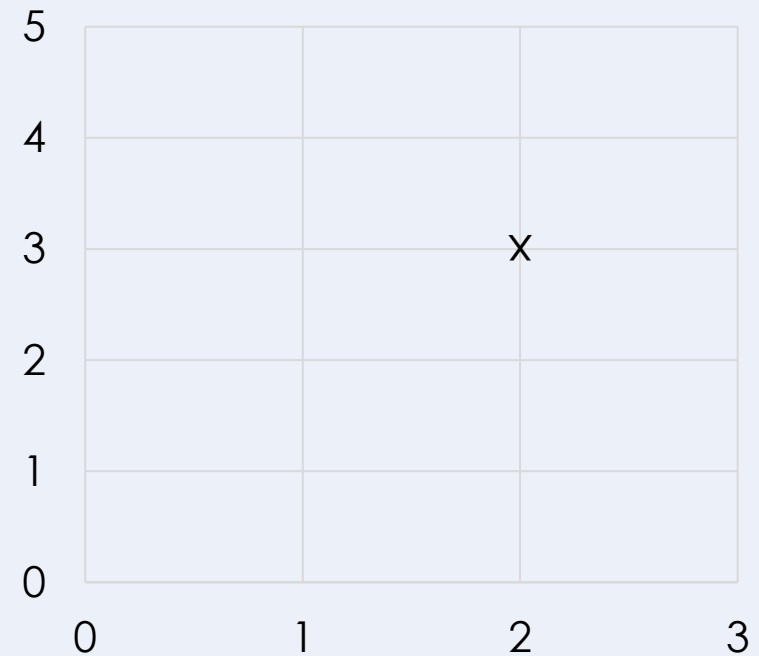
Coordinates are given in the form (x, y)

4. Identify the coordinates of this point.

$(2, 3)$

5. State the general equation for a straight line.

$y = mx + c$



Linear Graphs

Maths in Science Lesson 17

Science
Mastery



Lesson 15: Standard Form

Lesson 16: Orders of Magnitude

➤ **Lesson 17: Linear Graphs**

Lesson 18: Using Equations

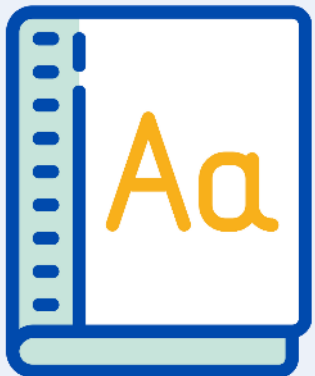
Lesson 19: Probability

Lesson 20: Derived Quantities

Following this lesson, students will be able to:

- Calculate gradient
- Explain what can be calculated from the gradient of a distance-time graph
- State that linear graphs can be represented using the equation $y = mx + c$

Key Words:



linear

gradient

slope

speed

axis

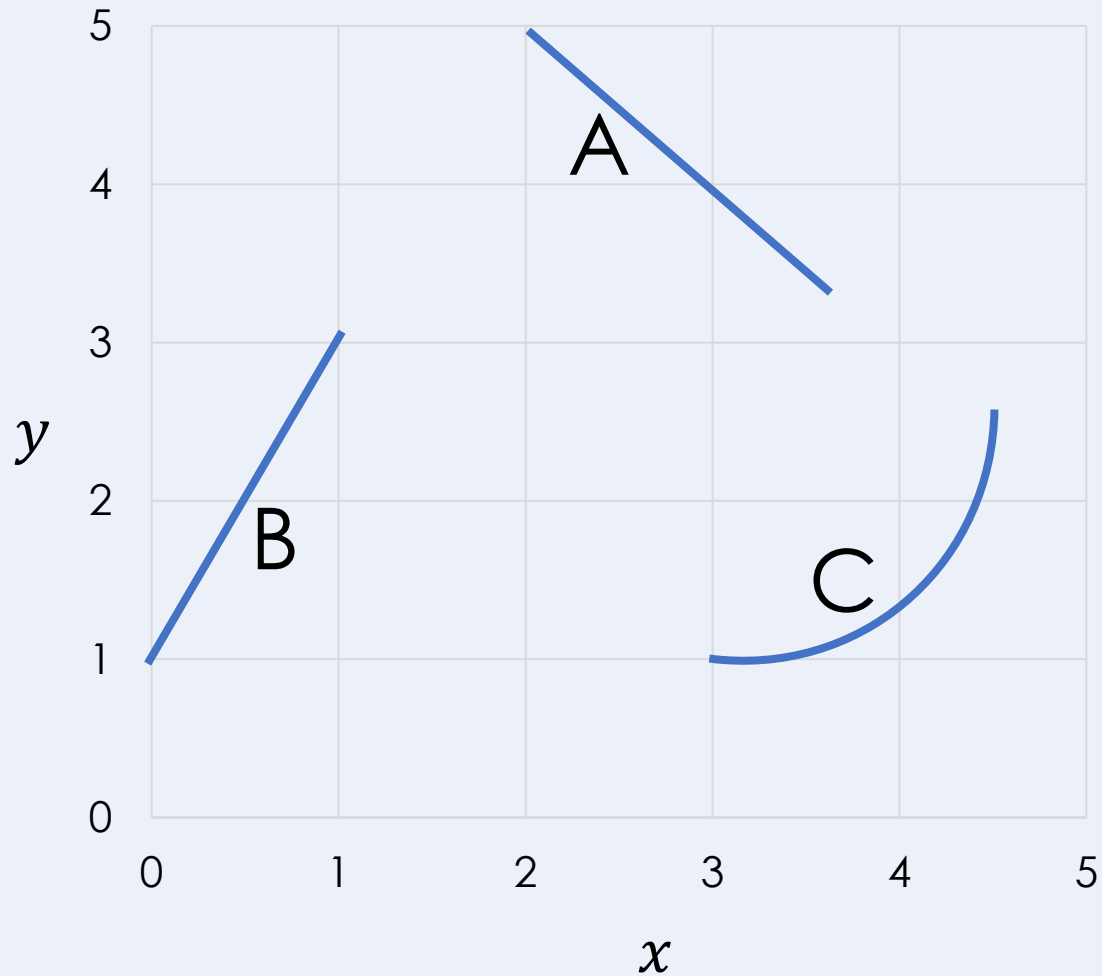
intercept

This is the fix-it portion of the lesson

The **fix-it** is an opportunity to respond to gaps in knowledge, especially those identified by the previous lesson's exit ticket.

- The teacher should customise this slide as needed, to facilitate
 - **reteach, explanation, demonstration** or **modelling** of ideas and concepts that students have not yet grasped or have misunderstood.
 - **practise** answering specific questions or of key skills.
 - **redrafting** or **improving** previous work.

What is gradient?



The gradient is the '**steepness**' of the slope at any point.

On a **straight** line, the gradient is **constant** (the steepness doesn't change).

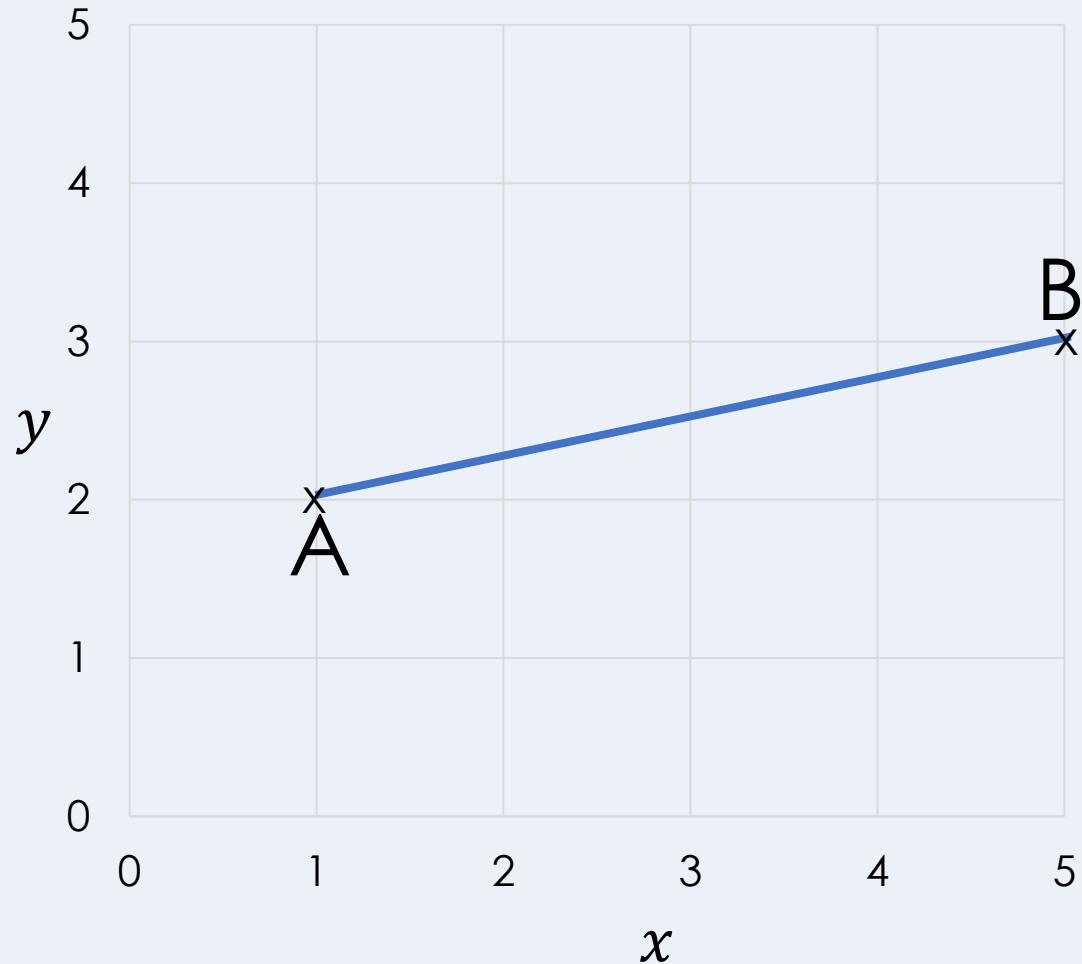
On a **curved** line, the gradient **changes** at every point.

The gradient can be **positive** (sloping upwards), **negative** (sloping downwards), or **zero** (horizontal).

Which lines (A, B, or C) have a positive gradient? **B and C**

Which lines (A, B, or C) have a constant gradient? **A and B**

Finding the gradient



To calculate the gradient of a straight line, we need to know the **coordinates** of the **start** and the **end** points of the line.

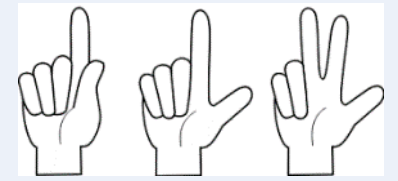
What are the coordinates of point A?

(1,2)

What are the coordinates of point B?

(5,3)

Choose the correct answer for each question:



A. Gradients can be...

1. Positive
2. Negative
3. Zero
4. All of the above

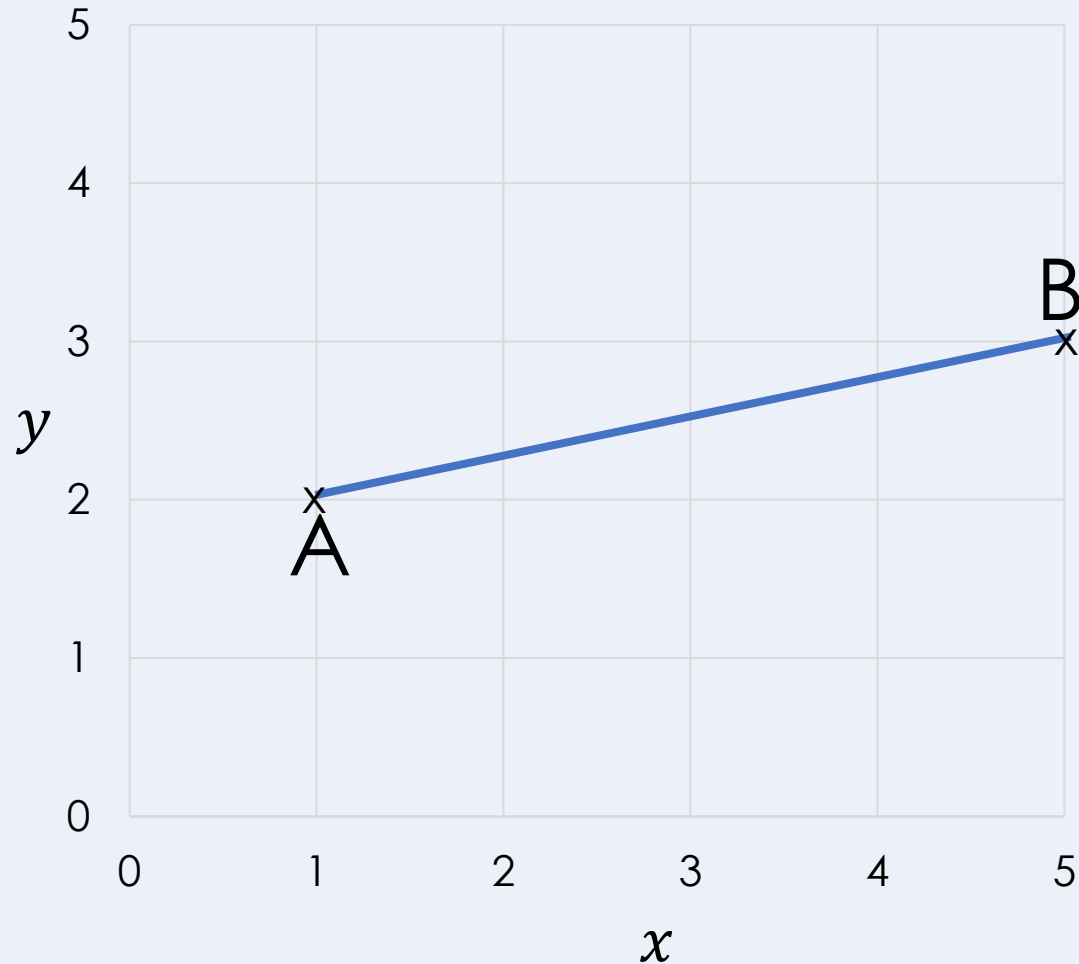
B. To find the gradient of a straight line you need...

1. The labels of each axis
2. The coordinates of the start and end points
3. The coordinates of the origin
4. The equation for a straight line

C. The gradient is...

1. The shape of a line
2. The thickness of a line
3. The length of a line
4. The steepness of a line

Finding the gradient



To calculate the gradient we use the equation:

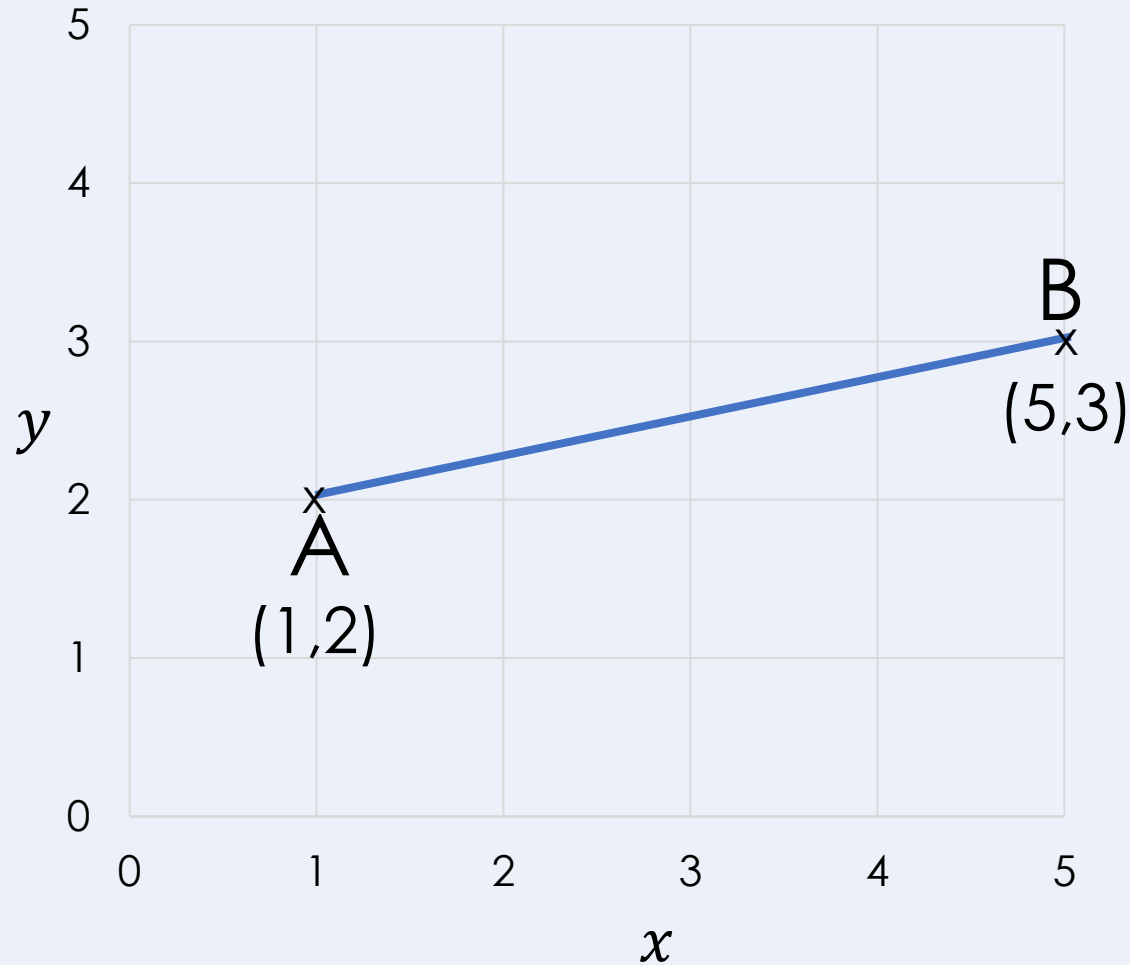
$$\text{Gradient} = \frac{\Delta y}{\Delta x}$$

$$\frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1}$$

A (1,2) is the first point (the start of the line) so its coordinates are (x_1, y_1) .

B (5,3) is the second point (the end of the line) so its coordinates are (x_2, y_2) .

Finding the gradient



To calculate the gradient we use the equation:

$$\text{Gradient} = \frac{\Delta y}{\Delta x}$$

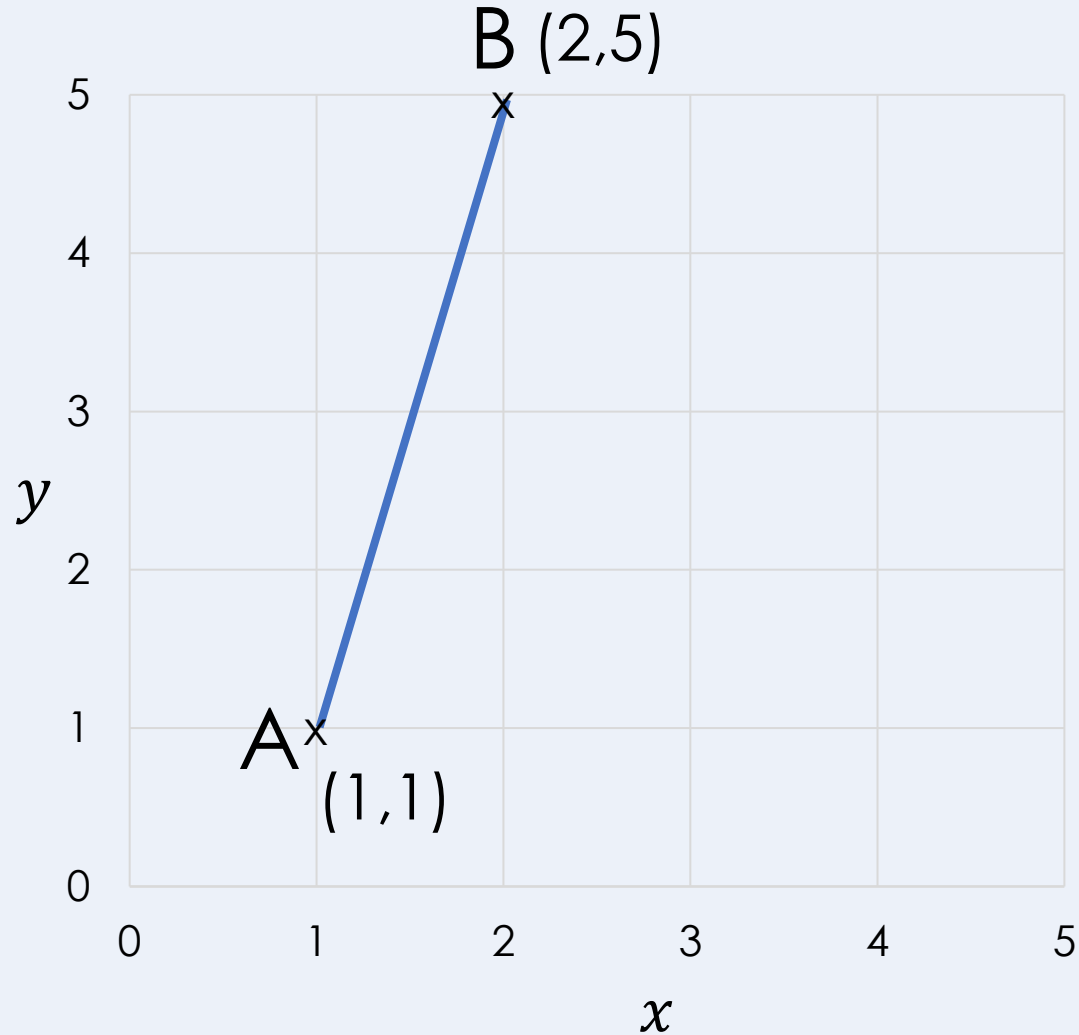
$$\frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1}$$

$$\text{Gradient} = \frac{3 - 2}{5 - 1}$$

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

$$\text{Gradient} = 0.25$$

Finding the gradient



To calculate the gradient we use the equation:

$$\text{Gradient} = \frac{\Delta y}{\Delta x}$$

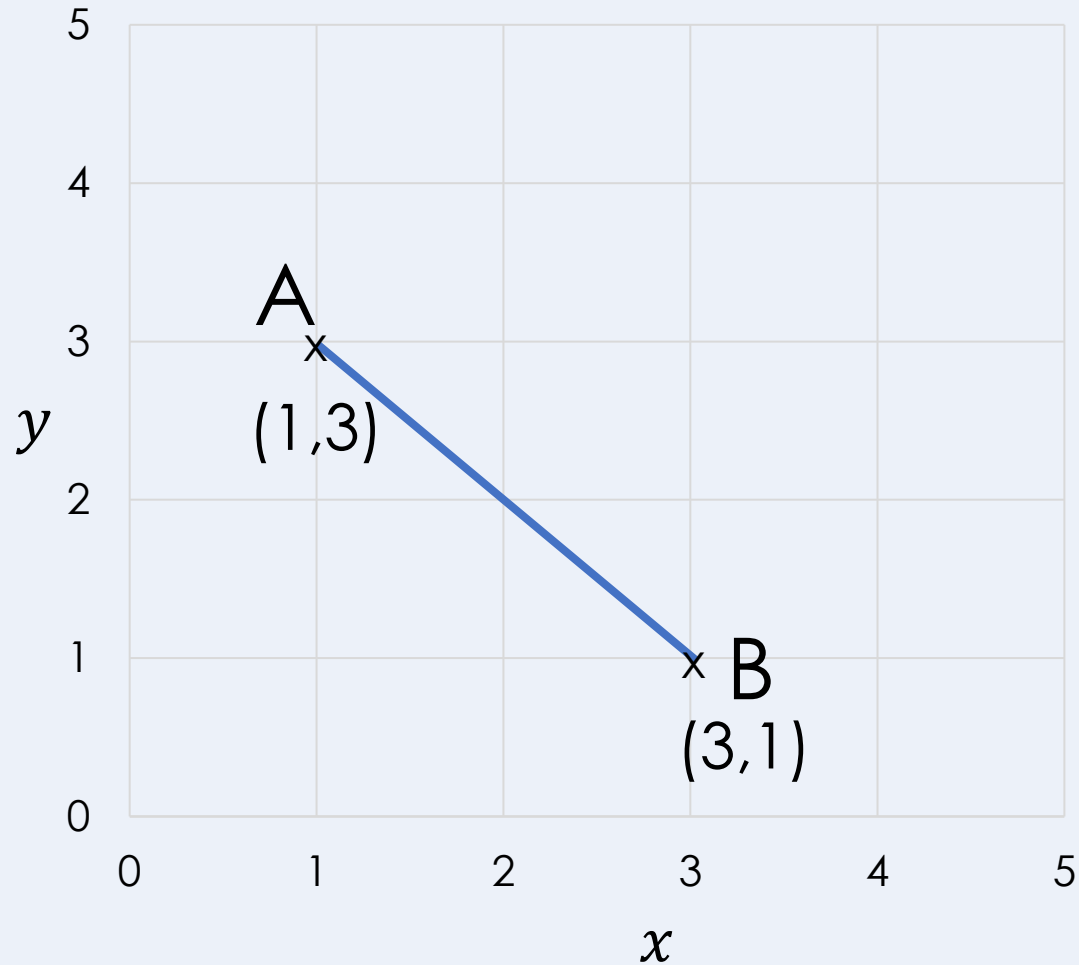
$$\frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1}$$

$$\text{Gradient} = \frac{5 - 1}{2 - 1}$$

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

$$\text{Gradient} = 4$$

Finding the gradient



To calculate the gradient we use the equation:

$$\text{Gradient} = \frac{\Delta y}{\Delta x}$$

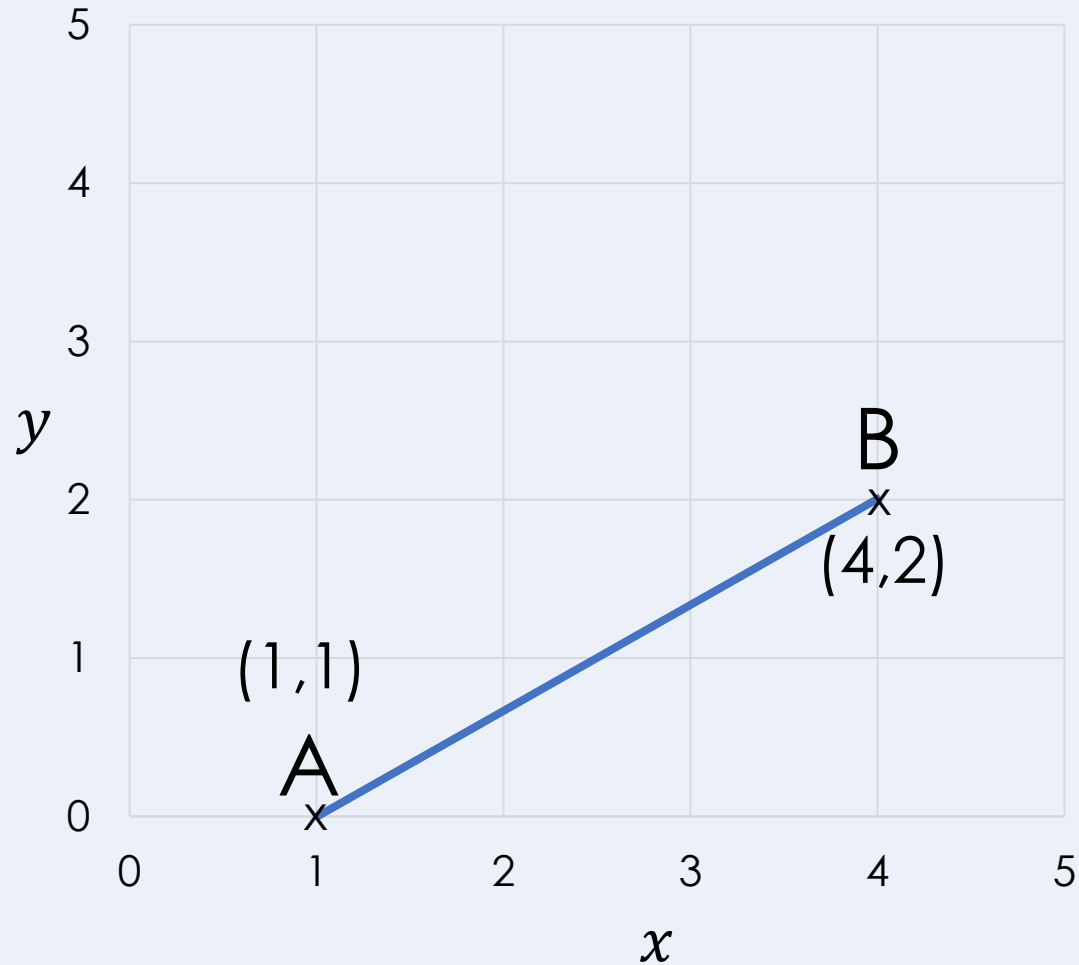
$$\frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1}$$

$$\text{Gradient} = \frac{1 - 3}{3 - 1}$$

$$\text{Gradient} = \frac{(-2)}{2}$$

$$\text{Gradient} = -1$$

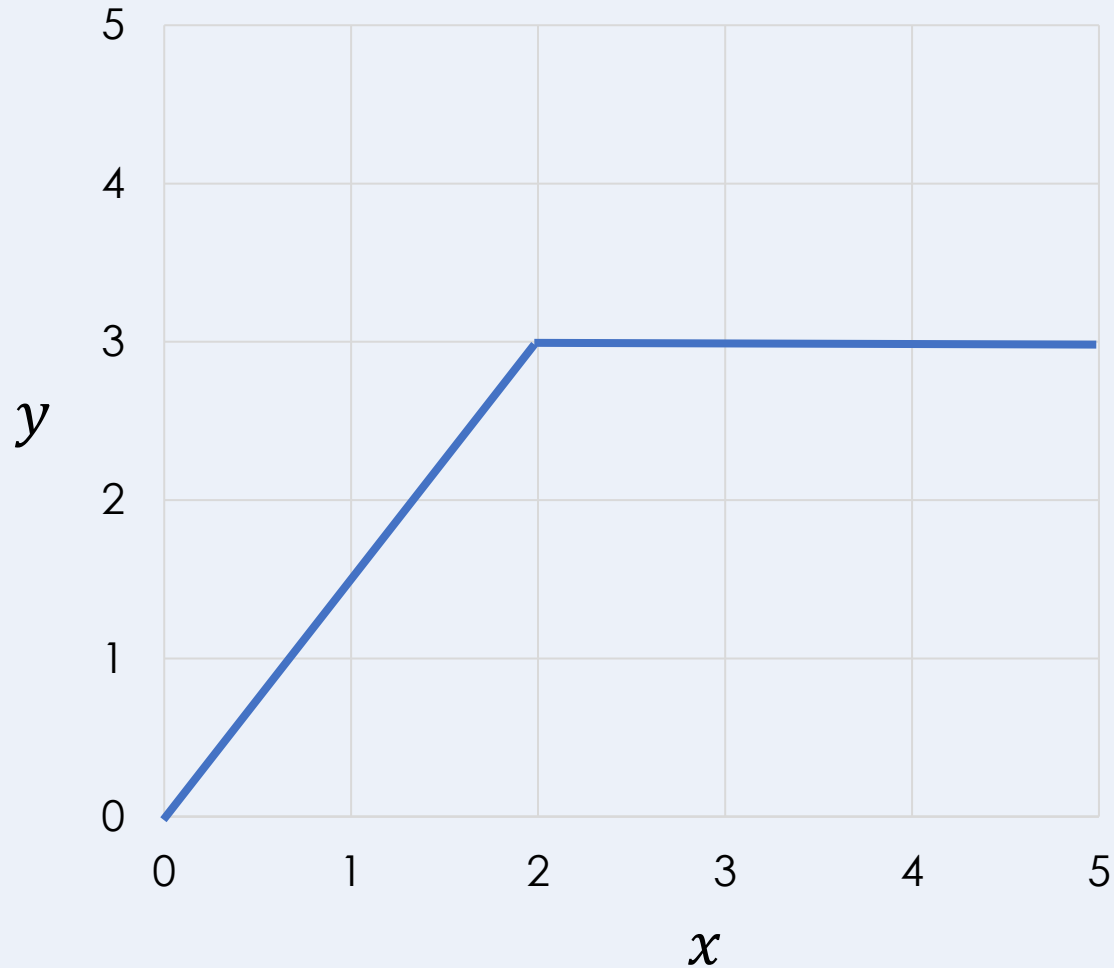
Finding the gradient



What is the gradient of this line?

- ☒ A. 0.33
- ☐ B. 3
- ☐ C. 0.66
- ☐ D. 2

What does the gradient show?



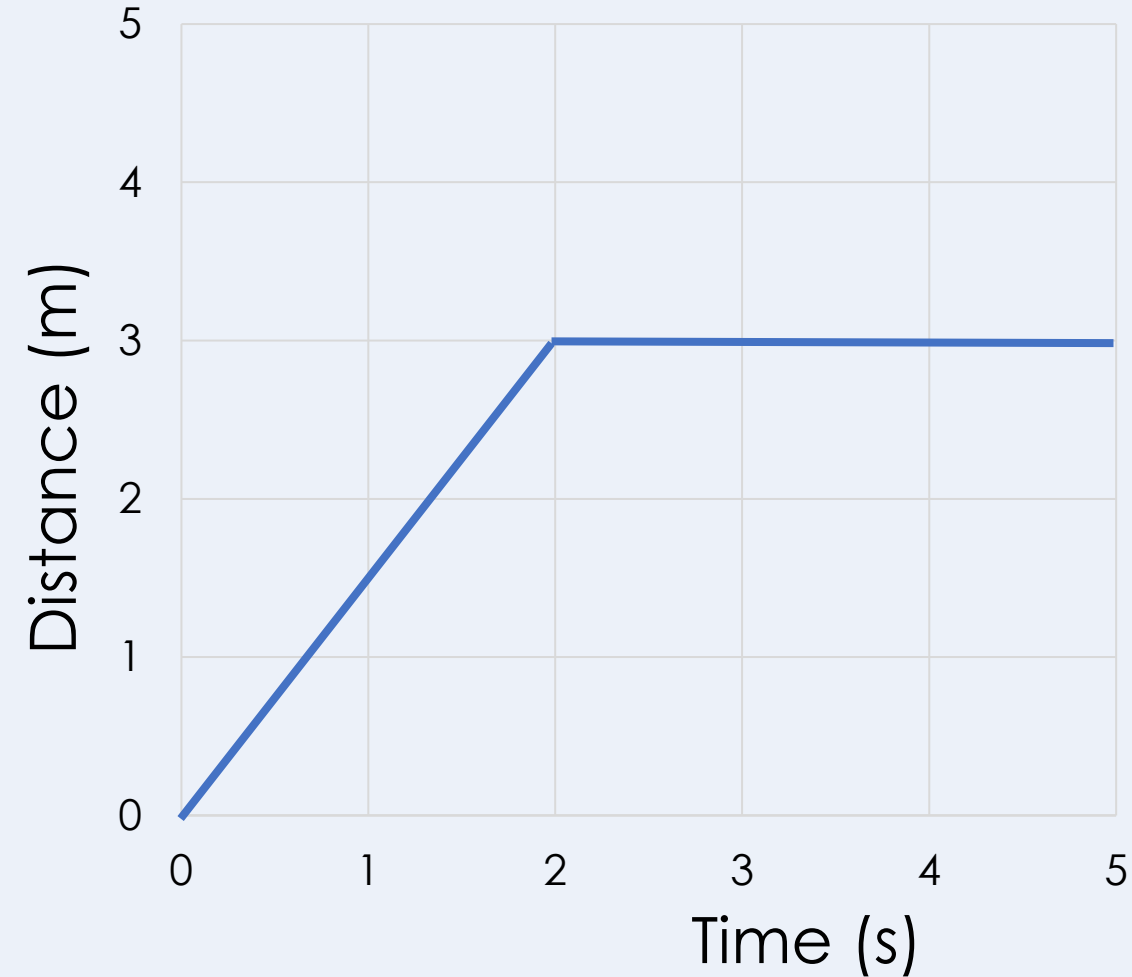
What quantities go on each axis of a distance-time graph?

Time is on the x axis and distance is on the y axis.

Describe the motion of this object from the distance-time graph.

The object travels 3 metres in 2 seconds and is then stationary for 3 seconds.

What does the gradient show?



In science, the gradient usually represents a **physical quantity**.

This can be related to the quantities on the x and y axes.

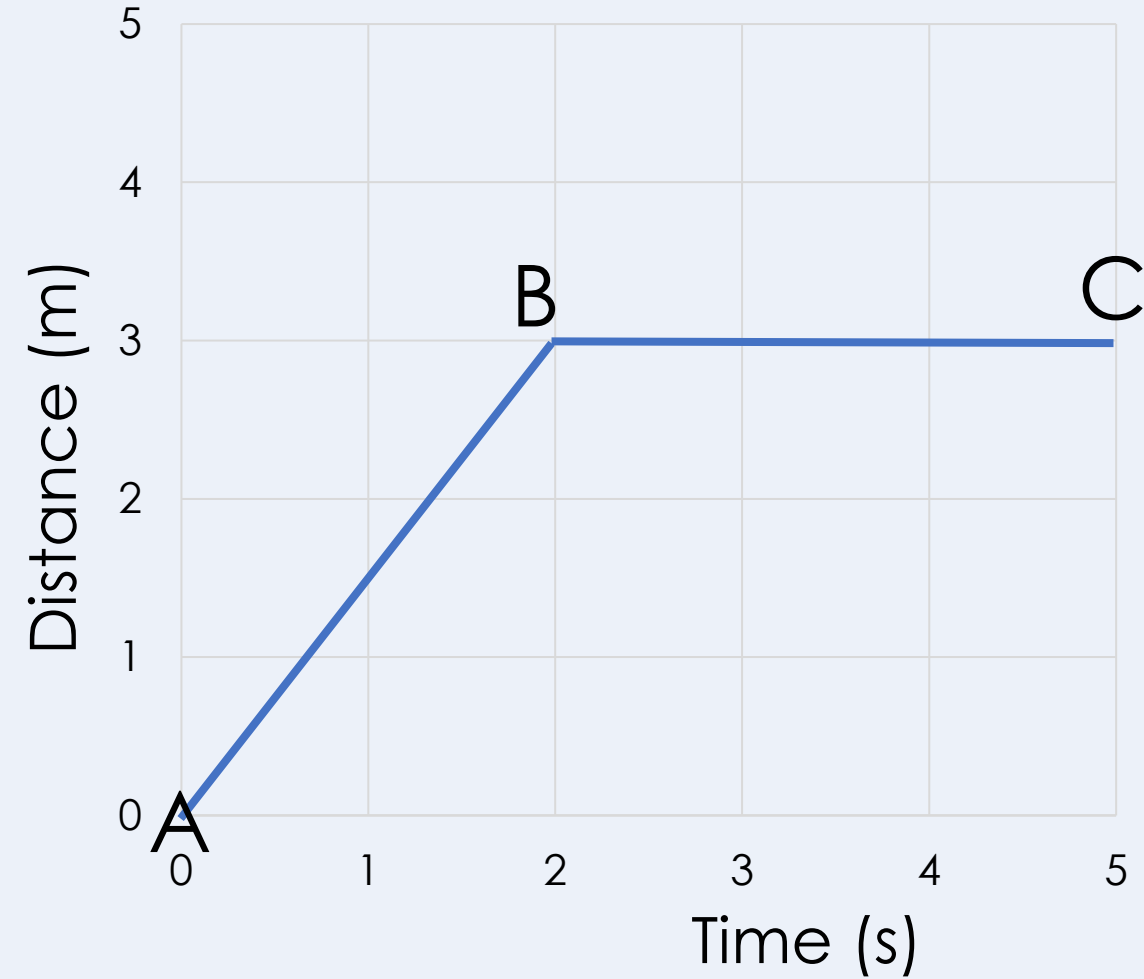
$$\text{Gradient} = \frac{\Delta y}{\Delta x}$$

$$\text{Gradient} = \frac{\text{Change in distance}}{\text{Change in time}}$$

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}}$$

Therefore the **gradient** is equal to the **speed**.

What does the gradient show?



From A to B:

$$\frac{\Delta y}{\Delta x} = \frac{3 - 0}{2 - 0}$$

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

$$\text{Gradient} = 1.5$$

Therefore speed = 1.5 m/s

From B to C:

$$\frac{\Delta y}{\Delta x} = \frac{3 - 3}{5 - 2}$$

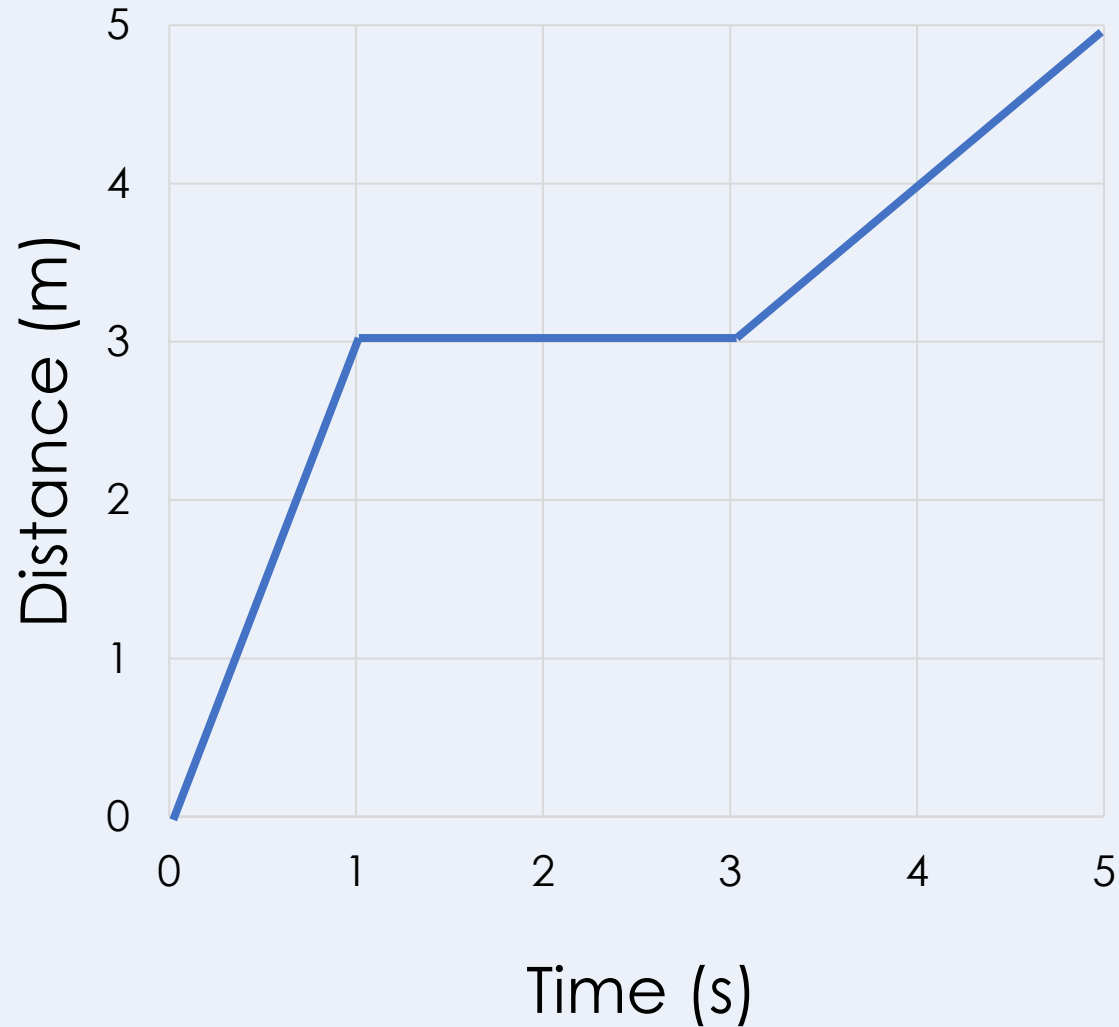
$$\text{Gradient} = \frac{0}{3}$$

$$\text{Gradient} = 0$$

Therefore speed = 0 m/s

$$\text{Gradient} = \frac{\Delta y}{\Delta x}$$

Determine if each statement is true or false:



1. The gradient is steepest between 3 and 5 seconds.

False

2. Between 1 and 3 seconds the object is stationary.

True

3. The gradient on a distance-time graph is similar to the speed.

False

4. The speed during the first second is 3 m/s.

True

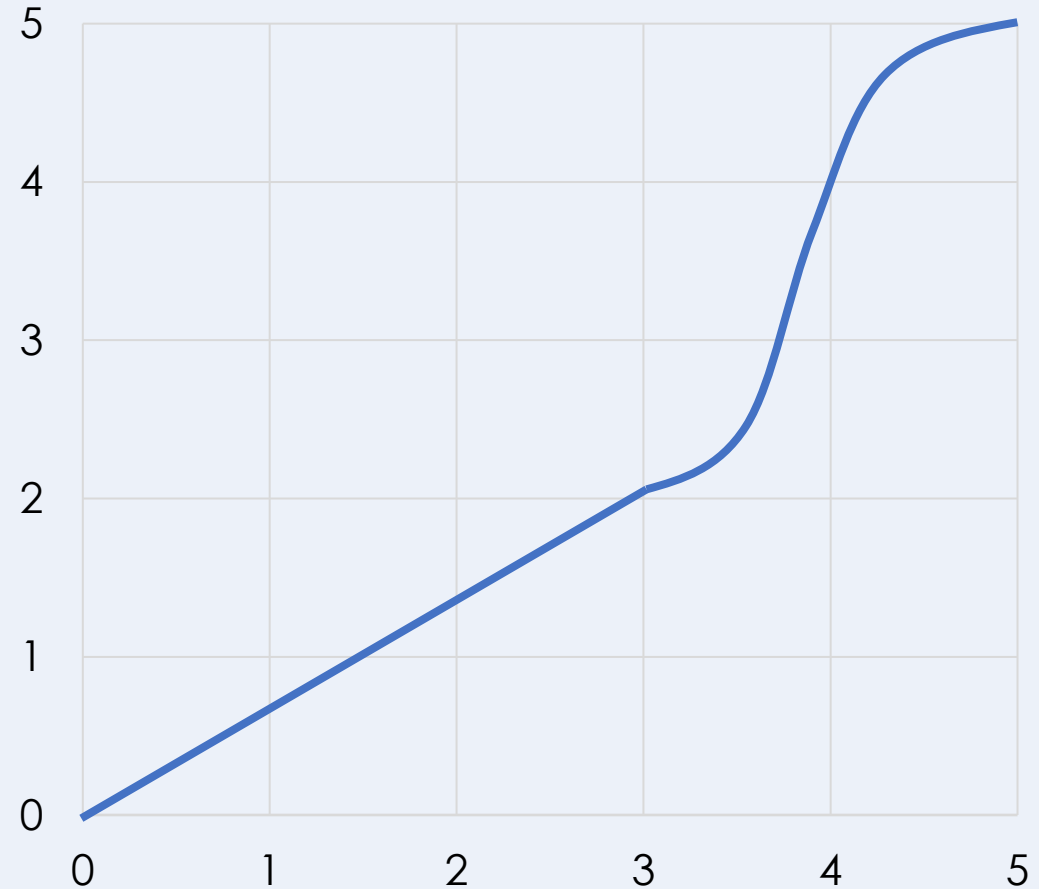
Describing linear graphs

Straight lines can be described using the equation:

$$y = mx + c$$

where m is the gradient and c is the y -intercept.

Where there is a curved line, these can no longer be described using this equation as the value for m (the gradient) changes.



Answer the questions below.

1. Which is the best description of the gradient of a graph?

- ☐ A. How much it slopes upwards
- ☒ B. Its steepness
- ☐ C. How fast an object is going

2. Which correctly shows how the gradient is calculated?

☒ A. $\frac{y_2 - y_1}{x_2 - x_1}$

☐ B. $\frac{y_1 - y_2}{x_1 - x_2}$

☐ C. $\frac{x_2 - x_1}{y_2 - y_1}$

3. What does the gradient of a distance-time graph represent?

- ☒ A. The speed of an object
- ☐ B. An object that is stationary
- ☐ C. How far an object has travelled

Maths in Science Lesson 17

What was good about this lesson?

What can we do to improve this lesson?

[Send us your feedback by clicking this link. Thank you!](#)