

**Kite & Key Academy**

Premium Learning • Personalised Education

# Year 10 Mathematics

Student Textbook

Aligned with the NSW Mathematics Syllabus

Concept-based • Exam-ready

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# Lesson 2

## Linear Relationships

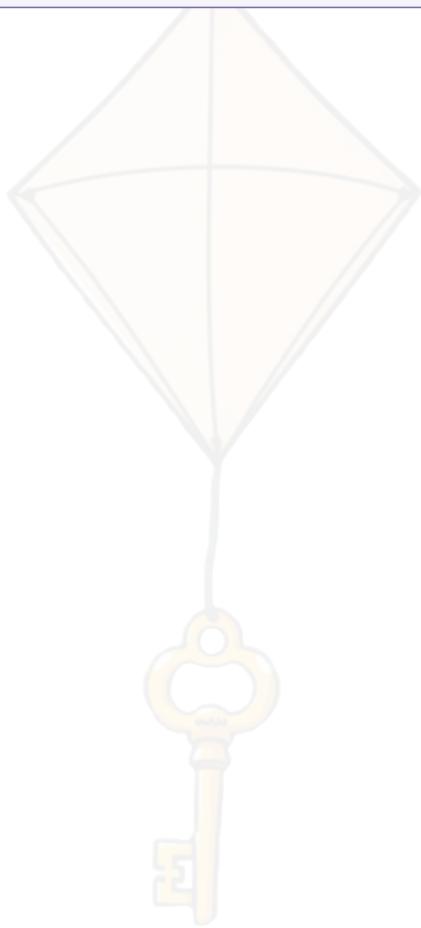
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*“Clarity creates confidence.”*

## Lesson 2: Linear Relationships

### Learning Outcomes

- Recognise linear relationships in tables, graphs, and equations.
- Interpret the gradient and intercept of a linear graph.
- Construct linear equations from real-world contexts.
- Graph linear relationships accurately on the Cartesian plane.



## Concept 2.1 What Is a Linear Relationship?

A linear relationship describes a situation where change happens at a constant rate. Once you understand the pattern, you can predict what happens next.

A relationship is **linear** if:

- The rate of change between values is constant
- The graph forms a straight line
- The relationship can be written in the form:

$$y = mx + b$$

where:

- $m$  is the **gradient** (rate of change)
- $b$  is the **y-intercept** (starting value)



### Key Insight

If a situation increases or decreases by the same amount each time, it is almost always linear.

### Common Examples

- Hourly pay at a fixed rate
- Distance travelled at constant speed
- Phone plans with a fixed monthly fee

### Example

A taxi charges \$5 to get in the car, plus \$2 per kilometre. Explain why this situation is linear.

**Check Point**

1. State whether each situation is **linear** or **non-linear**:

- A car accelerating faster over time

- Earning \$25 per hour

2. Identify the constant rate of change:

$x$	$y$
1	4
2	6
3	8

3. Explain what the gradient represents in a real-life situation.

## Concept 2.2 Gradient and Intercept

*Every straight line tells a story. The gradient shows how fast the story moves, and the intercept tells us where it begins.*

The **gradient** measures how steep a line is.

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

The **y-intercept** is where the line crosses the y-axis.

### Key Insight

A positive gradient means the graph rises from left to right. A negative gradient means it falls.

## Interpreting an Equation

Given:

$$y = 3x - 2$$

- Gradient = 3
- y-intercept = 2

### Example

Describe what the equation  $y = 4x + 10$  could represent in a real-world context.

**Check Point**

1. State whether each situation is **linear** or **non-linear**.

- A car accelerating faster over time

- Earning \$25 per hour

2. Identify the constant rate of change from the table below.

$x$	$y$
1	4
2	6
3	8

3. Explain what the gradient represents in a real-life situation.

## Concept 2.3 Graphing Linear Relationships

A graph is a visual argument. If it is accurate, the mathematics speaks for itself.

To graph a linear relationship:

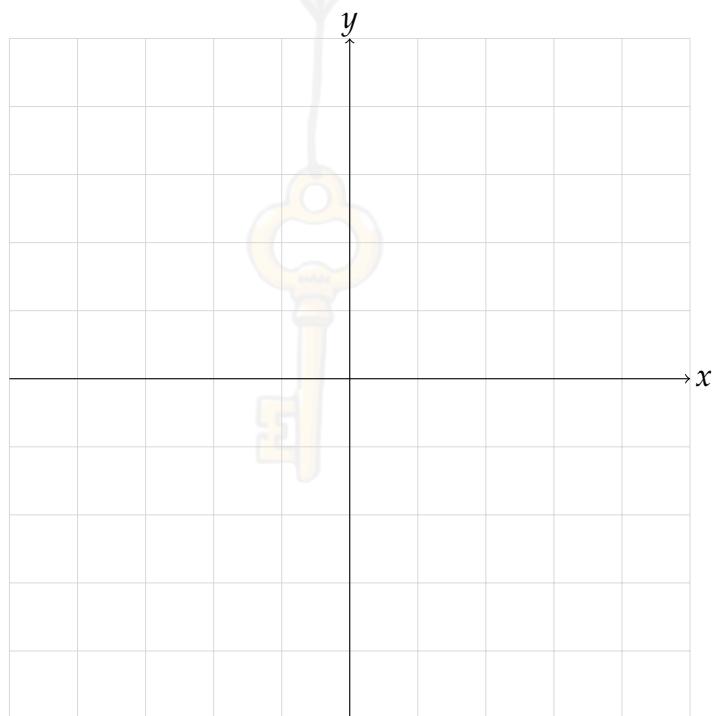
1. Identify the y-intercept
2. Use the gradient to find a second point
3. Draw a straight line through both points



### Key Insight

Two points determine a line — but three points confirm accuracy.

### Graph Template



### Example

Sketch the graph of  $y = 2x - 1$ .

**Check Point**

1. Plot the graph of:

$$y = x + 3$$

2. State the gradient of the line shown.

3. Explain how you know the graph represents a linear relationship.

