The Panda Math Tutor

Straight Lines

IGCSE Mathematics

The Panda Math Tutor

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1 Introduction to Straight Lines

Note

Straight lines are one of the most important topics in coordinate geometry. Understanding how to work with straight lines on the Cartesian plane is essential for IGCSE Mathematics. You need to be comfortable with finding gradients, writing equations of lines, and understanding the relationships between parallel and perpendicular lines.

In this chapter, we will explore:

- The gradient (slope) of a line — Section 2
- The equation of a straight line — Section 3
- Finding the equation of a line — Section 4
- Parallel and perpendicular lines — Section 5
- The midpoint of a line segment — Section 6
- The length of a line segment — Section 7
- Intersection of lines — Section 8

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2 The Gradient (Slope) of a Line

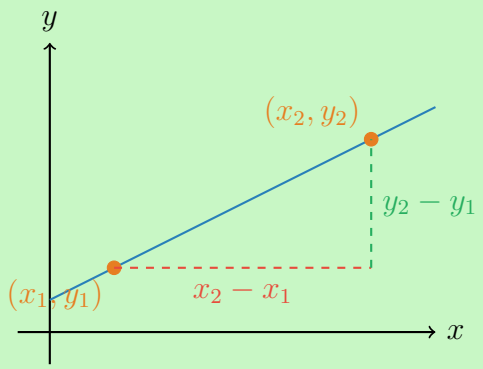
Definition

The **gradient** (or **slope**) of a straight line measures how steep the line is. It tells us how much the line rises (or falls) for every unit it moves horizontally.
The gradient is usually denoted by the letter m.

Gradient Formula

The gradient of a straight line passing through two points (x_1, y_1) and (x_2, y_2) is:

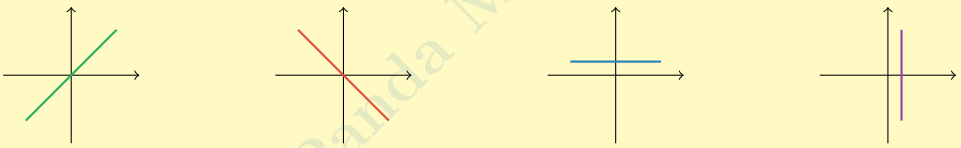
$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{\text{change in } y}{\text{change in } x} = \frac{\text{rise}}{\text{run}}$$



Note

Understanding the sign of the gradient:

- **Positive gradient** ($m > 0$): the line slopes **upwards** from left to right
- **Negative gradient** ($m < 0$): the line slopes **downwards** from left to right
- **Zero gradient** ($m = 0$): the line is **horizontal**
- **Undefined gradient**: the line is **vertical** (division by zero)



Positive ($m > 0$) **Negative** ($m < 0$) **Zero** ($m = 0$) **Undefined**

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Example

Find the gradient of the line passing through each pair of points:
(a) $(3, 1)$ and $(7, 13)$ (b) $(2, 11)$ and $(6, 3)$ (c) $(-5, 6)$ and $(4, 6)$

Solution:

(a) $m = \dfrac{13-1}{7-3} = \dfrac{12}{4} = 3$ (positive — line goes uphill)

(b) $m = \dfrac{3-11}{6-2} = \dfrac{-8}{4} = -2$ (negative — line goes downhill)

(c) $m = \dfrac{6-6}{4-(-5)} = \dfrac{0}{9} = 0$ (horizontal line)

Preview ends here

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