

The gradient of a straight line



**Year 12 Further Maths
Units 3 and 4**

www.maffsguru.com

Learning Objectives

By the end of the lesson I would hope that you have an understanding and be able to apply to questions the following concepts:

- Understand what the gradient of a straight line is
- Know how to find the gradient of a straight line
- Understand that gradients can be positive and negative
- Understand how to identify special lines from their gradients

Recap

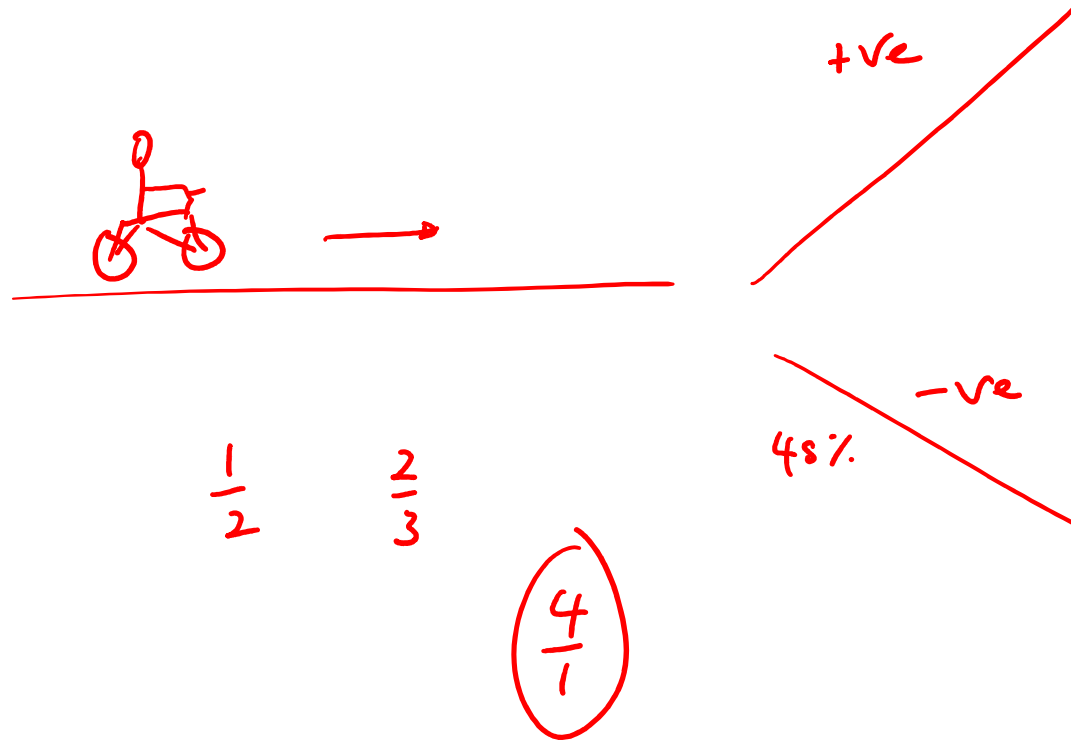
This is the start of a new section of the Further Mathematics course and so, there isn't really a recap. However, much of the work which is about to be covered has been covered in Years 9 and 10.

What is gradient?

Gradient is a number given to the slope of a **straight line**.

The number can be either positive or negative.

It can be a whole number, fraction or decimal.



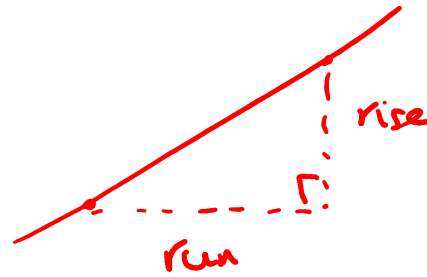
How to find the gradient of a straight line

We can use one of two formulae to find the gradient of a straight line.

$$\text{Gradient} = \frac{\text{rise}}{\text{run}}$$

$$\text{Gradient} = \frac{y_2 - y_1}{x_2 - x_1}$$

It's important to know that we need to have two coordinates to be able to find the gradient of a straight line



$$\begin{array}{l} x_1, y_1 \\ (1, 4) \\ x_1, y_1 \end{array}$$

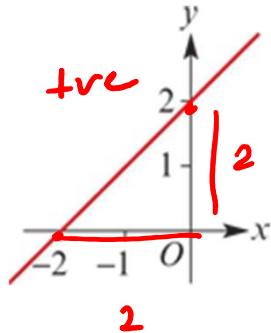
$$\begin{array}{l} x_2, y_2 \\ (7, 10) \\ x_2, y_2 \end{array}$$

$$\begin{aligned} \text{Grad} &= \frac{4 - 10}{1 - 7} = \frac{-6}{-6} \\ &= 1 \end{aligned}$$

$$\begin{aligned} \text{Grad} &= \frac{y_2 - y_1}{x_2 - x_1} \\ &= \frac{10 - 4}{7 - 1} \\ &= \frac{6}{6} = 1 \end{aligned}$$

Examples of how to find gradients

Find the gradient of this line.



$$\text{Gradient} = \frac{y_2 - y_1}{x_2 - x_1}$$

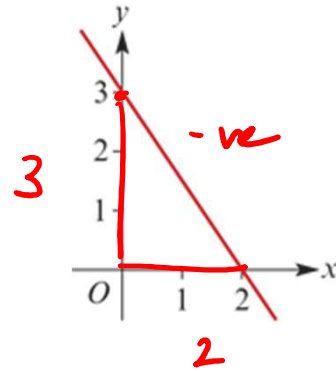
$$\begin{aligned} \text{grad} &= \frac{\text{rise}}{\text{run}} \\ &= \frac{2}{2} \\ &= \underline{\underline{+1}} \end{aligned}$$

$$\begin{aligned} &(0, 2) \quad (-2, 0) \\ \text{Grad} &= \frac{y_2 - y_1}{x_2 - x_1} = \frac{0 - 2}{-2 - 0} \\ &= \frac{-2}{-2} \\ &= \underline{\underline{1}} \end{aligned}$$

Examples have been extracted, with permission, from the Cambridge Further Mathematics Units 3 and 4 Textbook

Examples of how to find gradients

Find the gradient of this line.



$$\begin{aligned}\text{Gradient} &= \frac{\text{Rise}}{\text{Run}} \\ &= \frac{-3}{2} \\ &= \underline{\underline{-\frac{3}{2}}}\end{aligned}$$

$$\begin{aligned}&(0, 3) \quad (2, 0) \\ \text{Grad} &= \frac{y_2 - y_1}{x_2 - x_1} \\ &= \frac{0 - 3}{2 - 0} \\ &= \frac{-3}{2} \\ &= \underline{\underline{-\frac{3}{2}}}\end{aligned}$$

Examples have been extracted, with permission, from the Cambridge Further Mathematics Units 3 and 4 Textbook

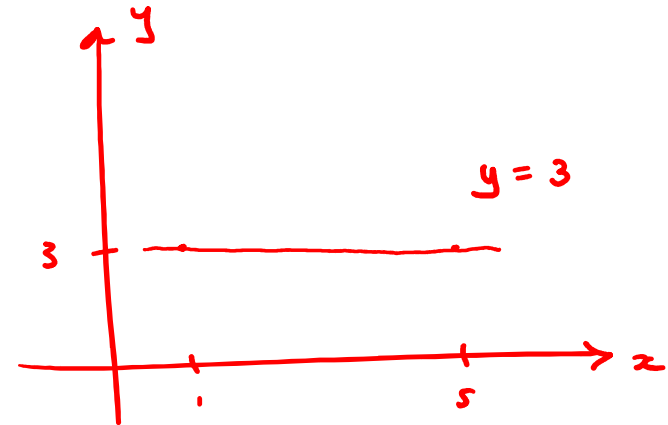
Special lines

There are a number of “special” lines which have gradients we need to learn.

Example:

Find the gradient of the line which connects the points (1, 3) and (5, 3)

$$\begin{aligned} & (1, 3) \quad (5, 3) \\ \text{grad} &= \frac{y_2 - y_1}{x_2 - x_1} \\ &= \frac{3 - 3}{5 - 1} \\ &= \frac{0}{4} = \underline{\underline{0}} \end{aligned}$$



Special lines

There are a number of “special” lines which have gradients we need to learn.

Example:

Find the gradient of the line which connects the points (3, 1) and (3, 10)

$$\begin{aligned} & (3, 1) \quad (3, 10) \\ \text{Grad} &= \frac{y_2 - y_1}{x_2 - x_1} \\ &= \frac{10 - 1}{3 - 3} \\ &= \frac{9}{0} = \underline{\underline{\infty}} \end{aligned}$$

