

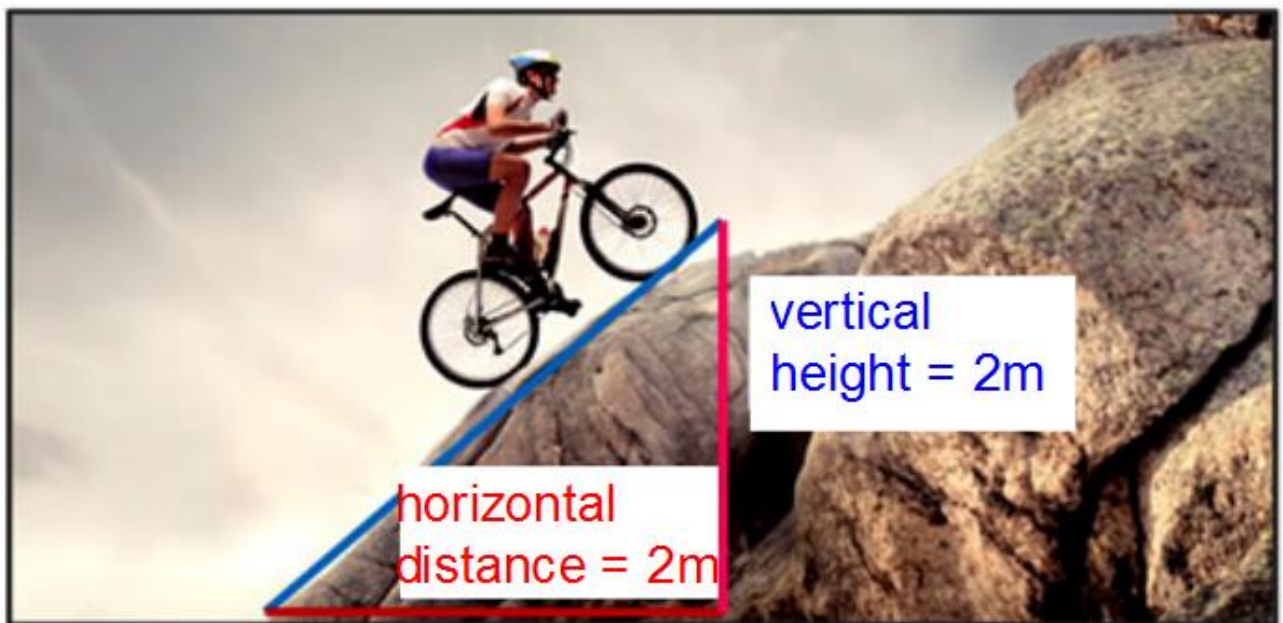
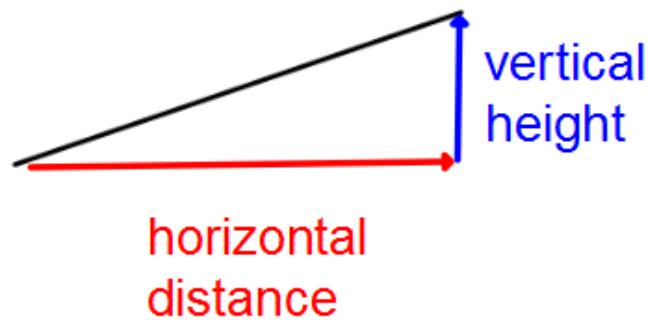
Gradient

Note

The gradient defines the slope of a hill.

The gradient is defined as

$$\text{gradient} = \frac{\text{vertical height}}{\text{horizontal distance}}$$

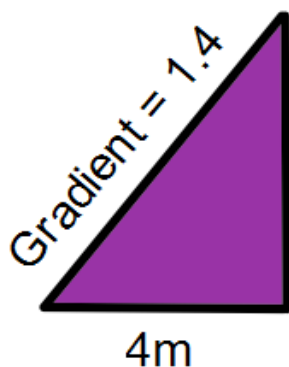


$$\text{gradient} = \frac{\text{vertical height}}{\text{horizontal distance}} = \frac{2}{2} = 1$$

Working Backwards with Gradient

Note

If you know the gradient of a slope and either the vertical or horizontal distance you are able to work the missing distance.

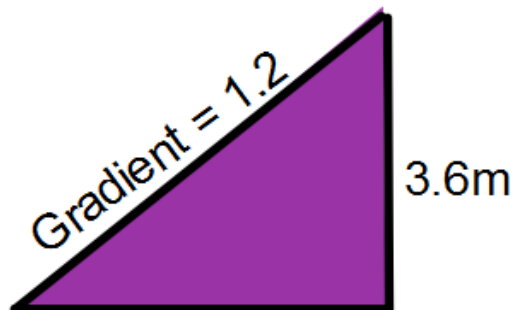


$$\text{gradient} = \frac{\text{vertical height}}{\text{horizontal distance}}$$

$$1.4 = \frac{V}{4}$$

$$V = 1.4 \times 4$$

$$V = 5.6\text{m}$$



$$\text{gradient} = \frac{\text{vertical height}}{\text{horizontal distance}}$$

$$1.2 = \frac{3.6}{H}$$

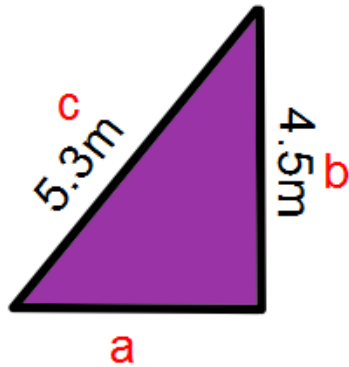
$$1.2H = 3.6$$

$$H = \frac{3.6}{1.2} = 3\text{m}$$

Pythagoras and Gradient

Note

If we know the slope length and either the vertical or horizontal distance we can use our knowledge of Pythagoras Theorem to find the missing distance and then the gradient.



$$a^2 = c^2 - b^2$$

$$a^2 = 5.3^2 - 4.5^2$$

$$a^2 = 7.84$$

$$a = \sqrt{7.84}$$

$$a = 2.8\text{m}$$

$$\begin{aligned} \text{gradient} &= \frac{\text{vertical height}}{\text{horizontal distance}} = \frac{4.5}{2.8} = 1.6071\dots \\ &= 1.6 \end{aligned}$$

Types of Gradient

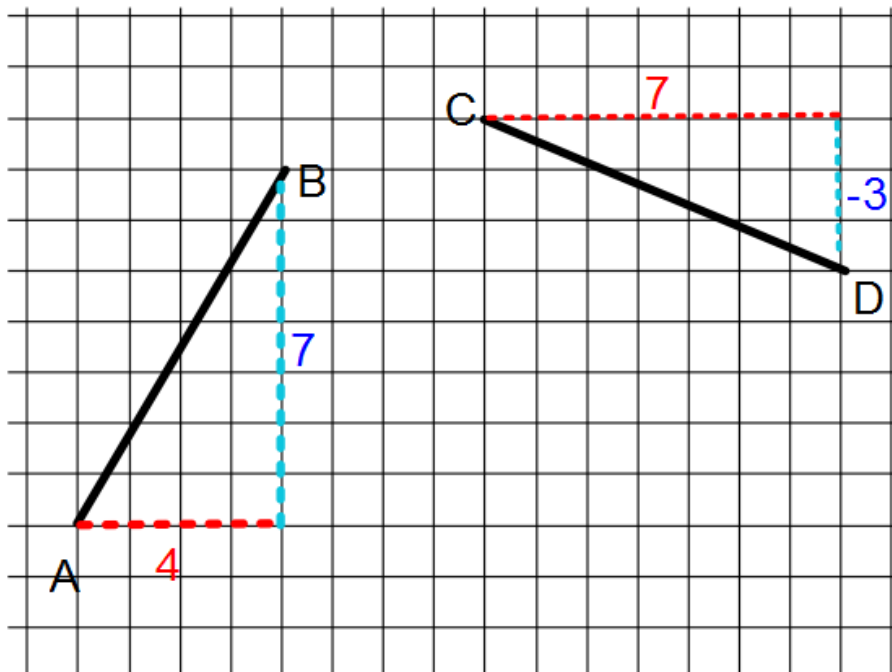
There are four types of Gradient: Uphill, Downhill, Flat Horizontal, and Straight Up Vertical.

Mathematically we name these : Positive, Negative, Zero, and Infinite.



Gradients of Lines on Co-ordinate Grids

When a line is on a grid you can count the boxes horizontally and vertically from the start to the finish of the line to enable you to work out the gradient.



$$m_{ab} = \frac{\text{vertical change}}{\text{horizontal change}}$$

$$m_{ab} = \frac{7}{4}$$

$$m_{cd} = \frac{\text{vertical change}}{\text{horizontal change}}$$

$$m_{cd} = \frac{-3}{7} = -\frac{3}{7}$$

Gradient of a Line between Two Points

To find the gradient of any line that we have two points on we use the following formula:

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

Where the coordinates of the points are (x_1, y_1) and (x_2, y_2)

Example: What is the gradient between the points A(3,4) and B(-2,11)?

$$m = \frac{y_2 - y_1}{x_2 - x_1} \quad m = \frac{11 - 4}{-2 - 3} \quad m = \frac{7}{-5} = -\frac{7}{5}$$



Note

Working Backwards to find a Co-ordinate

You can find missing co-ordinates if you are given the gradient of a line:

Example: The gradient of a line is 2 and passes through A(2,y) and B(-1,2)

$x_2 y_2$

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$x_1 y_1$

$$2 = \frac{2 - y}{-1 - 2}$$

$$2 = \frac{2 - y}{-3}$$

$$-6 = 2 - y$$

$$-8 = -y$$

$$y = 8$$