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Gradient

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Gradients of Line Graphs

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- ▶ The steepness or gradient of the line, can be found by putting the value for the change in height over the change in horizontal distance. That is,

$$\text{gradient} = \frac{\text{change in height}}{\text{change in horizontal distance}} = \frac{\text{rise}}{\text{run}}.$$
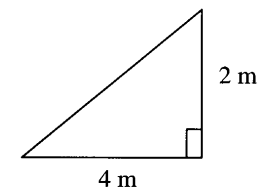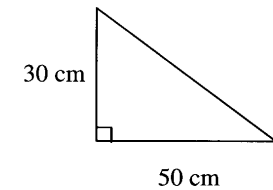
- ▶ We can also call it the **rate of change**.

Exercise

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Find the gradient of the following line segments.

(a)

2 m
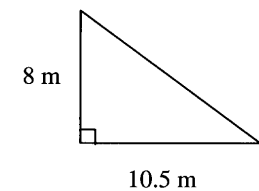
4 m

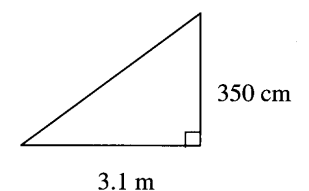(b)

30 cm

50 cm

(c)

8 m

10.5 m

(d)

350 cm

3.1 m

Answers

1.

$$\text{gradient} = \frac{\text{change in height}}{\text{change in horizontal distance}} = \frac{2}{4} = \frac{1}{2}.$$

2.

$$\text{gradient} = \frac{\text{change in height}}{\text{change in horizontal distance}} = \frac{-30}{50} = \frac{-3}{5}.$$

3.

$$\text{gradient} = \frac{\text{change in height}}{\text{change in horizontal distance}} = \frac{-8}{10.5} = \frac{-80}{105} = \frac{-16}{21}.$$

4.

$$\text{gradient} = \frac{\text{change in height}}{\text{change in horizontal distance}} = \frac{350}{310} = \frac{35}{31}.$$

Did you remember to change the measurements so that they are in the same units?

Finding the gradient of a given line

To find the gradient of this line we use the following procedure.

1. Choose *any* two points on the line.

2. Draw a triangle that shows the change in height over the change in horizontal distance between the two points.

3. Calculate the gradient by putting the change in height over the change in horizontal distance. *Do not forget to check for a rising or falling line.*
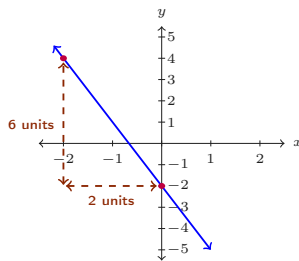
Example:

Find the gradient of the following line with equation
$y = -3x - 2$.

Two convenient points to choose this time might be $(-2, 4)$ and $(0, -2)$.

Note that this time the line falls as we move from left to right so the gradient must be negative.

Therefore the gradient is:

$$\text{gradient} = \frac{\text{change in height}}{\text{change in horizontal distance}}$$
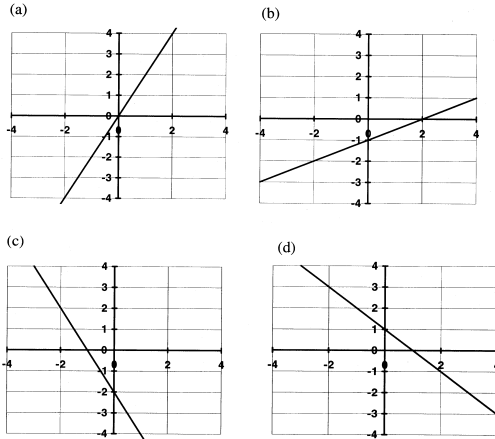$$= \frac{-6}{2} = -3.$$

Exercises

For each of the following lines, calculate the gradient. Do not forget to consider the scale on the axes and the rising or falling of the line.

(a)

(b)

(c)

(d)

Answers

For these questions you might have chosen a variety of different points with which to work. With this in mind only the final gradient is given.

1. gradient $= 2$.

2. gradient $= \frac{1}{2}$.

3. gradient $= -2$.

4. gradient $= -1$.

Drawing a line given the gradient

The steps that we follow to do this are:

1. plot the given point;

2. move horizontally and vertically according to the 'instructions' given by the gradient, and mark another point onto the Cartesian plane; and

3. finally draw a line through and beyond these two plotted points.

Example

Let us follow through these steps and draw a line passing through the point $(1, -2)$ with a gradient of 3.

Step 1.

Plot the point $(1, -2)$.

Step 2.

Look at the gradient to determine the 'instructions' it is providing.

$$\text{Now, gradient} = \frac{\text{change in height}}{\text{change in horizontal distance}}.$$

We know that the gradient for this question is 3, and we express this as $\frac{3}{1}$, so we write:

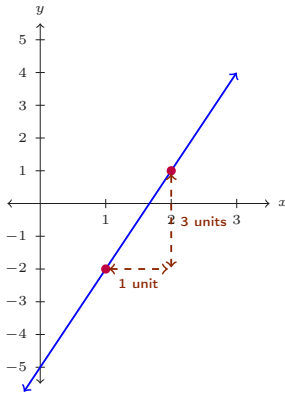$$\text{gradient} = \frac{3}{1}.$$

We take particular note that the gradient in this case is positive. This means that from our plotted point $(1, -2)$, we move 1 unit horizontally to the right and 3 units vertically upwards. This is the position of the second point.
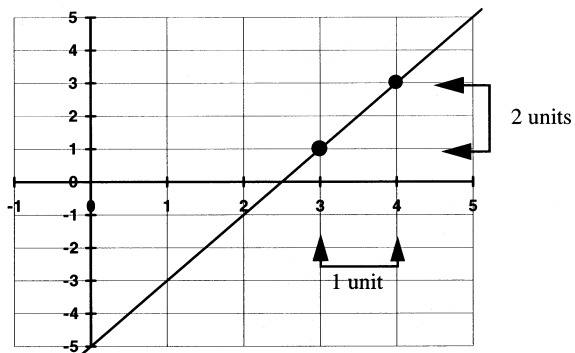
Example (cont)

Step 3.

Now draw a line through and beyond the plotted points.

Exercises

1. Draw a line with a gradient of 2 passing through $(3, 1)$.

2. Draw a line with a gradient of $\frac{2}{3}$ passing through the point $(-1, -2)$.

Answers
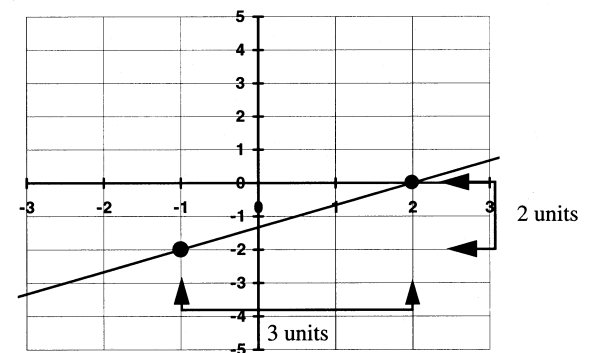
1. A gradient of 2 can be written $\frac{2}{1}$.

Answers (cont)

2. The gradient here is $\frac{2}{3}$.

Further help
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