PROPORTIONAL REASONING...
Multiplicative Change

@whisto_maths

What do I need to be able to do?

By the end of this unit you should be able to:
- Solve problems and explain direct proportion
- Use conversion graphs to make statements, comparisons and form conclusions.
- Understand and use scale factors for length

Keywords

Proportion: a statement that links two ratios
Variable: a part that the value can be changed
Axes: horizontal and vertical lines that a graph is plotted around
Approximation: an estimate for a value
Scale Factor: the multiple that increases/ decreases a shape in size
Currency: the system of money used in a particular country
Conversion: the process of changing one variable to another
Scale: the comparison of something drawn to its actual size.

Direct Proportion

As one variable changes the other changes at the same rate.

This is a multiplicative change

4 cans of pop = £2.40

$\times 0.5$ ⟮ 4 cans of pop = £2.40
2 cans of pop = £1.20 ⟯

$\times 3$ ⟮ 4 cans of pop = £2.40
12 cans of pop = £7.20 ⟯ $\times 3$

This multiplier is the same In the same way that this would be for ratio

Sometimes this is easiest if you work out how much one unit is worth first
e.g. 1 can of pop = £0.60

Conversion Graphs

Compare two variables
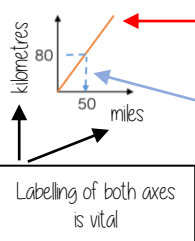
This is always a straight line because as one variable increases so does the other at the same rate

To make conversions between units you need to find the point to compare – then find the associated point by using your graph.
Using a ruler helps for accuracy
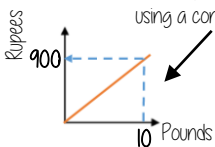Showing your conversion lines help as a "check" for solutions

Labelling of both axes is vital

Conversion between currencies

£1 = 90 Rupees ← Currency is directly proportional

For every £1 I have 90 Rupees

$\times 10$ ⟮ £1 = 90 Rupees
£10 = 900 Rupees ⟯ $\times 10$

Currency can be converted using a conversion graph

Convert 630 Rupees into Pounds

$\times 7$ ⟮ £1 = 90 Rupees
£7 = 630 Rupees ⟯ $\times 7$ ← 630 ÷ 90 = 7

Ratio between similar shapes

Angles in similar shapes do not change.
e.g. if a triangle gets bigger the angles can not go above 180^0

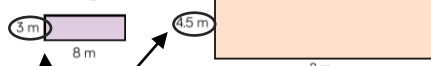The two rectangles are similar.

3 m / 8 m   4.5 m / ? m

Corresponding sides

$\times 1.5$ ⟮ 3m : 4.5m
1 m : 1.5 m ⟯ $\div 3$

$\times 8$ ⟮ 8m : 12m
1 m : 1.5 m ⟯ $\div 8$

Note Simplify to the same ratio

Understand Scale Factor

The two rectangles are similar.

3 m / 8 m   4.5 m / ? m

3 x 1.5 = 4.5

This is a multiplicative change

Missing length
8 x 1.5 = 12m

Use **corresponding** sides to calculate a scale factor

Scale factor can also be calculated by:

Bigger corresponding side
Smaller corresponding side

Small corresponding side ⟶ $\times SF$ ⟶ Big corresponding side
⟵ $\div SF$ ⟵
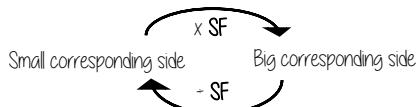
Draw and interpret scale diagrams

A picture of a car is drawn with a scale of 1:30

For every 1cm on my image is 30cm in real life

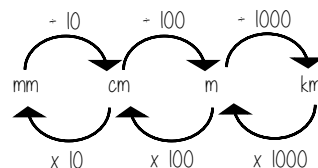**The car image is 10cm**

Image : Real life
$\times 10$ ⟮ 1cm : 30cm
10cm : 300cm ⟯ $\times 10$

The car in real life is 210cm

Image : Real life
$\times 7$ ⟮ 1cm : 30cm
7cm : 210 cm ⟯ $\times 7$

Interpret maps with scale factors

$\div 10$ $\div 100$ $\div 1000$

mm   cm   m   km

$\times 10$ $\times 100$ $\times 1000$

Ratios need to be in the same units

1 cm : 250 m

1 cm : 250m
1 cm : 25000cm

250 x 100 = 25000

For every 1cm on my map is 25000cm in real life