

YEAR 9 — REASONING WITH GEOMETRY... Enlargement & Similarity

@whisto_maths

What do I need to be able to do?

By the end of this unit you should be able to:

- Recognise enlargement and similarity
- Enlarge a shape by a positive SF
- Enlarge a shape from a point
- Enlarge a shape by a fractional SF
- Work out missing sides and angles in a pair of similar shapes.

Keywords

Similar Shapes: shapes of different sizes that have corresponding sides in equal proportion and identical corresponding angles.

Scale Factor: the multiple describing how much a shape has been enlarged

Enlarge: to change the size of a shape (enlargement is not always making a shape bigger)

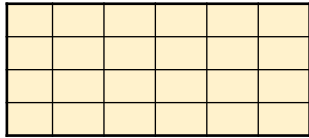
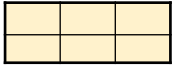
Corresponding: objects (or sides) that appear in the same place in two similar situations.

Image: the picture or visual representation of the shape

Recognise enlargement & similarity

Shapes are similar if all pairs of corresponding sides are in the same ratio

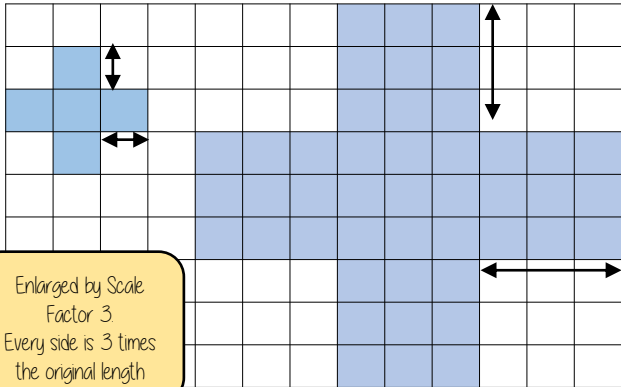
These shapes are similar because all sides are increased by the same ratio



Enlargements are similar shapes with a ratio other than 1

Enlarge by a positive scale factor

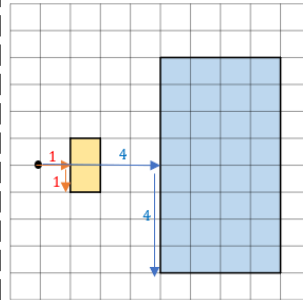
With a scale factor larger than 1 it makes the shape bigger



Enlarged by Scale Factor 3
Every side is 3 times the original length

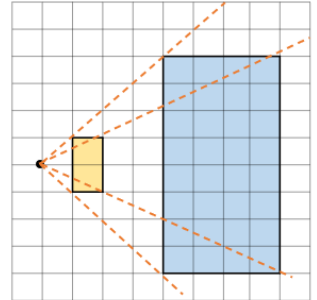
Enlarge a shape from a point

Scaled distances method



Scale the distance between the point of enlargement and each corresponding vertices

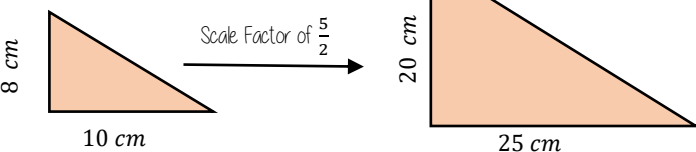
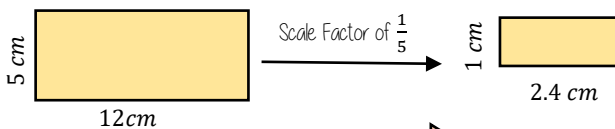
Rays method



Multiply the distance from the centre of corresponding vertices by the scale factor along the ray

Positive fractional scale factor

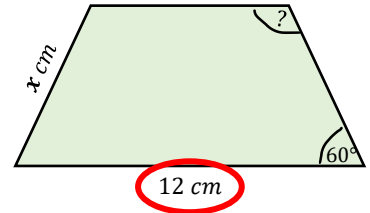
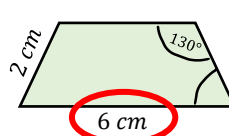
With a scale factor between 0 and 1 it makes the shape smaller



Calculations in similar shapes

Don't forget that properties of shapes don't change with enlargements or in similar shapes

The two trapezium are similar find the missing side and angle



Corresponding sides identify the scale factor

$$\frac{12}{6} = 2$$

Scale Factor = 2

Calculate the missing side

Length (corresponding side) \times scale factor
 $2\text{ cm} \times 2$
 $x = 4\text{ cm}$

Enlargement does not change angle size

Calculate the missing angle

Corresponding angles remain the same
 130°

YEAR 9 — REASONING WITH GEOMETRY...

Solving ratio & proportion problems

@whisto_maths

What do I need to be able to do?

By the end of this unit you should be able to:

- Solve problems with direct proportion
- Use conversion graphs
- Solve problems with inverse proportion
- Solve ratio problems
- Solve 'best buy' problems

Keywords

Proportion: a comparison between two numbers

Ratio: a ratio shows the relative size of two variables

Direct proportion: as one variable is multiplied by a scale factor the other variable is multiplied by the same scale factor.

Inverse proportion: as one variable is multiplied by a scale factor the other is divided by the same scale factor.

Direct Proportion

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

R



4 cans of pop = £2.40

4 cans of pop = £2.40
 $\times 0.5$ → 2 cans of pop = £1.20
 $\times 50$ → 200 cans of pop = £120

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

This is a multiplicative change

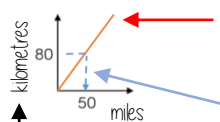
4 cans of pop = £2.40
 $\times 3$ → 12 cans of pop = £7.20

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

R



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

Inverse Proportion

As one variable is multiplied by a scale factor the other is divided by the same scale factor

Examples of inversely proportional relationships

Time taken to fill a pool and the number of taps running

Time taken to paint a room and the number of workers

T is inversely proportional to G. When T=2 then G=20

T	1	2	8
G	40	20	5

$\div 2$ (from 1 to 2) $\times 4$ (from 2 to 8)
 $\times 2$ (from 40 to 20) $\div 4$ (from 20 to 5)

Best Buys

Have a directly proportional relationship

To calculate best buys you need to be able to compare the cost of one unit or units of equal amounts



Shop A

4 cans for £1.20

↓ $\pounds 1.20 \div 4$

Cost per item

1 can is £0.30
Or 30p

Shop B

3 cans for 93p

↓ $\pounds 0.93 \div 3$

1 can is £0.31
Or 31p

Shop A is the best value as it is 1p cheaper per can of pop



Shop A

4 cans for £1.20

↓ $4 \div \pounds 1.20$

Cost per pound

£1 buys 3.333 cans of pop

3 cans for 93p

↓ $3 \div \pounds 0.93$

£1 buys 3.23 cans of pop

Shop A is still shown as being the best value but pay attention to the unit you are calculating, per item or per pound

Best value is the most product for the lowest price per unit

Sharing a whole into a given ratio

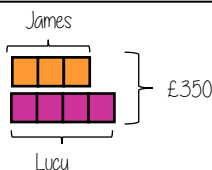
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James and Lucy share £350 in the ratio 3:4.
Work out how much each person earns

Model the Question

James: Lucy

3 : 4



£350 ÷ 7 = £50

□ = one part = £50

Find the value of one part

Whole: £350
7 parts to share between
(3 James, 4 Lucy)

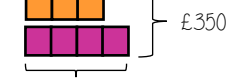
Put back into the question

James: Lucy

James = 3 × £50 = £150

Lucy = 4 × £50 = £200

$\left(\begin{matrix} \times 50 & 3 : 4 & \times 50 \\ \hline \pounds 150 & \pounds 200 \end{matrix} \right)$



Lucy = 4 × £50 = £200

Finding a value given 1:n (or n:1)

R

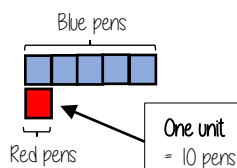
Inside a box are blue and red pens in the ratio 5:1
If there are 10 red pens how many blue pens are there?

Model the Question

Blue : Red

5 : 1

□ = one part = 10 pens



Put back into the question

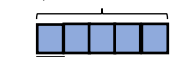
Blue: Red

$\left(\begin{matrix} \times 10 & 5 : 1 & \times 10 \\ \hline 50 : 10 \end{matrix} \right)$

50 : 10

There are 50 Blue Pens

Blue pens = 5 × 10 = 50 pens



Red pens = 1 × 10 = 10 pens

Red pens = 1 × 10 = 10 pens