

What do I need to be able to do?

- Recognise line symmetry
- Recognise and understand rotational symmetry
- Reflect shapes in horizontal and vertical lines
- Reflect shapes in diagonal lines
- Translate shapes in two directions
- Translate shapes given a vector
- Rotate shapes from a given centre
- Enlarge shapes using a given scale factor (including fractional SF)
- Enlarge shapes from a centre of enlargement
- Perform a combination of transformations
- Describe the transformation that has taken place given the original and new shape
- Use scale factors to find lengths of missing sides
- Use scale factors to find lengths of missing sides in similar shapes

Keywords:

- Rotate:** a rotation is a circular movement.
- Symmetry:** when two or more parts are identical after a transformation. **Regular:** a regular shape has angles and sides of equal lengths.
- Invariant:** a point that does not move after a transformation.
- Vertex:** a point two edges meet.
- Horizontal:** from side to side
- Vertical:** from up to down
- 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

Rotate from a point (in a shape)

Original shape

Point of rotation

Image 90° clockwise

- Trace the original shape (mark the point of rotation)
- Keep the point in the same place and turn the tracing paper
- Draw the new shape

Clockwise Anti-Clockwise

Rotate from a point (outside a shape)

Image 90° anti-clockwise

Point of rotation

Original shape

- Trace the original shape (mark the point of rotation)
- Keep the point in the same place and turn the tracing paper
- Draw the new shape

Translation and vector notation

Vector Notation $\begin{pmatrix} 1 \\ -2 \end{pmatrix}$

How far left or right to move
Negative value (left)
Positive value (right)

Translation $\begin{pmatrix} -3 \\ 3 \end{pmatrix}$

How far up or down to move
Negative value (down)
Positive value (up)

Original shape

Every vertex has been translated by the same amount

Compare rotations and reflections

Reflections are a mirror image of the original shape.

Information needed to perform a reflection

- Line of reflection (Mirror line)

Rotations are the movement of a shape in a circular motion

Information needed to perform a rotation

- Point of rotation
- Direction of rotation
- Degrees of rotation

Enlarge by a positive scale factor

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

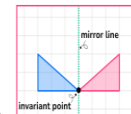
Enlarged by Scale Factor 3
Every side is 3 times the original length

What are invariant points?

Invariant points are points which have stayed in the same place after a transformation.

E.g.

Here is a reflection. The invariant point is labelled.



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 a shape from a point

Scaled distances method

Rays method

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

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

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

2 cm, 6 cm, 12 cm, 2 cm, 130°, 60°

Corresponding sides identify the scale factor

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°

Positive fractional scale factor

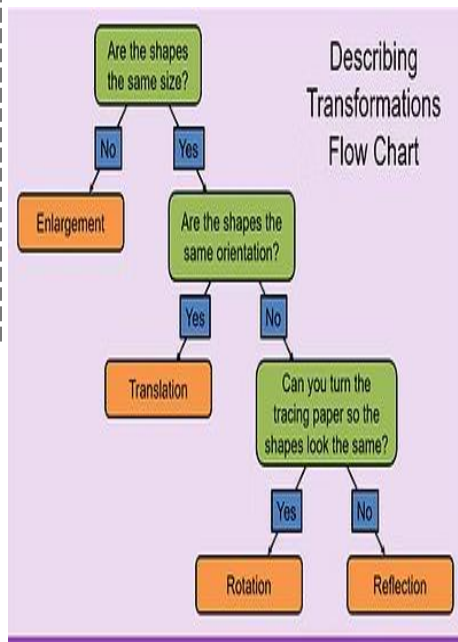
With a scale factor between 0 and 1 it makes the shape smaller

Scale Factor of $\frac{1}{5}$

12 cm, 5 cm, 1 cm, 2.4 cm

Scale Factor of $\frac{4}{5}$

10 cm, 8 cm, 20 cm, 25 cm



Maths – Forming and solving Equations

What do I need to be able to do?

- Solve one and two step equations, including with fractions.
- Solve equations with brackets
- Solve equations with unknowns on both sides
- Solve equations involving powers of the unknown
- Form and solve equations in a variety of contexts
- Rearrange one step formulae
- Rearrange two step formulae

Keywords:

Equation – a mathematical statement that two things are equal.

Expand brackets - multiply everything in the brackets by the number outside.

Solve - To find the value of the letter

Inverse - The opposite operation

Evaluate - Work out

Simultaneous equations – solve more than one equation at the same time.

Solve equations with brackets

$$\begin{array}{l}
 3(x+5) = 27 \\
 \text{Expand Brackets} \quad \text{Expand Brackets} \\
 3x + 15 = 27 \\
 -15 \quad -15 \\
 3x = 12 \\
 +3 \quad +3 \\
 x = 4
 \end{array}$$

Simultaneous equations

2 chocolate bars & 1 apple costs £2.50

1 chocolate bar & 1 apple costs £1.50

How much is a chocolate bar?

$$\begin{array}{rcl}
 \begin{array}{c} \text{chocolate bar} \\ \text{chocolate bar} \end{array} \begin{array}{c} \text{apple} \end{array} & = & \text{£2.50} \\
 \begin{array}{c} \text{chocolate bar} \\ \text{apple} \end{array} & = & \text{£1.50} \\
 \hline
 \text{chocolate bar} & = & \text{£1}
 \end{array}$$

How do we find the value of an apple?

Equations with unknown on both sides

$$\begin{array}{l}
 5a + 8 = 3a + 18 \\
 -3a \quad -3a \\
 2a + 8 = 18 \\
 -8 \quad -8 \\
 2a = 10 \\
 \div 2 \quad \div 2 \\
 a = 5
 \end{array}$$

Forming equations

$$\begin{array}{l}
 a + 5 + 3a + 15 = 180 \\
 4a + 20 = 180 \\
 4a = 160 \\
 a = 40^0
 \end{array}$$

Substitute the cost of a chocolate bar to find the cost of an apple.

$$\begin{array}{rcl}
 \begin{array}{c} \text{chocolate bar} \\ \text{apple} \end{array} & = & \text{£1.50} \\
 \text{£1} + \text{apple} & = & \text{£1.50} \\
 \text{apple} & = & 50p
 \end{array}$$

Formulae and Equations

Formulae – all expressed in symbols

Substitute in values

Equations – include numbers and can be solved

Rearranging Formulae (one step)

$$\begin{array}{|c|c|}
 \hline
 x \\
 \hline
 y \quad z \\
 \hline
 \end{array}$$

$$x = y + z$$

Rearrange to make y the subject

$$y = x - z$$

$$y \rightarrow +z \rightarrow x$$

$$y \leftarrow -z \leftarrow x$$

Using inverse operations or fact families will guide you through rearranging formulae.

Rearranging can also be checked by substitution

Language of rearranging...

Make XXX the subject

Change the subject

Rearrange

Rearranging Formulae (two step)

In an equation (find x)

$$4x - 3 = 9$$

$$+3 \quad +3$$

$$4x = 12$$

$$\div 4 \quad \div 4$$

$$x = 3$$

In a formula (make x the subject)

$$xy - s = a$$

$$+s \quad +s$$

$$xy = a + s$$

$$\div y \quad \div y$$

$$x = \frac{a+s}{y}$$

The steps are the same for solving and rearranging

Rearranging is often needed when using $y = mx + c$

eg find the gradient of the line $2y - 4x = 9$

Make y the subject first $y = \frac{4x+9}{2}$

Gradient = $\frac{4}{2} = 2$