

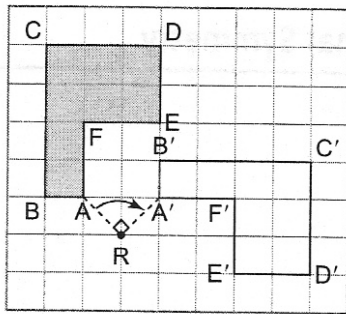
7.6 Skill Builder

Rotations

A **rotation** may be clockwise or counterclockwise.
Some common rotations are 90° , 180° , and 270° .

This shape was rotated 90° clockwise about point R.

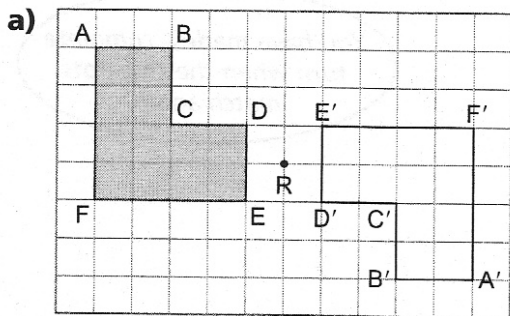
A complete turn measures 360° .



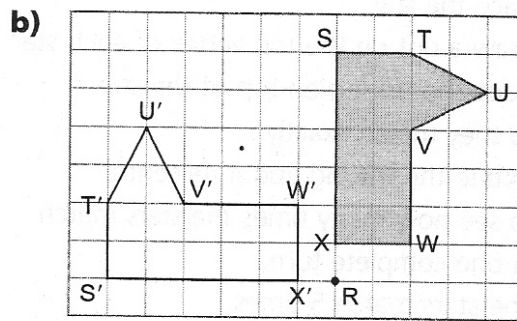
$\angle ARA' = 90^\circ$, $\angle BRB' = 90^\circ$, and so on.
Each angle is the angle of rotation.
We can use a protractor to check.

Check

1. For each picture, write the angle of rotation.



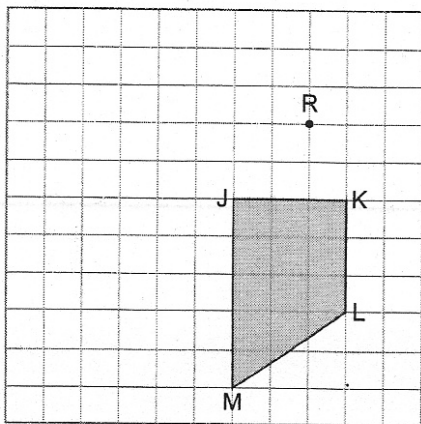
Angle of rotation: _____



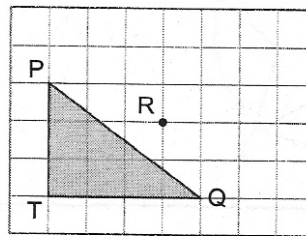
Angle of rotation: _____

2. Draw the image after each rotation about point R.

a) 90° clockwise



b) 180°



We can use tracing paper to help us rotate a shape.

7.6 Rotations and Rotational Symmetry

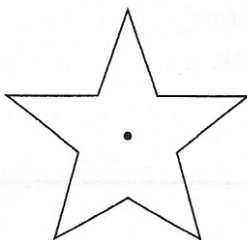
FOCUS Draw and classify shapes with rotational symmetry.

A shape has **rotational symmetry** when it can be turned less than 360° about its centre to match itself exactly.

The number of matches in a complete turn is the **order of rotation**.

Example 1 Determining the Order of Rotational Symmetry

Find the order of rotational symmetry for this star.



Solution

Trace the star.

Draw a dot on the top vertex of each star.

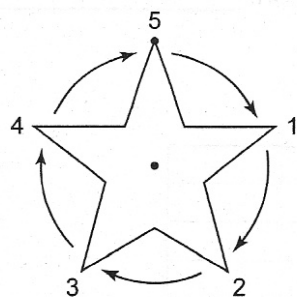
Place the tracing on top of the star so they match exactly.

Rotate the tracing about its centre to see how many times the stars match in one complete turn.

The stars match 5 times.

So, the star has rotational symmetry of order 5.

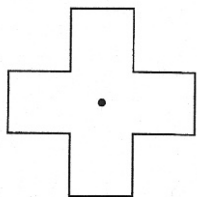
You have made a complete turn when the two dots match again.



Check

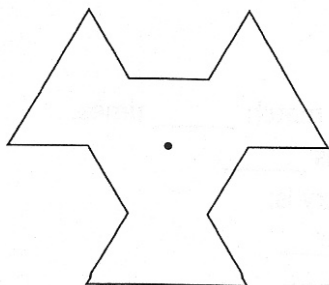
1. Find the order of rotational symmetry for each shape.
Use tracing paper to help.

a)



The shape and its tracing match ____ times.
So, the shape has rotational symmetry of order ____.

b)



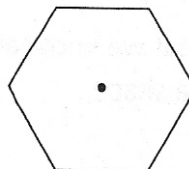
The shape and its tracing match ____ times.
So, the shape has rotational symmetry of order ____.

The smallest angle you need to turn for two shapes to match is the **angle of rotation**.

$$\left[\text{The angle of rotation symmetry} = \frac{360^\circ}{\text{the order of rotation}} \right]$$

Example 2 Determining the Angle of Rotation Symmetry

Find the angle of rotation symmetry for this shape.



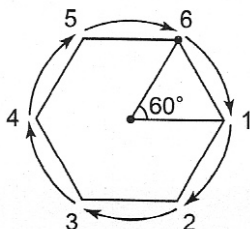
Solution

In one complete turn, the shape and its tracing match 6 times.
So, the order of rotation is 6.

The angle of rotation symmetry is:

$$\frac{360^\circ}{\text{the order of rotation}} = \frac{360^\circ}{6} = 60^\circ$$

The angle of rotation symmetry is 60°.

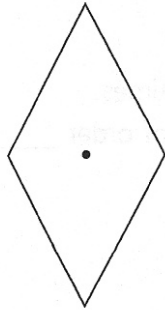


The shapes will match when the tracing is rotated by a multiple of 60°.

Check

1. Find the angle of rotation symmetry for each shape.

a)



The shape and its tracing match _____ times.

So, the order of rotation is _____.

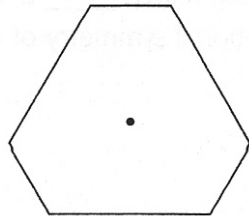
Angle of rotation symmetry is:

$$\frac{360^\circ}{\text{the order of rotation}} = \frac{360^\circ}{\underline{\hspace{2cm}}}$$

$$= \underline{\hspace{2cm}}$$

The angle of rotation symmetry is _____.

b)



The shape and its tracing match _____ times.

So, the order of rotation is _____.

Angle of rotation symmetry is:

$$\frac{360^\circ}{\text{the order of rotation}} = \frac{360^\circ}{\underline{\hspace{2cm}}}$$

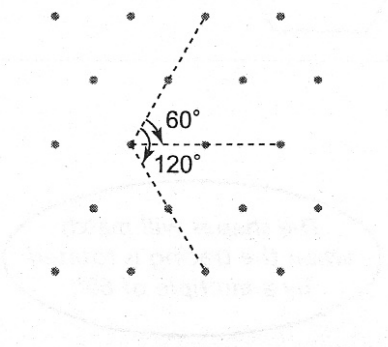
$$= \underline{\hspace{2cm}}$$

The angle of rotation symmetry is _____.

Shapes that need a complete turn to match again do not have rotational symmetry.

We use isometric dot paper to draw images after rotations that are multiples of 60°.

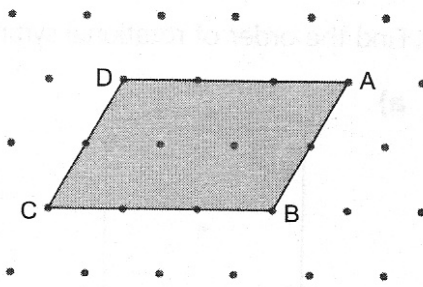
We can use what we know about isometric dot paper to help us rotate a shape.



Example 3 Drawing Rotation Images

Rotate parallelogram ABCD 60° clockwise about vertex C.

Draw and label the rotation image.



Solution

Trace the shape.

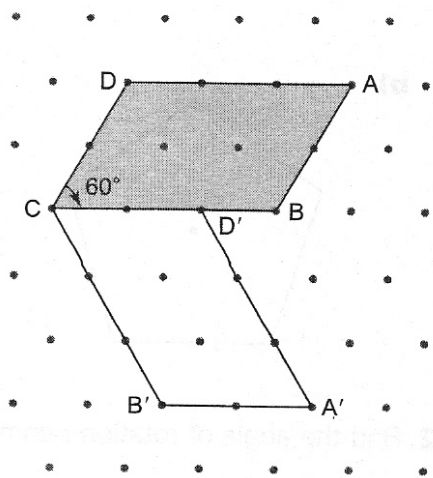
Label the vertices on the tracing.

Rotate the tracing 60° clockwise about vertex C.

Draw and label the rotation image.

The centre of rotation, C, does not move.

So, it is not labelled C'.

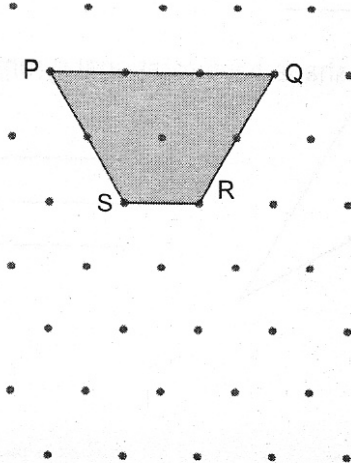
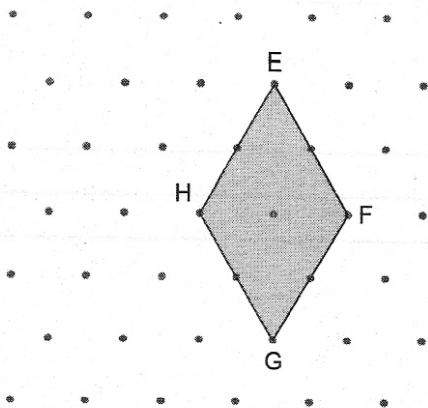


Check

1. Draw and label the image after each rotation.

a) 60° counterclockwise about vertex G

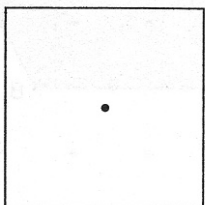
b) 120° clockwise about vertex S



Practice

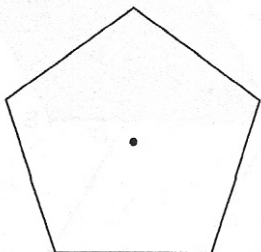
1. Find the order of rotational symmetry for each shape.

a)



The shape and its image match _____ times.
So, the shape has rotational symmetry of order _____.

b)



The shape and its image match _____ times.
So, the shape has rotational symmetry of order _____.

2. Find the angle of rotation symmetry for each shape in question 1.

a) The order of rotation is _____.

Angle of rotation symmetry is:

$$\frac{360^\circ}{\text{the order of rotation}} = \frac{360^\circ}{\underline{\hspace{2cm}}}$$

$$= \underline{\hspace{2cm}}$$

The angle of rotation symmetry is _____.

b) The order of rotation is _____.

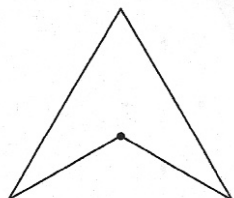
Angle of rotation symmetry is:

$$\frac{360^\circ}{\text{the order of rotation}} = \frac{360^\circ}{\underline{\hspace{2cm}}}$$

$$= \underline{\hspace{2cm}}$$

The angle of rotation symmetry is _____.

3. Does this shape have rotational symmetry?



4. The angle of rotation symmetry for a shape is 36° .
What is the shape's order of rotation?

The angle of rotation symmetry is: $\frac{360^\circ}{\text{the order of rotation}}$

So, $36^\circ = \frac{360^\circ}{\text{order of rotation}}$

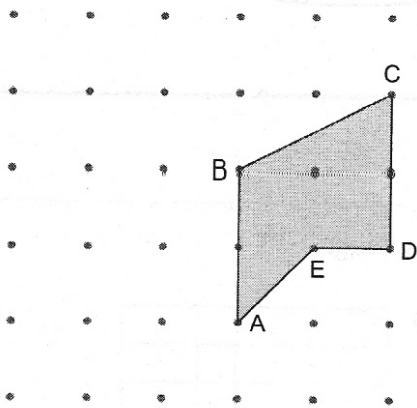
Think: Which number divides into 360 exactly 36 times?

I know $360 \div \underline{\quad} = 36$

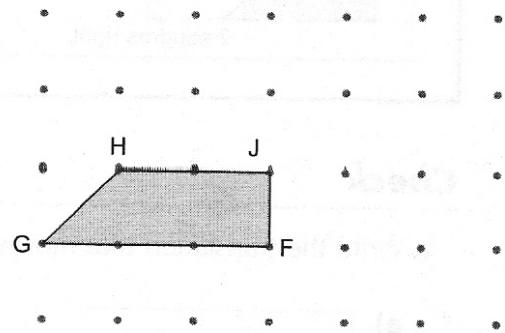
So, the order of rotation is $\underline{\quad}$.

5. Draw the image after each rotation.

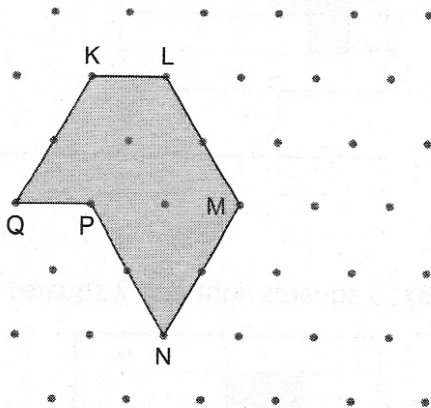
- a) 90° counterclockwise about vertex A



- b) 180° about vertex J



- c) 60° clockwise about vertex N



- d) 120° counterclockwise about vertex T

