Important Concepts . . .

Preview Review

Mathematics Grade 9 TEACHER KEY

W3 - Lesson 13: Rotational Symmetry

Important Concepts of Grade 9 Mathematics

W1 - Lesson 1 ..... Powers
W1 - Lesson 2 ..... Exponents
W1 - Lesson 3 ..... Rational Numbers
W1 - Lesson 4 ..... Order of Operations
W1 - Lesson 5 ..... Square Roots of Rational Numbers
W1 - Review
W1 - Quiz

W2 - Lesson 6 ..... Graphing Linear Relations
W2 - Lesson 7 ..... Solving Linear Relations
W2 - Lesson 8 ..... Linear Inequalities
W2 - Lesson 9 ..... Polynomials
W2 - Lesson 10 ..... Surface Area of 3D Objects
W2 - Review
W2 - Quiz

W3 - Lesson 11 ..... Properties of Circles
W3 - Lesson 12 ..... Polygons and Scale Diagrams
W3 - Lesson 13 ..... Rotational Symmetry
W3 - Lesson 14 ..... Representing Data
W3 - Lesson 15 ..... Probability
W3 - Review
W3 - Quiz

Materials Required

Paper
Pencil
Ruler
Tracing Paper
Scissors
Grid Paper

No Textbook Required

This is a stand-alone course.

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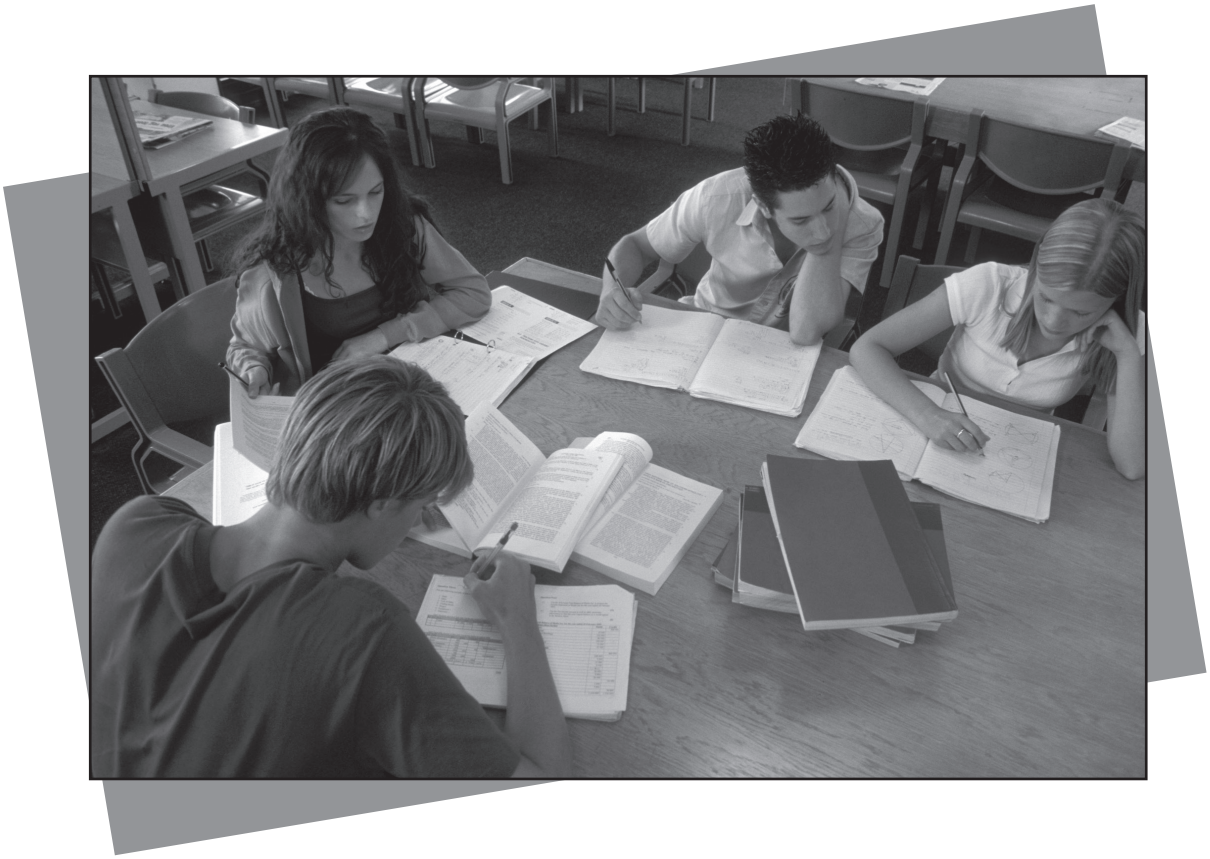
Preview/Review Concepts for Grade Nine Mathematics

Teacher Key



W3 – Lesson 13:

Rotational Symmetry

OBJECTIVES

By the end of this lesson, you will be able to:

- Classify a given set of 2-D shapes or designs according to the number of lines of symmetry.
- Identify a line of symmetry or the order and angle of rotation symmetry in a given tessellation.
- Identify the type of symmetry that arises from a given transformation on a Cartesian plane.
- Complete, concretely or pictorially, a given transformation of a 2-D shape on a Cartesian plane; record the coordinates; and describe the type of symmetry that results.

GLOSSARY

Symmetry: An image or object has symmetry if it can be split perfectly and the halves created can fit onto themselves.

Line of Symmetry: A line that divides an image or object into two identical halves. This line can split the image or object vertically, horizontally or oblique (slanted).

Order of Rotation: The numbers of times that a shape or an image can fit onto itself in one complete turn.

Angle of Rotation: The minimum angle of measure needed to turn a shape or image onto itself.

Centre of Rotation: The point where a shape or image turns.

Rotation Symmetry: Takes place when a shape or image can be turned around the centre of rotation so that it fits onto its outline more than once in a complete turn.

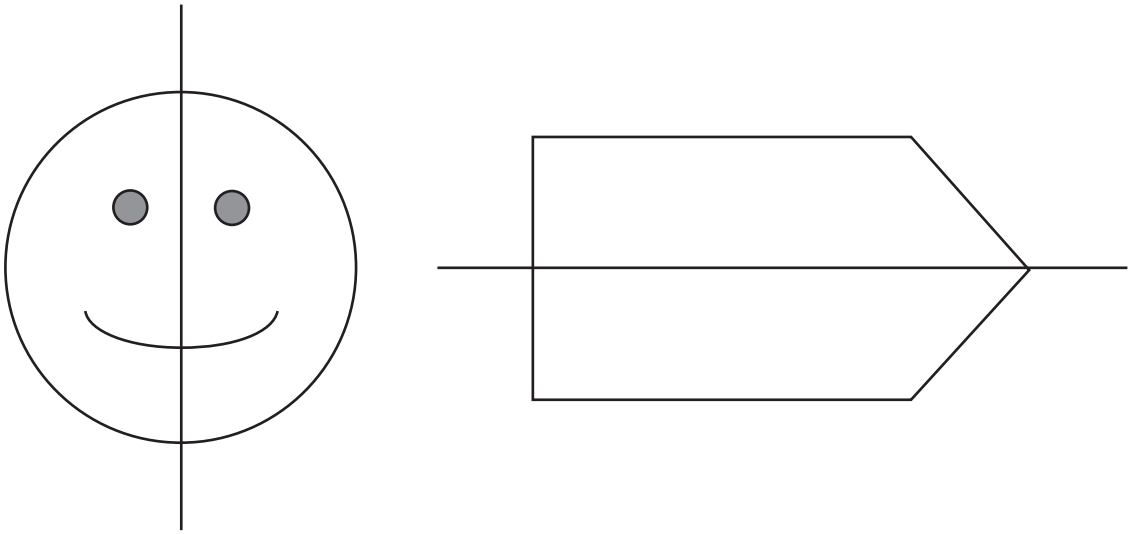
W3 – Lesson 13: Rotational Symmetry

Materials required:

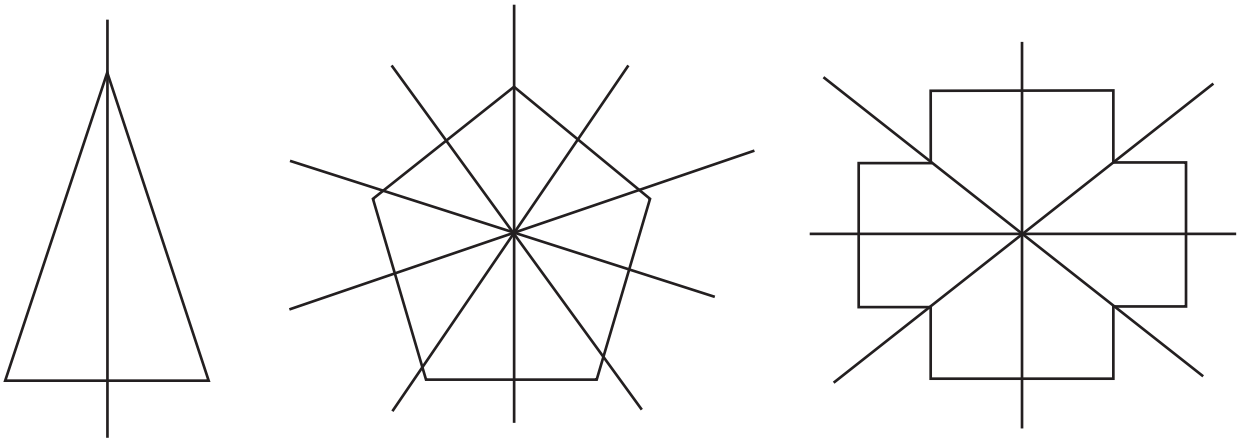
- Paper, Pencil, Ruler, Tracing Paper, Scissors, Grid Paper

Part 1: Lines of Symmetry

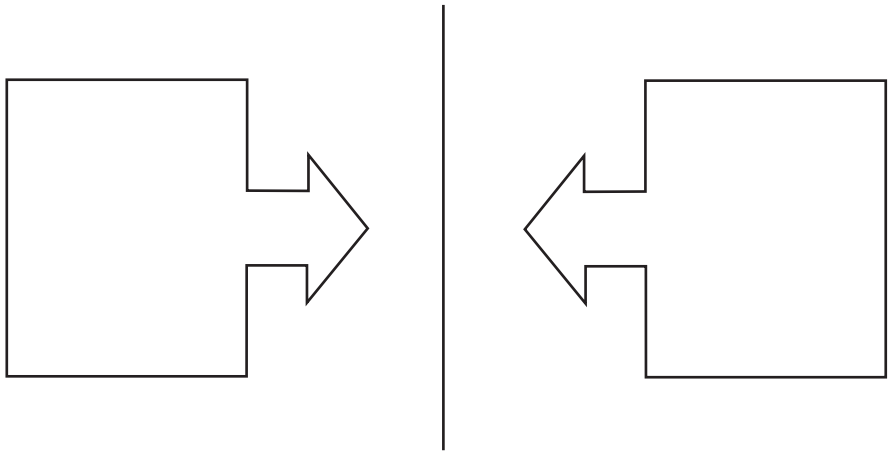
Lines of symmetry occur when a shape or image can be divided into identical halves. These identical halves are mirror images of each other and were created by the line of symmetry. This line of symmetry can also be called the line of reflection. It may or may not be part of the image itself.



Shapes and designs can have a varying number of lines of symmetry. It is important to note that the number of line of symmetry within a shape or image is always a whole number.

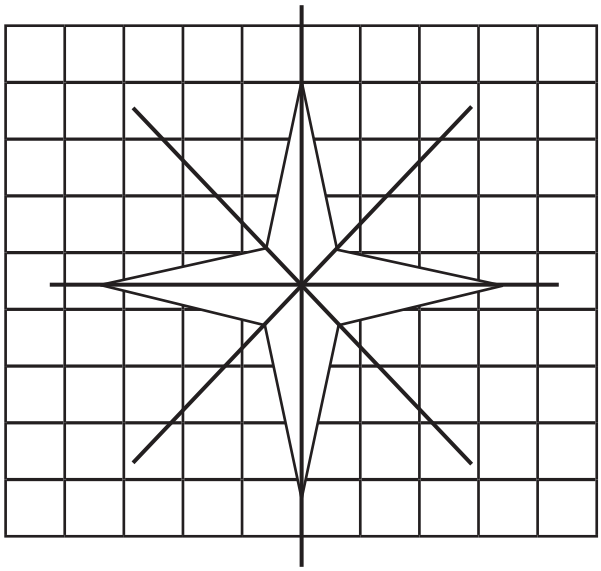


To complete a drawing or image using a line of symmetry, picture the mirror image or reflection. Folding or reflecting the shape or image will create the reflected image.



Example 1

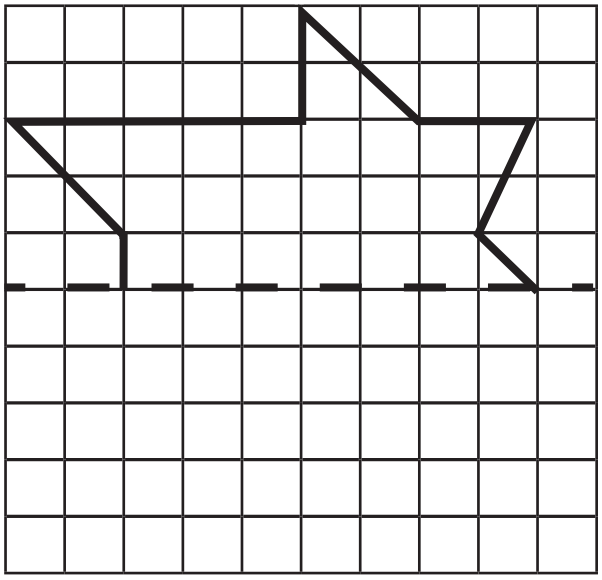
How many lines of symmetry does the image have?



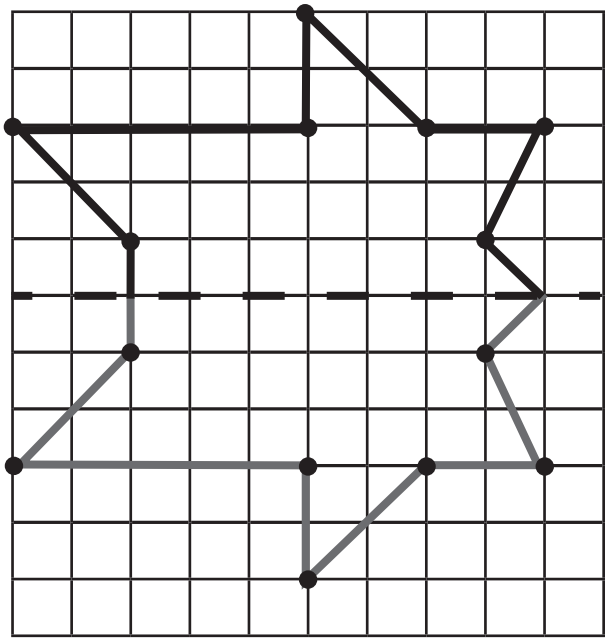
This shape has four lines of symmetry.

Example 2

The image below represents half of the complete figure. The image has been split by a line of symmetry. Draw the completed version of the image.



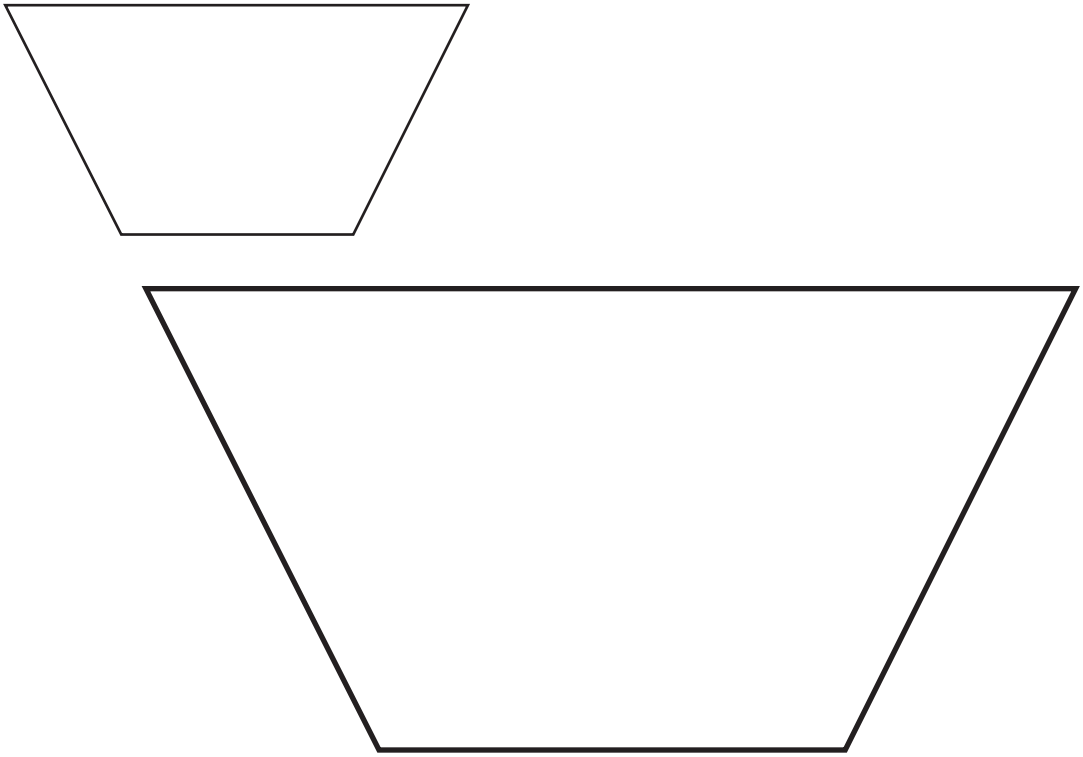
To complete the drawing, use the grid paper. On the half that is represented, label vertices. Reflect these points over the line of symmetry. Then join the points to complete the image.



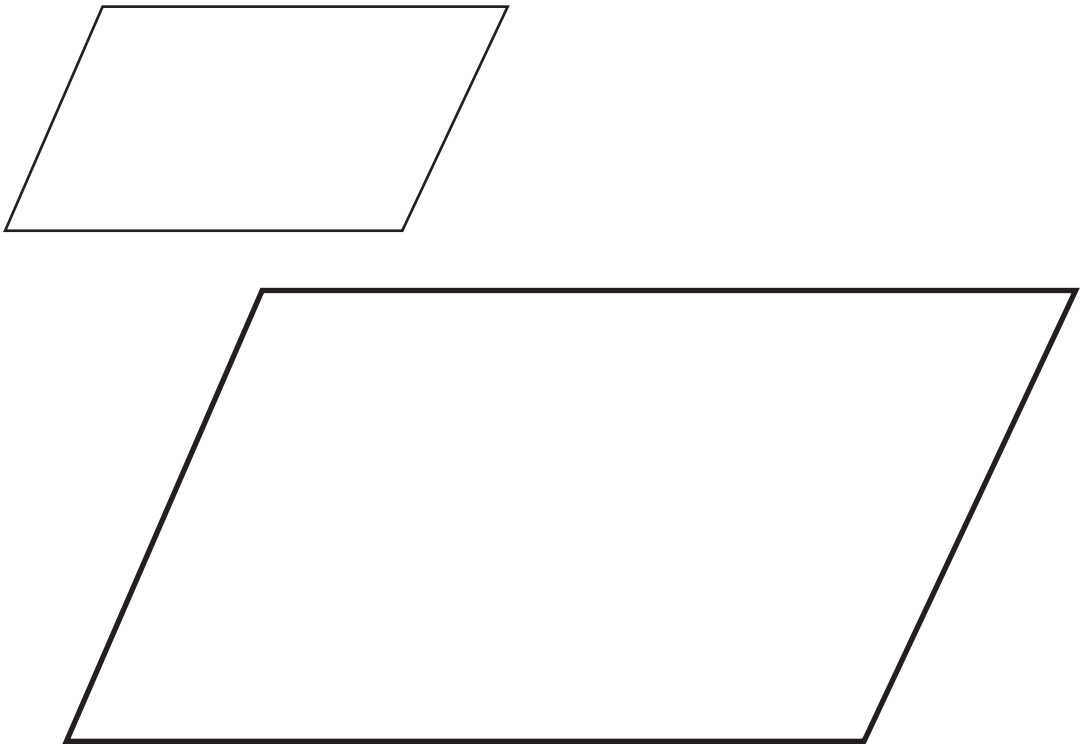
Practice Questions

1. Draw the image with a scale factor of 2.

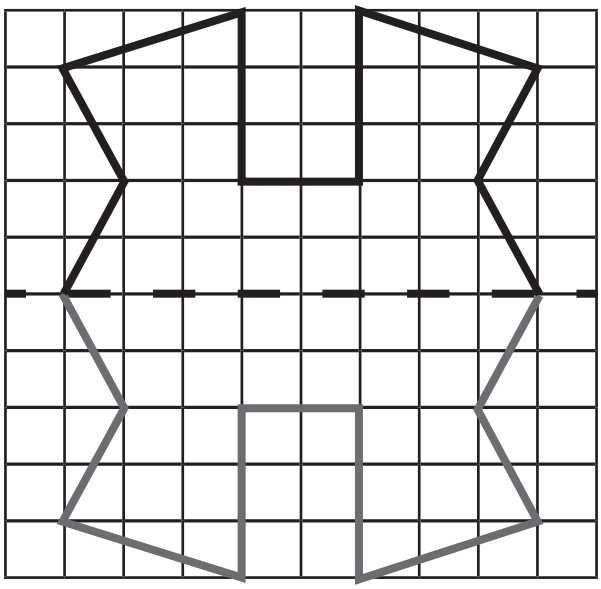
a.

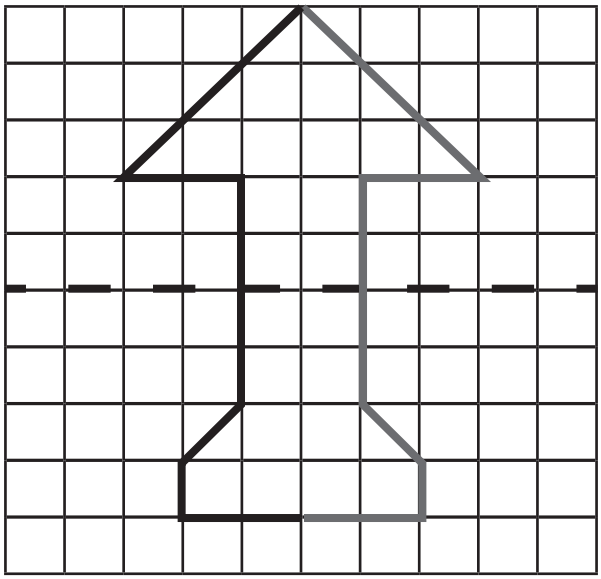


b.



2. Draw the completed image by using the line of symmetry.

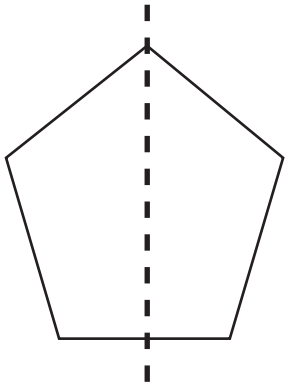




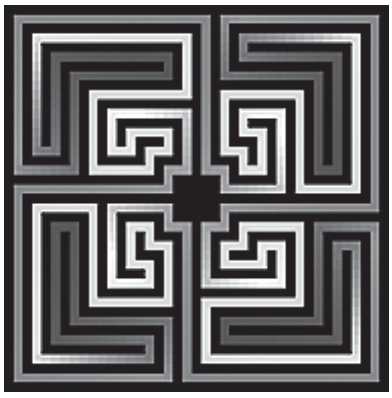
Part 2: Angle of Rotation

There are two basic types of symmetry for 2D images.

1 **Line Symmetry:** The line that divides an image into two reflect parts. This type of symmetry was explored in the previous section.



2. **Rotational Symmetry:** This occurs when an image can be turned about its centre of rotation so that it fits onto its shape more than once in a complete 360 degree turn.

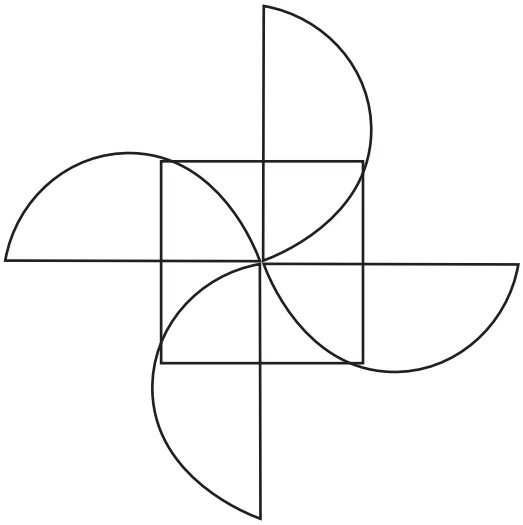


The order of rotation is the number of times that an image is able to fit onto itself in one complete 360 degree turn.

The above shape has an order of rotation of 4. It can be rotated on itself 4 times.

The angle of rotation is the smallest angle through which the image must be rotated to lie on itself. To find the angle of rotation, divide 360 (the number of degrees in a complete circle or one complete rotation) and divide it by the order of rotation.

Using the example below:

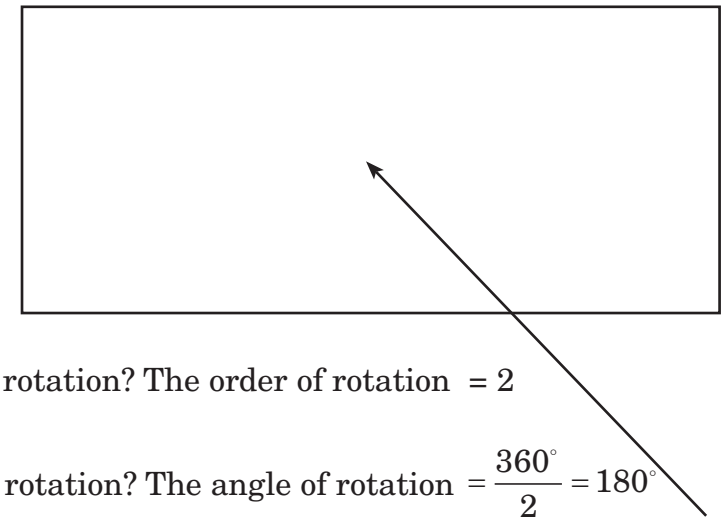


This image can be rotated on itself 4 times, so the order of rotation is 4.
The angle of rotation is calculated by dividing 360 by the order of rotation:

$$\frac{360^\circ}{4} = 90^\circ$$

Example 1

The following shape has symmetry.



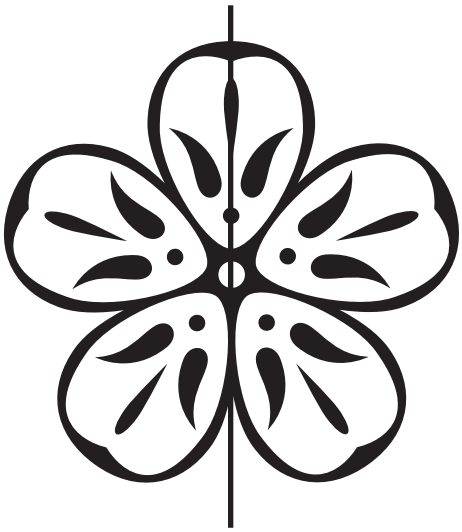
What is the order of rotation? The order of rotation = 2

What is the angle of rotation? The angle of rotation $= \frac{360^\circ}{2} = 180^\circ$

Where is the centre of rotation? This is located at the centre of the shape.

Example 2

The below design has both line symmetry and rotational symmetry.

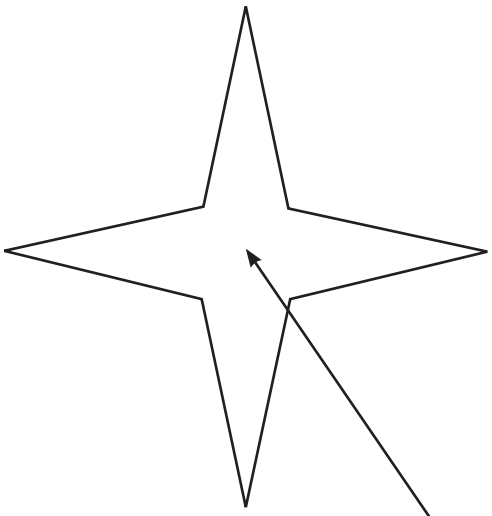


How many lines of symmetry does the image have? This shape has five lines of symmetry.

What is the angle of rotation? The shape can be rotated 5 times. So the angle of rotation is $\frac{360^\circ}{5} = 72^\circ$ degrees.

Practice Questions

1. Consider the following shape.



a. What is the order of rotation? ***4***

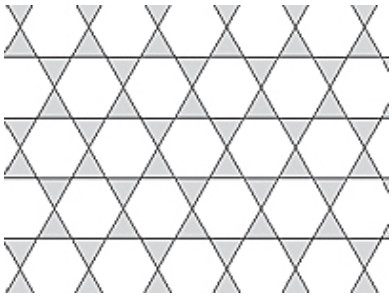
b. What is the angle of rotation? $\frac{360^\circ}{4} = 90^\circ$

c. Where is the centre of rotation? ***The centre of the shape.***

d. How many lines of symmetry does the shape have? ***4***

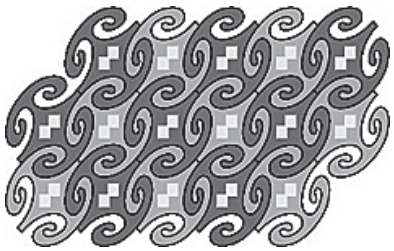
2. Does each of the following designs have line symmetry, rotational symmetry, neither or both?

a.



Both

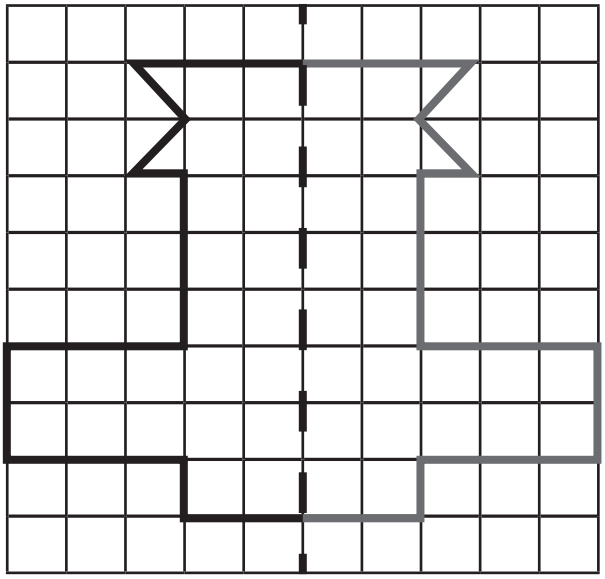
b.



Rotational Symmetry

Lesson 13 Assignment

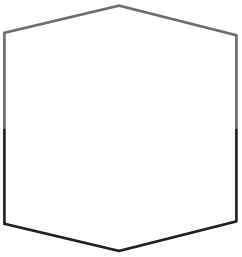
1. a. Draw the completed image by using the line of symmetry.



2. Draw the missing half of the image.

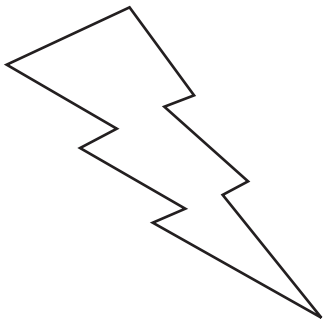
a.

b.

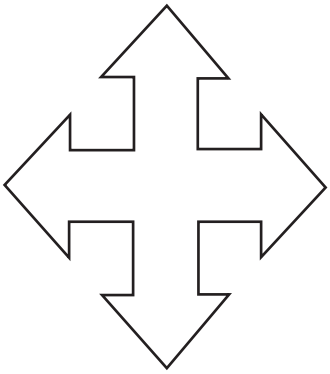


3. How many lines of symmetry does each of the following images have?

a.

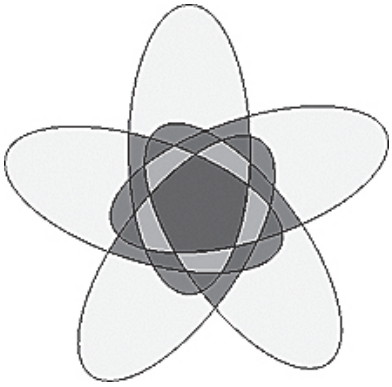


b.



None ***4***

4. Consider the following shape.



a. What is the order of rotation? ***5***

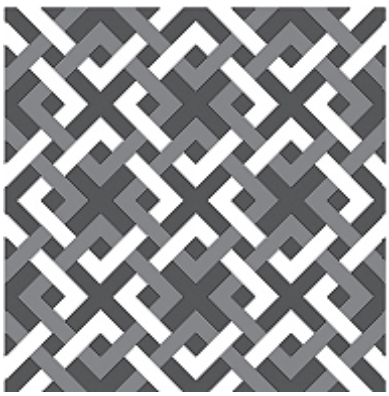
b. What is the angle of rotation? $\frac{360^\circ}{5} = 72^\circ$

c. Where is the centre of rotation? ***The centre of the shape.***

d. How many lines of symmetry does the shape have? ***5***

5. Does each of the following designs have line symmetry, rotational symmetry, neither or both?

a.



Both

b.

Rotational Symmetry

LEARNING
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