

11

Symmetry

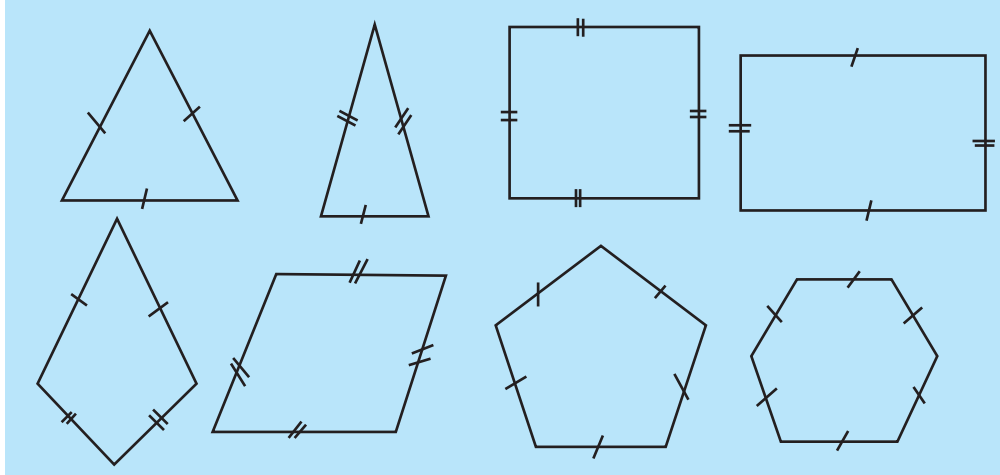
After studying this lesson, you can get a good understanding of

- ★ the concept of rotational symmetry
- ★ finding the order of rotational symmetry and the centre of rotation in geometrical figures.

In grade 7, you have learned about bilateral symmetry and also to find the axes of symmetry in geometrical figures which have bilateral symmetry and also to construct a symmetrical figure when the axes of symmetry is given.

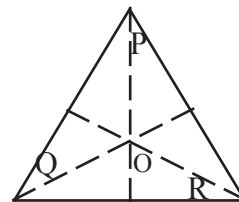
Exercise 11.1

Copy the diagrams given below in your exercise book and draw the axes of symmetry. Write the number of axes of symmetry.



11.1 Rotational symmetry

- (i) Take a thick paper and draw an equilateral triangle of side 4 cm on it.
- (ii) Draw the three axes of symmetry of the triangle as shown in the diagram and mark the point of intersection as O.
- (iii) Cut off the triangle using a pair of scissors and name the vertices as P, Q, R inside the triangle.



- (iv) Keeping the triangle in your exercise book as it is and get a copy of the triangle on your book by drawing along the edges of the triangle.
- (v) Name the triangle in your exercise book as P_1, Q_1, R_1 , by writing the letters outside the triangle so that vertex P_1 corresponds to P and Q_1 and R_1 correspond to Q and R respectively.
- (vi) By using the metal point of a pair of compasses or any other sharp point pierce the thick paper at O .
- (vii) By keeping the point of the compass fixed, rotate the triangle about the point O clockwise. Until P meets P_1 again. Find the number of times the triangle PQR coincide with the triangle $P_1 Q_1 R_1$.

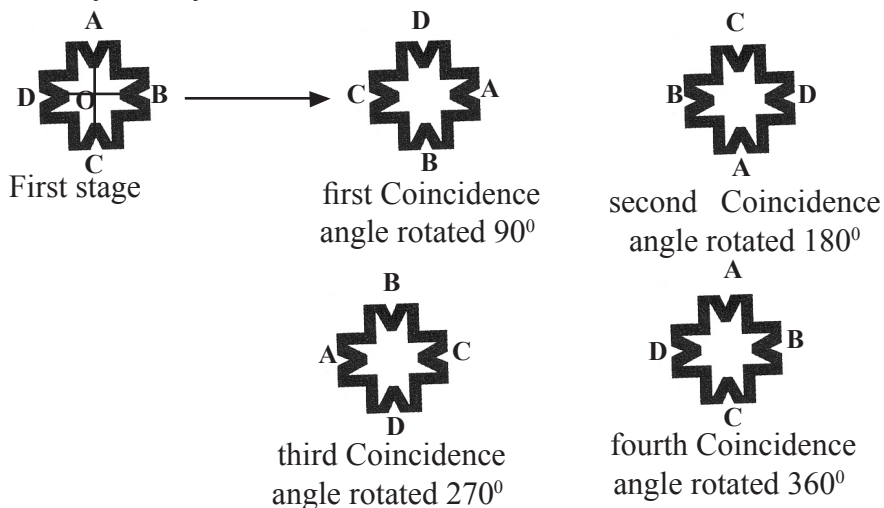
When triangle PQR is rotated about the point O the number of times it coincides with the triangle $P_1 Q_1 R_1$ is 3. First at 120° then at 240° and finally at 360° .

When a figure is rotated about a fixed point through 360° and if the number of times it coincides with the original figure is more than 1, then it is said to have rotational symmetry.

When the equilateral triangle is rotated about O through 360° , it coincided three times with the original triangle. Therefore it is said to have a rotational symmetry of order 3 and the point O is called the centre of rotation.

Any figure when rotated through 360° about a fixed point the number of times it coincides with the original figure is called the order of rotational symmetry and the point about which it is rotated is called the centre of rotation.

Given below is a logo of a life insurance company. Let us see whether it has rotational symmetry

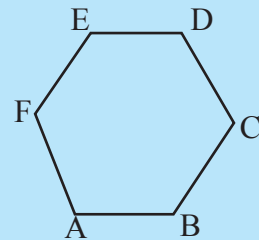


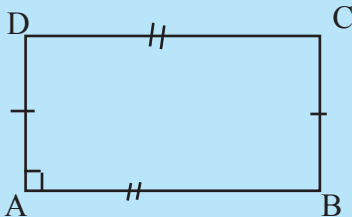
Exercise 11.2

- (1) (i) Draw a square of side 4 cm on a thick paper. Mark the axes of symmetry
- (ii) Cut off the square and name it as ABCD inside the square. Mark the point of intersection of the axes of symmetry as O.
- (iii) Keeping the square in your exercise book and trace it into the book by drawing along the outer edge of the square, and name the vertex corresponding to A as A_1 and the other corresponding vertices as B_1, C_1 and D_1 .
- (iv) Fix a pin at O and by rotating ABCD about O through 360° , find the number of times it coincides with the original square.
- (v) What is the order of rotational symmetry of a square?

- (2) In your exercise book, draw the regular hexagon ABCDEF as shown.

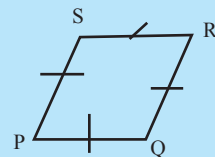
- (i) Obtain its centre of rotation.
- (ii) When the hexagon is rotated about its centre of rotation through 360° , how many times does it coincide with the original figure? Accordingly what is its order of rotational symmetry?
- (iii) How many axes of bilateral symmetry are there in this polygon?



- (3)  (i) How many axes of symmetry are there in a rectangle?
- (ii) What is the order of rotational symmetry of a rectangle?

- (4) (i) Find whether there is bilateral symmetry in a parallelogram, and write your answer.
- (ii) Find out about rotational symmetry in a parallelogram. What are the angles of rotation at which the figure coincides with the original figure.
- (iii) What is the order of rotational symmetry in a parallelogram?

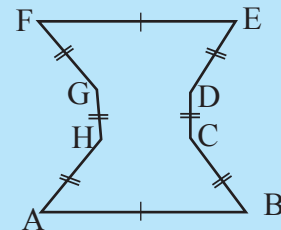
- (5) (i) What is the number of axes of symmetry of the rhombus PQRS?
- (ii) What is the order of rotational symmetry of the rhombus?



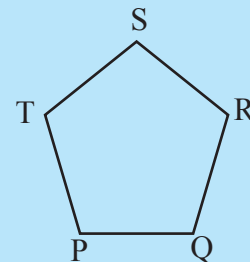
(6) Complete the table given below.

| Diagram | Number of axes of symmetry | Order of rotational symmetry |
|----------------------|----------------------------|------------------------------|
| Equilateral triangle | | |
| Square | | |
| Rectangle | | |
| Rhombus | | |
| Parallelogram | | |

(7) In the plane figure A B C D E F G H
 (i) write the number of axes of symmetry
 (ii) write the order of rotational symmetry



(8) In the regular pentagon P Q R S T, write the number of axes of symmetry and the order of rotational symmetry.



Summary

- ★ When a plane figure is rotated about a point on it through 360° and if it coincides with the original figure more than once, then it is said to have rotational symmetry.
- ★ When rotated through 360° , the number of times it coincides is the order of rotational symmetry and the point at which it is rotated is called the centre of rotation.