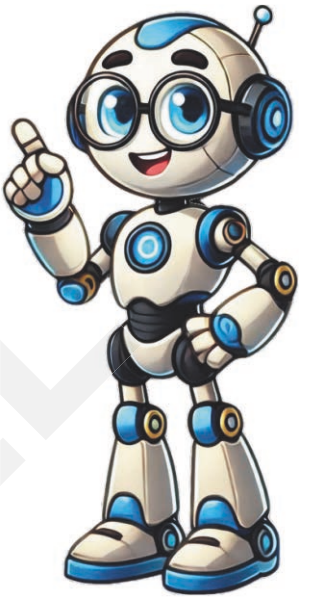
9
Chapter

Symmetry

We'll cover the following key points:

→ Introduction to Symmetry
→ Line of Symmetry
→ Recreational/Enrichment Material



Hi, I'm EeeBee

Do you Remember fundamental concept in previous class.
In class 5th we learnt

→ Introduction to Symmetry
→ Rotational Symmetry
→ 2D Shapes and Symmetry
→ Symmetry in 3D Shapes

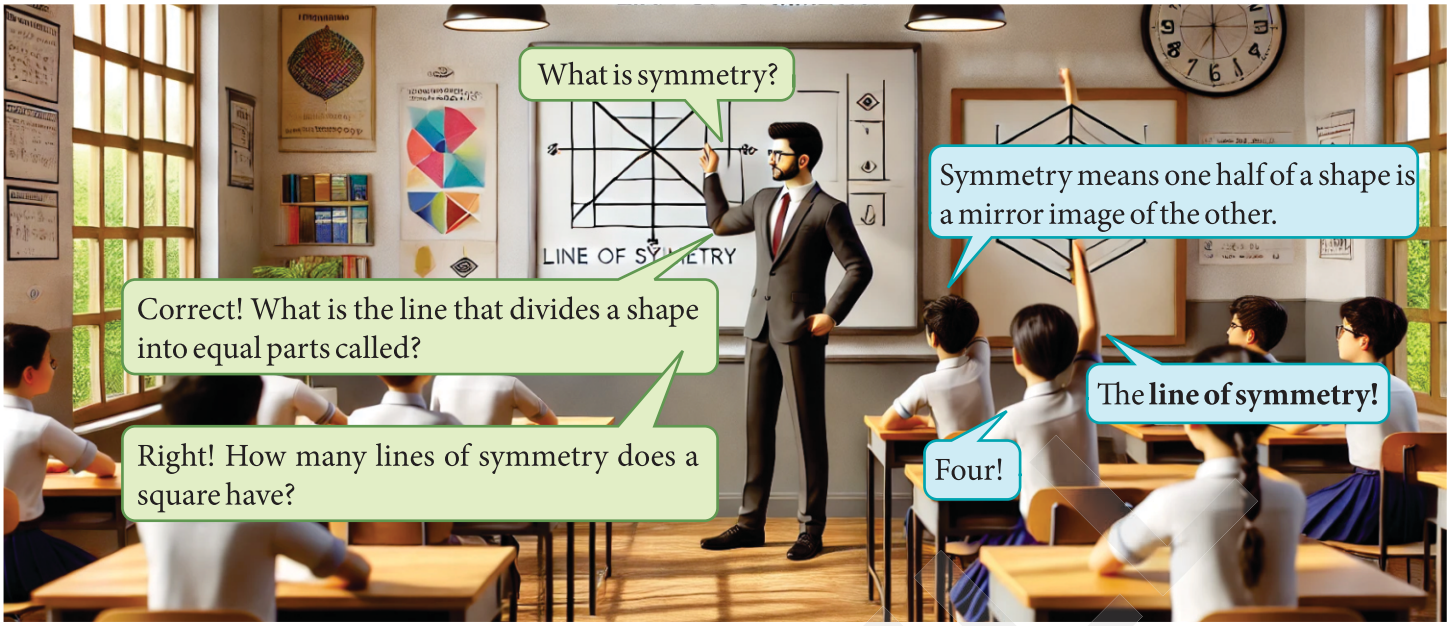
Still curious? Talk to me by scanning the QR code.

Learning Outcomes

By the end of this chapter, students will be able to:

- Identify lines of symmetry in various shapes, letters, and real-world objects.
- Differentiate between horizontal, vertical, and diagonal symmetry.
- Explore symmetry in geometric figures such as triangles, quadrilaterals, circles, and polygons.
- Create symmetric patterns using different shapes, designs, and colors.
- Use symmetry to design rangoli, mosaics, and traditional patterns.
- Understand rotational symmetry and its applications in daily life, including logos, wheels, and fans.
- Identify the order of rotational symmetry in various geometric figures.
- Explore reflective symmetry in nature, art, and everyday objects like butterflies, leaves, and human faces.
- Solve problems involving symmetry in geometric shapes, including folding and cutting paper.
- Learn about symmetry in alphabets, numbers, and cultural symbols.
- Use symmetry to create artistic designs in both 2D and 3D objects, including origami and model-making.

Introduction



Symmetry is often introduced as an important concept in geometry. Symmetry refers to a balanced arrangement of parts that are identical or similar to each other on opposite sides of a central point, line, or plane. Here's an overview of what symmetry at this level typically covers:

1. Types of Symmetry:

- **Reflective Symmetry (Mirror Symmetry):** This occurs when one half of an object is a mirror image of the other half. A line of symmetry divides the object into **two identical halves**. For example, the letter "A" has vertical symmetry.
- **Rotational Symmetry:** This is when an object can be rotated around a central point and still look the same at certain angles. For example, a square has rotational symmetry at 90°, 180°, 270°, and 360°.
- **Translational Symmetry:** This occurs when an object can be shifted (translated) along a straight line and still match its original position.

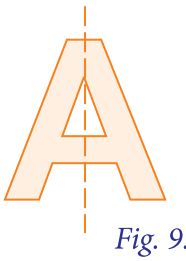


Fig. 9.1

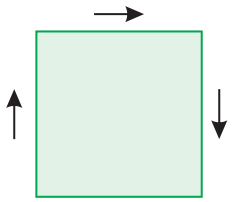


Fig. 9.2

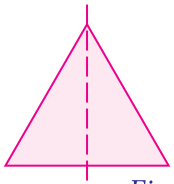


Fig. 9.3

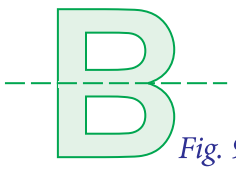


Fig. 9.4

2. Line of Symmetry:

- A line of symmetry divides a shape into two identical parts. For example, a rectangle has two lines of symmetry: one vertical and one horizontal.
- A shape may have more than one line of symmetry, or it may have none (like a scalene triangle).

3. Symmetry in Nature and Everyday Objects:

- Students are encouraged to identify symmetry in nature (such as the wings of butterflies or leaves) and in everyday objects (such as buildings, patterns in fabrics, etc.).

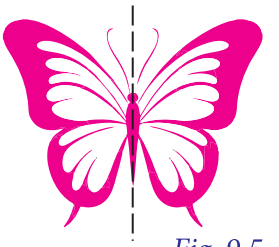


Fig. 9.5

4. Properties of Symmetry:

- When an object or figure has symmetry, the parts on one side of the line (or point) mirror the parts on the other side. The size, shape, and arrangement are identical.

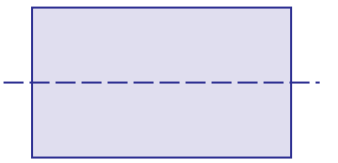


Fig. 9.6

5. Drawing Symmetry:

- Often, students are asked to draw shapes with specific lines of symmetry or to complete symmetrical figures by reflecting or rotating parts of the image.

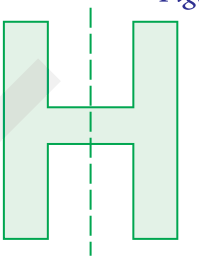


Fig. 9.7

Types of Symmetry:

Reflective Symmetry (Mirror Symmetry):

Reflective symmetry, also known as mirror symmetry, occurs when one half of an object is a mirror image of the other half. The line that divides the object into **two identical halves** is called the **line of symmetry** or **axis of symmetry**.

How to Identify Reflective Symmetry:

Step 1: Look for the line that divides the shape or object into two identical halves.

Step 2: Fold the object along that line. If both halves match perfectly, the shape has reflective symmetry.

Step 3: Count how many lines of symmetry are present. For example, a circle has an infinite number of lines of symmetry.

Examples of Reflective Symmetry:

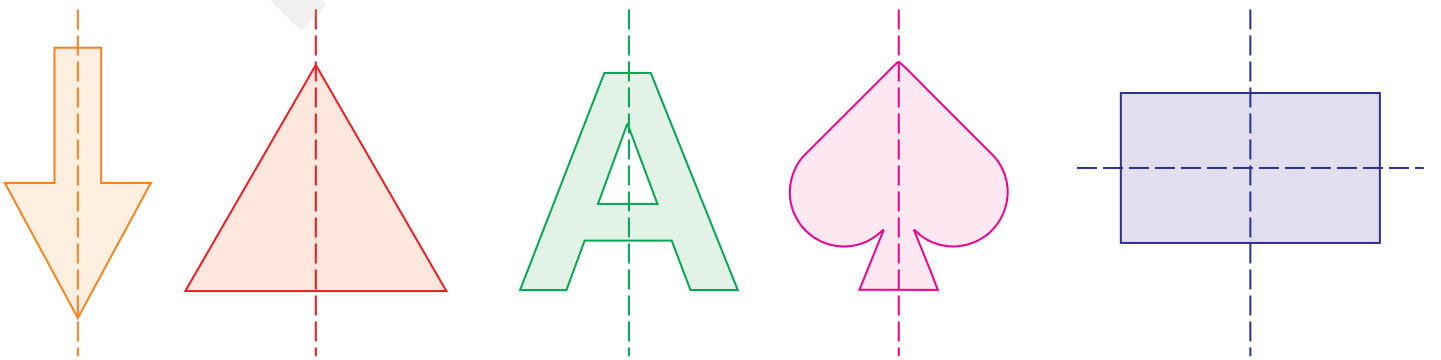


Fig. 9.8

Rotational Symmetry:

Fig. 9.9

Rotational symmetry occurs when an object can be rotated around a central point (**called the center of rotation**) and still look the same at certain angles. The object matches its original position after a certain amount of rotation.

Key Concepts of Rotational Symmetry:

1. Center of Rotation:

- This is the point around which the object rotates. Every object with rotational symmetry has a specific center of rotation.

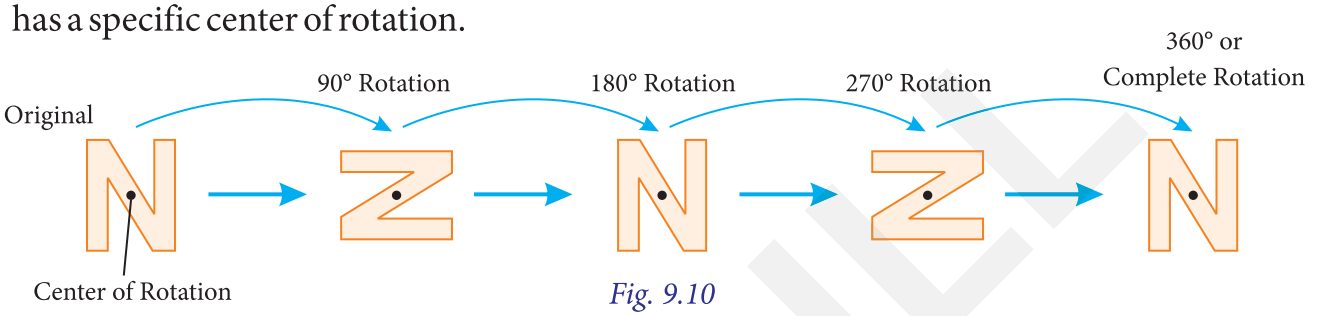


Fig. 9.10

2. Order of Rotation (Rotation Symmetry Order):

- This refers to how many times the object matches its original position in one full rotation (360°).
- For example, if an object looks the same after rotating 90°, 180°, 270° and 360°, the order of its rotational symmetry is 4.

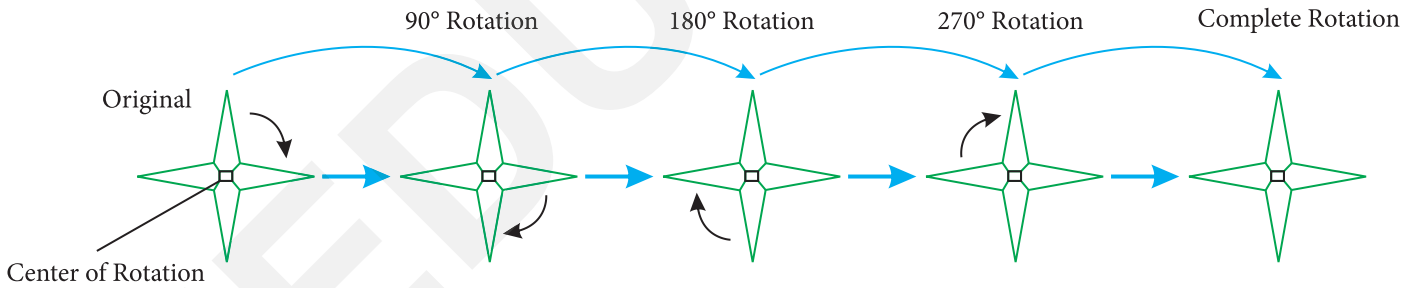


Fig. 9.11

3. Angle of Rotation:

- The angle by which the object must be rotated to look the same again. For an object with order 4, the angle of rotation is 90° (since 360° ÷ 4 = 90°).

How to Identify Rotational Symmetry:

Step 1: Place the object at its center of rotation and rotate it.

Step 2: Check at different angles (e.g., 90°, 180°, 270°) to see if the object matches its original position.

Step 3: Count how many times the object looks the same during one complete rotation (360°).

Examples of Rotational Symmetry:

1. **Square:**
   - A square has **4 lines of rotational symmetry** because it looks the same after a rotation of 90°, 180°, 270°, and 360°.
   - The order of rotational symmetry is 4, and the angle of rotation is 90°.

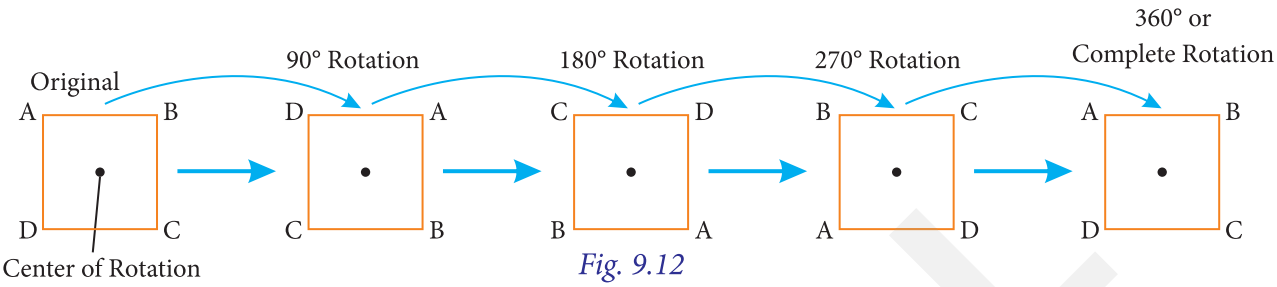


Fig. 9.12

2. **Equilateral Triangle:**
   - An equilateral triangle has **3 lines of rotational symmetry** because it looks the same after a rotation of 120°, 240°, and 360°.
   - The order of rotational symmetry is 3, and the angle of rotation is 120°.

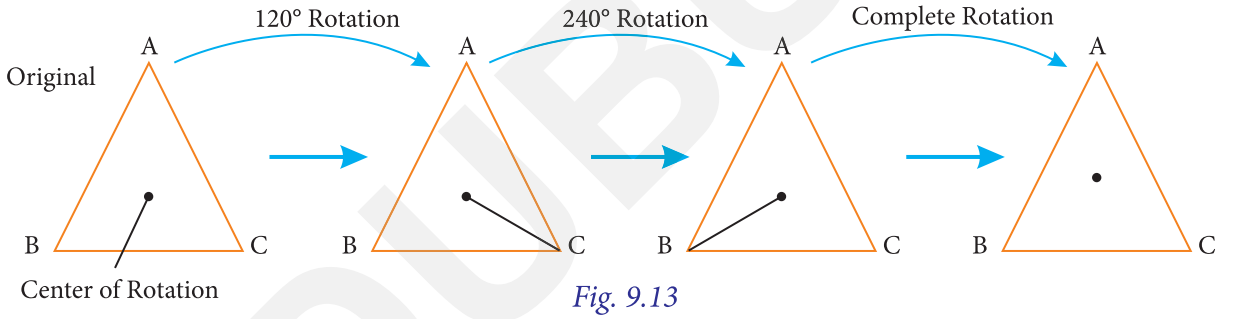


Fig. 9.13

3. **Circle:**
   - A circle has **infinite rotational symmetry** because it looks the same at any angle of rotation.
   - The order of rotational symmetry is infinite, and the angle of rotation can be any value.

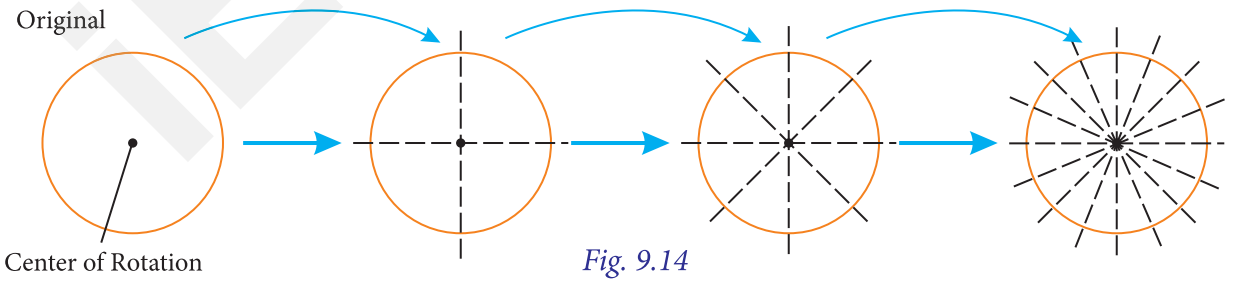


Fig. 9.14

4. **Regular Pentagon:**
   - A regular pentagon (five sides) has **5 lines of rotational symmetry** because it looks the same after a rotation of 72°, 144°, 216°, 288°, and 360°.
   - The order of rotational symmetry is 5, and the angle of rotation is 72°.

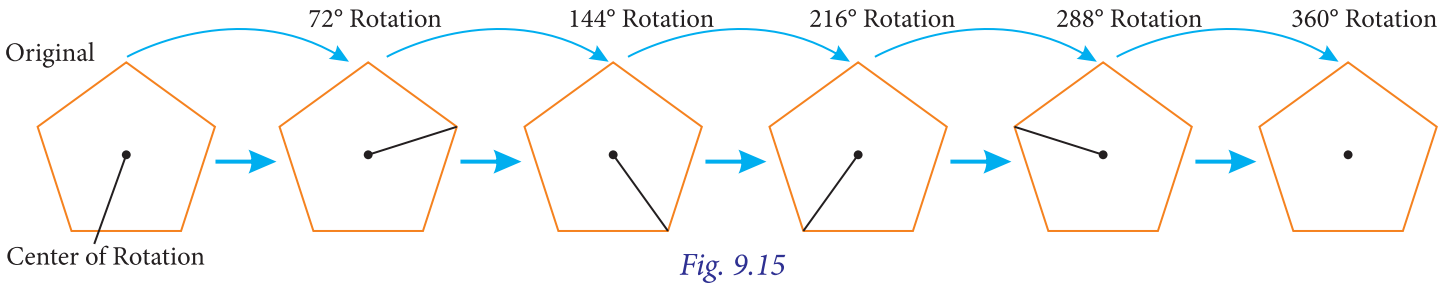


Fig. 9.15

Translational Symmetry:

Translational symmetry refers to a type of symmetry where an object or pattern can be shifted (or "translated") along a straight line without changing its appearance. In other words, when you move the object from one position to another, it looks the same as it did before the translation.

Examples of Translational Symmetry:

How to Identify Translational Symmetry:

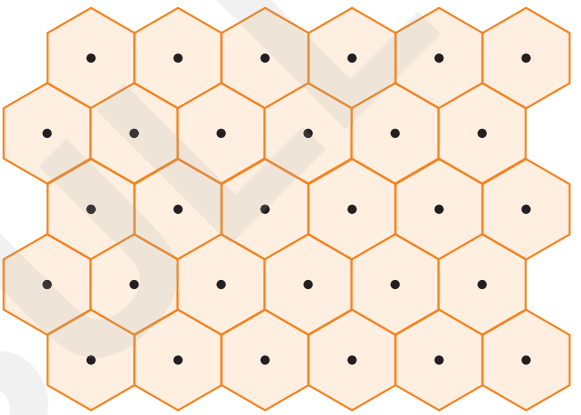


Fig. 9.16

Step 1: Look at the object or pattern and see if it can be shifted along a straight line (either horizontally, vertically, or diagonally).

Step 2: Translate the object or pattern by a certain distance in a certain direction.

Step 3: Check if the object looks exactly the same after translation. If it does, it has translational symmetry.

Step 4: If the object or pattern can be translated multiple times along the same direction and still looks the same, then the pattern has translational symmetry.

1. **Wallpaper Patterns:**

   Many wallpaper patterns, such as those with floral designs or geometric shapes, exhibit translational symmetry. If you slide the pattern horizontally or vertically, the design will repeat and look identical.

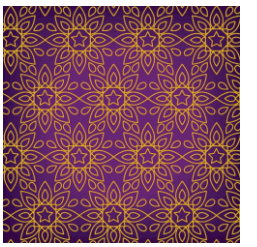


Fig. 9.17

2. **Tiling:**

   A tiled floor made of square tiles demonstrates translational symmetry. You can translate one tile horizontally or vertically, and it will match the next tile perfectly.

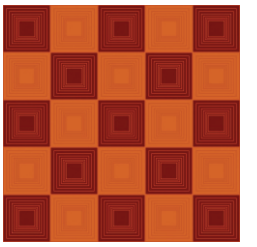


Fig. 9.18

3. **Floor Patterns:**

   A checkerboard pattern also exhibits translational symmetry. If you slide the pattern horizontally or vertically by one square, it will look the same.

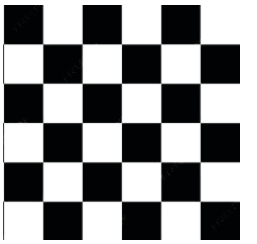


Fig. 9.19

4. **Geometric Figures:**

Some geometric shapes like parallelograms, rectangles, and triangles can exhibit translational symmetry, where you can move them along a straight path, and they will align with their original positions.

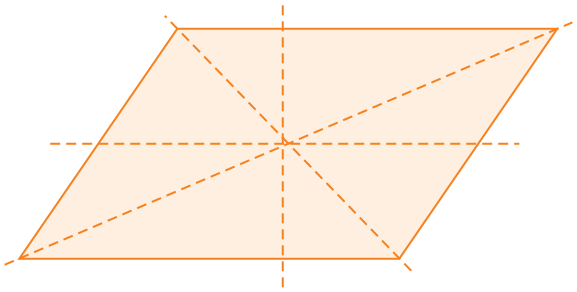


Fig. 9.20

Example : How do reflection symmetry look for the following shapes?

1. Star 2. Moon 3. Sun

Solution:

The reflection for the Star, Moon and Sun appear the same as the original images

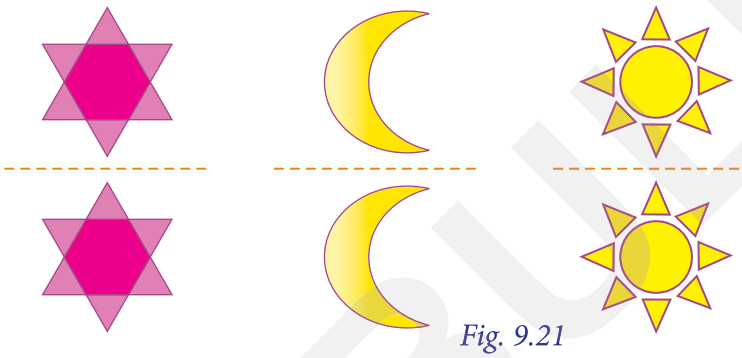


Fig. 9.21

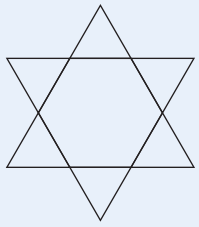
Exercise 9.1

Knowledge Application

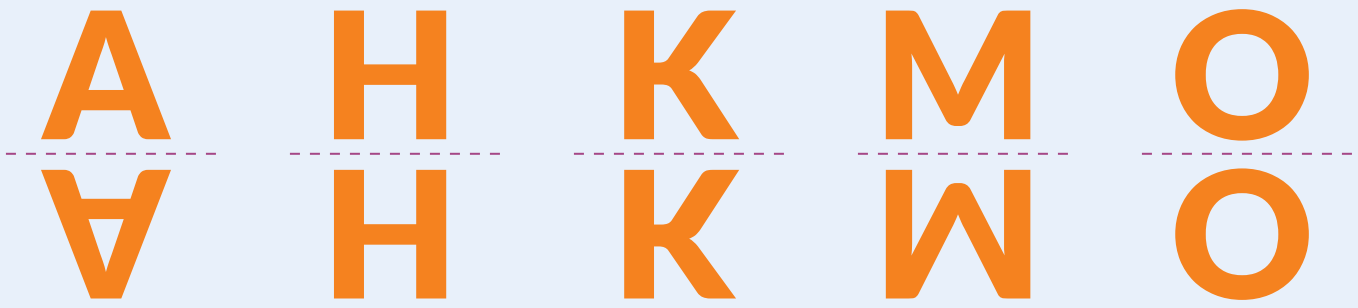
1. **Provide the missing information in the blanks:**
   (a) A shape has _____ symmetry when one half of the object is a mirror image of the other half.
   (b) The letter "M" has _____ lines of symmetry.
   (c) A _____ has rotational symmetry of order 4, with an angle of rotation of 90°.
   (d) A _____ is a shape that looks the same after a translation along a straight line.
   (e) A square has _____ lines of symmetry, including vertical, horizontal, and diagonal.
   (f) The number of lines of symmetry in a circle is _____.

2. **List all the letters of English alphabets which have rotational symmetry.**

3. **State whether the figure shows rotational symmetry. If yes, then what is the order of rotational symmetry?**



4. **Mark (ok sign) figure the English alphabets which look the same in their reflected image.**



5. **Does the following statement stand True (T) or False (F):**
   (a) A square has rotational symmetry of order 4.
   (b) The letter "P" has a line of symmetry through its horizontal axis.
   (c) A triangle with all equal sides and angles (equilateral triangle) has 3 lines of symmetry.
   (d) A parallelogram has rotational symmetry of order 2.
   (e) A rectangle has rotational symmetry of order 4.

6. **Multiple Choice Questions (MCQs):**
   (a) Which of the following shapes has rotational symmetry of order 2?
   i) Square ii) Rectangle iii) Equilateral Triangle iv) Parallelogram
   (b) The letter "X" has:
   i) 2 lines of symmetry ii) 1 line of symmetry
   iii) 3 lines of symmetry iv) No line of symmetry
   (c) Translational symmetry is best observed in:
   i) A circle ii) A checkerboard pattern
   iii) A triangle iv) A regular pentagon
   (d) Which shape has reflective symmetry but not rotational symmetry?
   i) Equilateral Triangle ii) Letter "Z"
   iii) Rectangle iv) Rhombus

7. **Short Answer Questions:**
   (a) How many lines of symmetry does a regular hexagon have?
   (b) What is the order of rotational symmetry for a regular pentagon?
   (c) Can a shape have both rotational and reflective symmetry at the same time? Provide an example.
   (d) Give an example of an object or shape that exhibits translational symmetry and explain why.

Line of Symmetry

A line of symmetry is an **imaginary line** that divides a shape or object into two identical halves. Each half is a mirror image of the other when folded along this line. The concept of symmetry helps us understand how shapes are balanced and how they appear when reflected or rotated.

Types of Lines of Symmetry:

1. Vertical Line of Symmetry:

- A line that divides the shape into two equal parts from **top to bottom**.
- **Example:** A **rectangle** has one vertical line of symmetry.

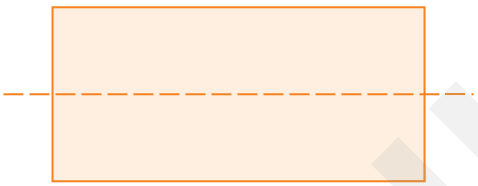


Fig. 9.22

2. Horizontal Line of Symmetry:

- A line that divides the shape into two equal parts from **left to right**.
- **Example:** A **square** has both a horizontal and a vertical line of symmetry. image

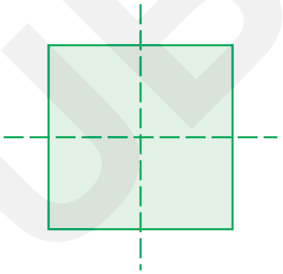


Fig. 9.23

3. Diagonal Line of Symmetry:

- A line that divides the shape into two equal parts at an angle. These lines are not necessarily vertical or horizontal.
- **Example:** An **equilateral triangle** has 3 lines of symmetry, all diagonal. image

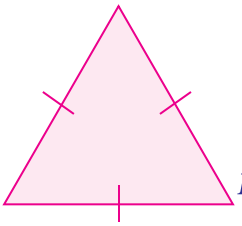


Fig. 9.24

Examples of Shapes and Their Lines of Symmetry:

1. Circle:

- A circle has an infinite number of lines of symmetry. Any line passing through the center will divide the circle into two identical halves.

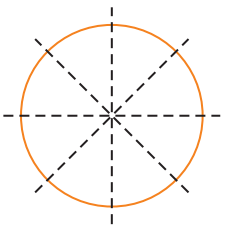


Fig. 9.25

2. **Square:** A square has 4 lines of symmetry:

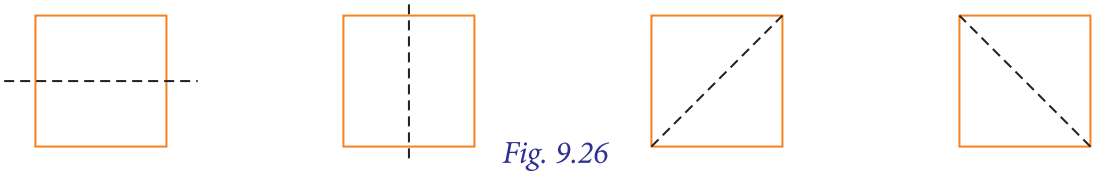


Fig. 9.26

3. **Rectangle:** A rectangle has 2 lines of symmetry:

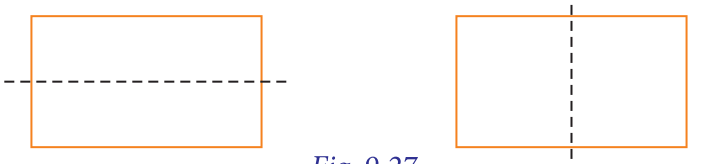


Fig. 9.27

4. **Isosceles Triangle:**

- An isosceles triangle has 1 line of symmetry that cuts through the middle from the top vertex to the base.

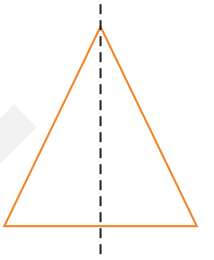


Fig. 9.28

5. **Parallelogram:**

- A parallelogram has no lines of symmetry. However, a rectangle and a rhombus (both specific types of parallelograms) do have symmetry lines.

Fig. 9.29

6. **Regular Hexagon:**

- A regular hexagon has 6 lines of symmetry. These lines go through opposite vertices or opposite edges.

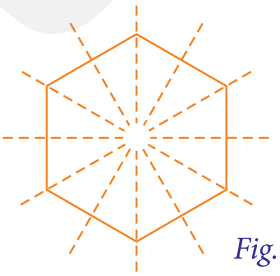


Fig. 9.30

7. **Heart:**

- A heart shape has 1 line of symmetry, typically vertically down the middle.

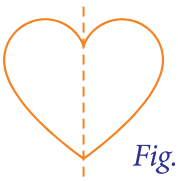


Fig. 9.31

KEY POINTS

- A shape can have one or more lines of symmetry depending on its properties.
- Regular polygons (where all sides and angles are equal) have as many lines of symmetry as they have sides.
- Irregular shapes may have no lines of symmetry, or just a few, depending on their structure.

Example: Copy the following figures on squared paper and complete them, so that the dotted line is the line of symmetry.

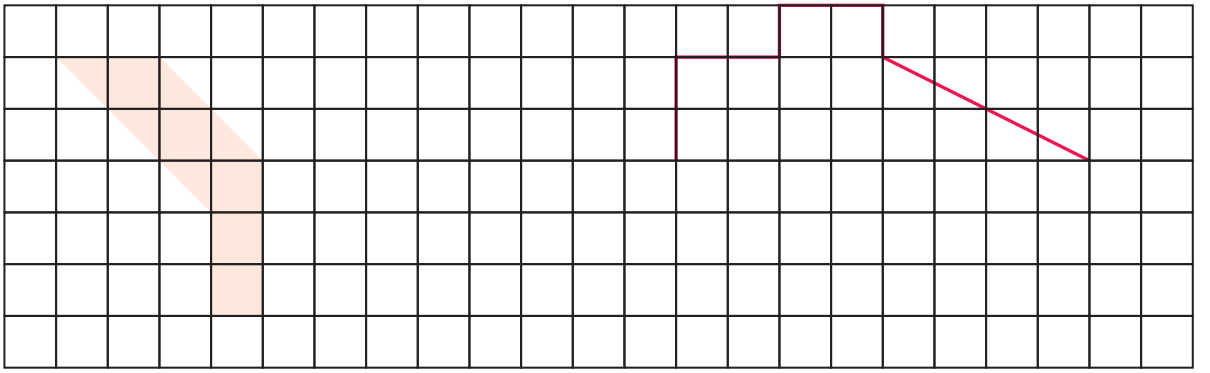
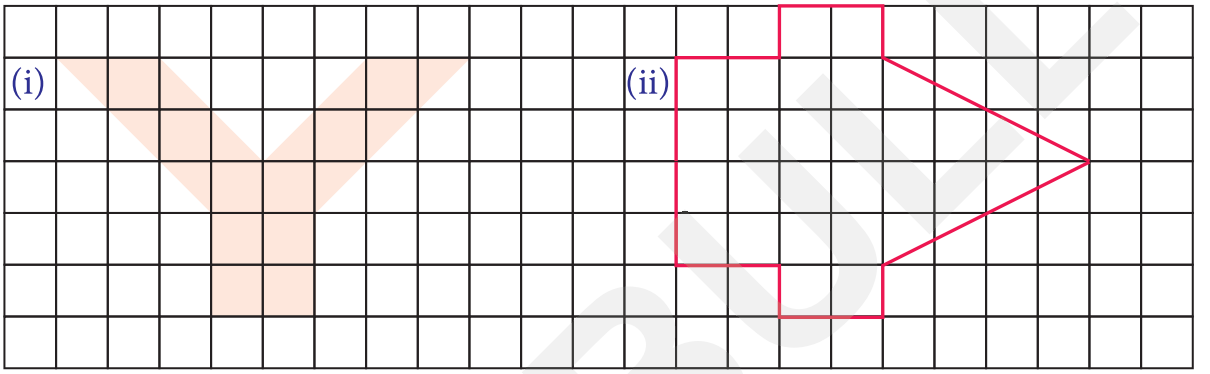


Fig. 9.32

Solution:



Two or More Lines of Symmetry

When a shape has two or more lines of symmetry, it means the shape can be divided into two or more identical parts by multiple lines. Each of these lines reflects the shape's symmetry, making it look identical on both sides of the line(s).

Shapes with Two or More Lines of Symmetry:

1. Square (4 lines of symmetry):

- A square has 4 lines of symmetry:

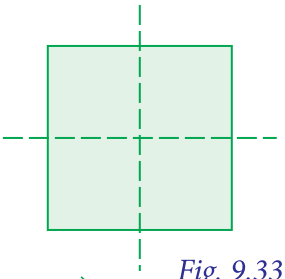


Fig. 9.33

2. Equilateral Triangle (3 lines of symmetry):

- An equilateral triangle has 3 lines of symmetry, all diagonal. Each line runs from one vertex to the midpoint of the opposite side.

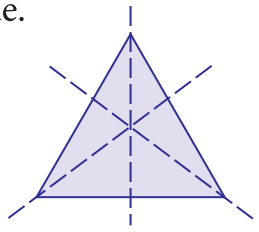


Fig. 9.34

Points of Rules

- Use a mirror to check symmetry in objects.
- Fold a paper to find its line of symmetry.
- Count lines of symmetry in different 2D shapes.
- Practice drawing mirror images to understand symmetry better.

3. Rectangle (2 lines of symmetry):

- A rectangle has 2 lines of symmetry:

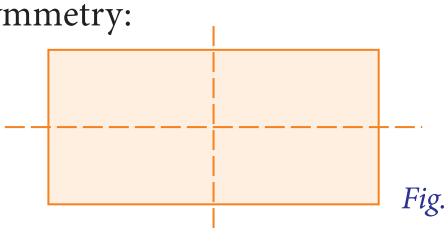


Fig. 9.35

Note: While a square is a specific type of rectangle, it has more lines of symmetry than a rectangle.

4. Regular Hexagon (6 lines of symmetry):

- A regular hexagon has 6 lines of symmetry. The lines go through opposite vertices or opposite edges.

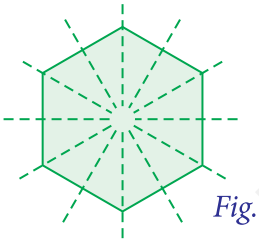


Fig. 9.36

5. Isosceles Triangle (1 line of symmetry):

- While an isosceles triangle only has 1 line of symmetry (the vertical line dividing it from top to bottom), a scalene triangle (with no equal sides) has no lines of symmetry.

6. Circle (Infinite lines of symmetry):

- A circle has an infinite number of lines of symmetry. Any line passing through the center of the circle will divide it into two identical halves.

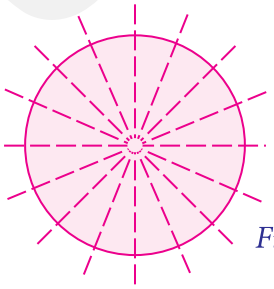


Fig. 9.37

7. Rhombus (2 lines of symmetry):

- A rhombus has 2 lines of symmetry. These are diagonal lines, running from opposite corners.

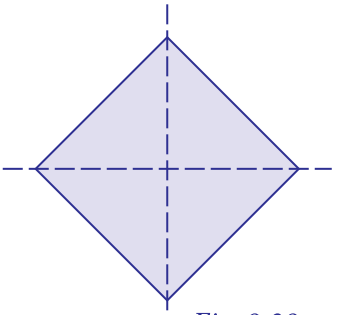


Fig. 9.38

8. Regular Pentagon (5 lines of symmetry):

- A regular pentagon has 5 lines of symmetry. Each line runs through a vertex and the midpoint of the opposite side.

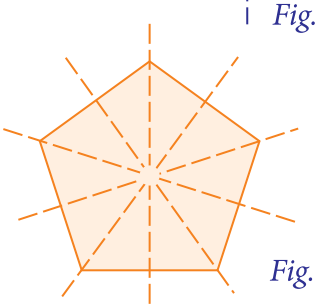


Fig. 9.39

Fun Fact

Symmetry plays a key role in art and architecture, with famous buildings like the **Parthenon** in Greece and artwork by **Leonardo da Vinci** incorporating symmetrical designs. Symmetry in nature, such as in the **petals of flowers** or the **wings of butterflies**, also has a practical purpose, helping organisms grow and develop in balanced ways.

Lines of Symmetry in National Flags

National flags often feature symmetry in their designs, reflecting balance, unity, and aesthetic appeal. The number and type of lines of symmetry depend on the layout of the flag.

Examples of National Flags with Lines of Symmetry

1. Flags with Vertical Line of Symmetry:

- **India:** The flag of India has a vertical line of symmetry along its center.
- **Canada:** The flag of Canada, with its maple leaf and red bars, has one vertical line of symmetry.
- **France:** The tricolor flag of France (blue, white, red) has a vertical line of symmetry dividing the white stripe in the center.

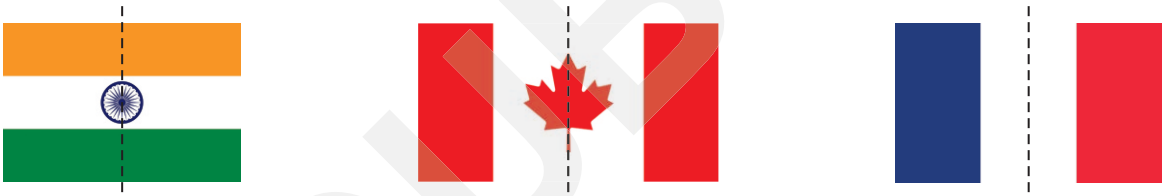


Fig. 9.40

2. Flags with Horizontal Line of Symmetry:

- **Germany:** The flag of Germany, with three horizontal stripes (black, red, yellow), has one horizontal line of symmetry.
- **Ukraine:** The blue and yellow horizontal stripes in Ukraine's flag create a horizontal line of symmetry.
- **Argentina:** The flag of Argentina has a horizontal line of symmetry, dividing the white central stripe and sun from the blue stripes above and below.

Fig. 9.41

3. Flags with Both Vertical and Horizontal Lines of Symmetry:

- **Switzerland:** The square flag of Switzerland, featuring a white cross on a red background, has both vertical and horizontal lines of symmetry.

- **England:** The flag of England (red cross on a white background) also has both vertical and horizontal lines of symmetry.

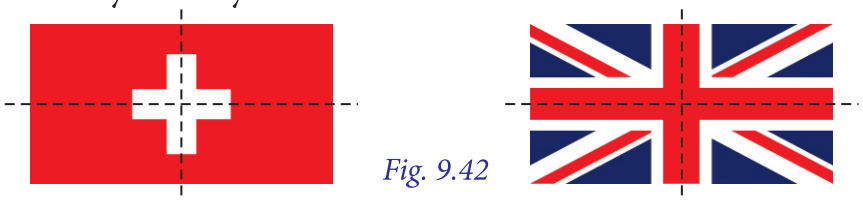


Fig. 9.42

4. Flags with Diagonal Lines of Symmetry:

- **Jamaica:** The flag of Jamaica, with a diagonal cross (saltire), has two diagonal lines of symmetry.

Fig. 9.43

5. Flags with No Lines of Symmetry:

Some flags do not exhibit any symmetry due to their complex or asymmetrical designs.

- **Nepal:** The flag of Nepal, with its unique two-triangle design, has no lines of symmetry.
- **United States:** The flag of the United States, with 50 stars and 13 stripes, does not have a line of symmetry due to the arrangement of the stars and stripes.

Fig. 9.44

Exercise 9.2

Knowledge Application

1. Provide the missing information in the blanks:

(a) A _____ divides a shape into two identical mirror-image halves.

(b) The Swiss flag has _____ lines of symmetry.

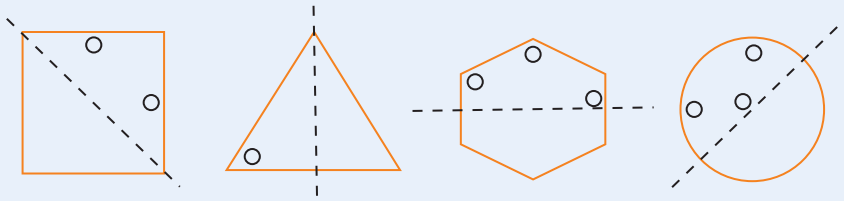
(c) A rectangle has _____ lines of symmetry, while a square has four.

(d) The flag of Canada has a _____ line of symmetry along its vertical axis.

(e) Flags with geometric patterns are more likely to have _____ lines of symmetry.

(f) A regular hexagon has _____ lines of symmetry.

2. **Given the line (s) of symmetry, find the other hole (s):**



(a) (b) (c) (d)

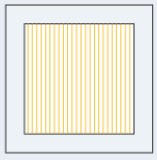
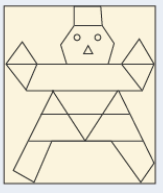
3. **Write 5 such English letters which have horizontal line of symmetry.**

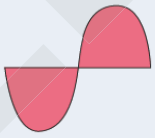
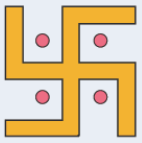
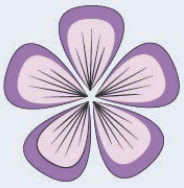
4. **Write 4 English letters which have vertical lines of symmetry**

5. **What is the difference in the number of lines of symmetry between a regular pentagon and an equilateral triangle?**

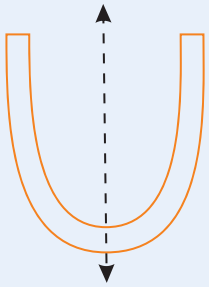
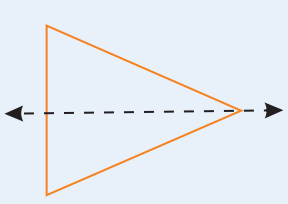
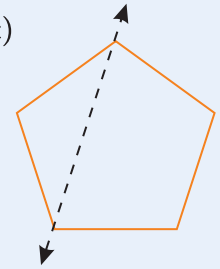
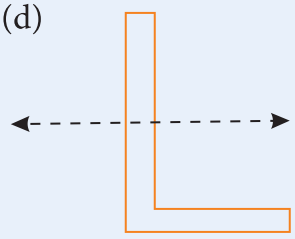
6. **Answer the following questions:**
   (a) Does a parallelogram have a line of symmetry?
   (b) How many lines of symmetry does a circle have?
   (c) Which shape has two lines of symmetry: a rectangle or a rhombus?
   (d) Does the flag of Switzerland have rotational symmetry? If so, what is the order?
   (e) Why does the flag of the United States have no lines of symmetry?

7. **Find the number of line(s) of symmetry for each of the following shapes:**

(a)  (b)  (c)  (d)  (e) 

(f)  (g)  (h)  (i) 

8. **Find in which of the following, the dotted line is a line of symmetry.**

(a)  (b)  (c)  (d) 

Recreational/Enrichment Material

Activity: Ask students to find objects around their home, school, or outdoors with one, two, or more lines of symmetry. For example, leaves, tiles, or logos.

Leaves: Draw a leaf from your yard or garden. Now, try to find the line of symmetry by folding it in half. Can you draw a line where the two halves would match perfectly? How many lines of symmetry does your leaf have?

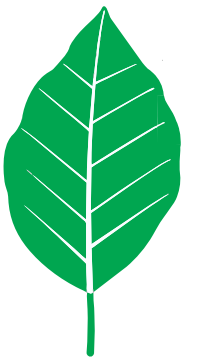


Fig. 9.45

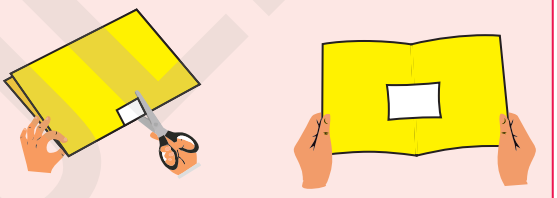
Objective: Builds awareness of symmetry in the real world

This activity helps students develop an understanding of symmetry by observing it in real-world objects.

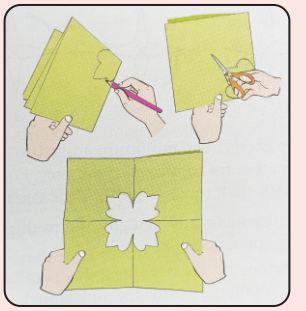
Activity Time

Paper Folding and Cutting Activity

1. Take a sheet of paper and fold it in half. Cut a shape or design along the fold (such as a triangle, circle, or a zigzag pattern). Unfold the paper and observe whether you get a symmetric shape. Does the cut design create symmetry? Try to make a specific shape by folding and cutting (e.g., a star, heart, or flower).



2. Take a thin sheet of paper and fold it several times in different directions. Make several cuts along the folds to create a unique design. Unfold the paper and examine the design you have made. How many lines of symmetry does the design have? Can you find the pattern that repeats itself?



Rotational and Line Symmetry of a Square

Rotational Symmetry of a Square:

Consider a square ABCD with a center as indicated in the figure. Upon rotating the square by 90°, 180°, 270°, and 360° about its center, it returns to its original position each time. Therefore, the square exhibits rotational symmetry of order 4, with the angles of symmetry being 90°, 180°, 270°, and 360°.

A square has **4 orders of rotational symmetry**. This means it can be rotated around its center and still look the same at specific angles. These angles are:

- 90° (one-quarter turn)
- 180° (half turn)
- 270° (three-quarters turn)
- 360° (Complete Rotation)

Take a Task

Watch Remedial

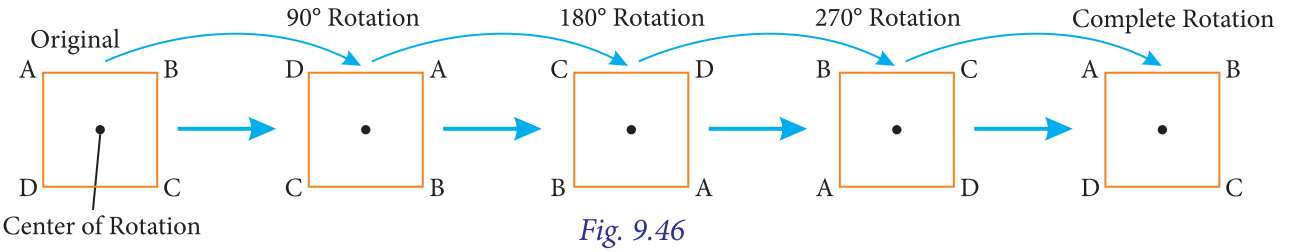


Fig. 9.46

So, when a square is rotated by these angles, it looks identical to its original position.

Line Symmetry of a Square:

A square has 4 lines of symmetry, which divide it into identical parts. The lines of symmetry in a square are:

1. Two diagonal lines (connecting opposite corners).
2. Two lines through the midpoints of opposite sides (vertical and horizontal lines).

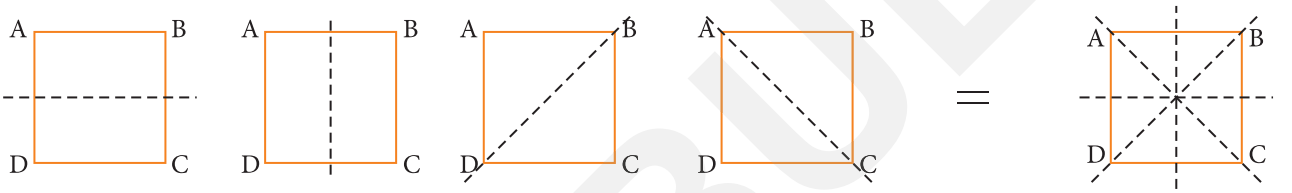


Fig. 9.47

Rotational and Line Symmetry of a Rectangle

Rotational Symmetry of a Rectangle:

Consider a rectangle ABCD with a center as shown in the given figure. When the rectangle is rotated by 180° or 360° about its center, it returns to its original position. Therefore, the rectangle has rotational symmetry of order 2, with symmetry angles of 180° and 360°.

A rectangle has 2 orders of rotational symmetry. This means it can be rotated around its center and still look the same at specific angles:

- 0° (no rotation)
- 180° (half turn)
- 360° (Complete Rotation)

After a 90° or 270° rotation, the rectangle will not look the same unless it is a square. Therefore, a rectangle only has rotational symmetry at 0° and 180°.

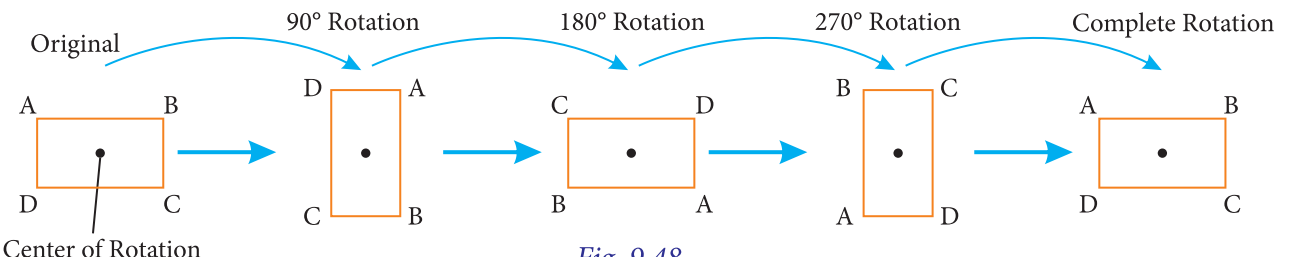


Fig. 9.48

Line Symmetry of a Rectangle:

A rectangle has 2 lines of symmetry, which divide it into identical parts. The lines of symmetry in a rectangle are:

1. One vertical line (through the midpoints of opposite sides).
2. One horizontal line (through the midpoints of the other two opposite sides).

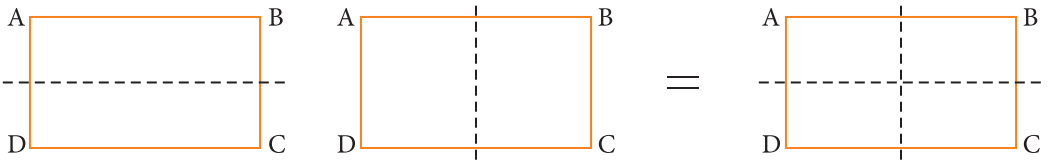


Fig. 9.49

Rotational and Line Symmetry of a Circle

Rotational Symmetry of a Circle:

A circle has infinite rotational symmetry. This means it can be rotated by any angle (0°, 10°, 45°, 90°, 360°, etc.) and still look the same. Unlike polygons, the symmetry of a circle is continuous, so there are no specific, fixed angles of rotation — it maintains its appearance at all rotations.

Line Symmetry of a Circle:

A circle has infinite lines of symmetry. Any straight line that passes through its center divides the circle into two equal halves. These lines can be drawn in any direction, whether vertically, horizontally, diagonally, or at any angle. The number of lines of symmetry is infinite.

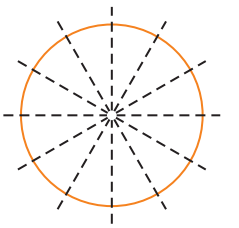


Fig. 9.50

Rotational Symmetry of Figures with Radial Arms

Figures with radial arms (such as stars, flowers, and other designs with arms or points radiating from a central point) have rotational symmetry depending on the number of arms or points they have.

For a figure with radial symmetry, the number of orders of rotational symmetry is equal to the number of arms, points, or sections the figure has. This is because the figure will look identical after rotating it by a specific angle based on the number of these elements.

1. **Order of rotational symmetry:** The number of arms or points.
2. **Angle of rotation:** The angle between each of these arms, which is calculated by dividing 360° by the number of arms or points.

Example:

A star with 5 points has 5 orders of rotational symmetry.

The angle of rotation is 360° ÷ 5 = 72°

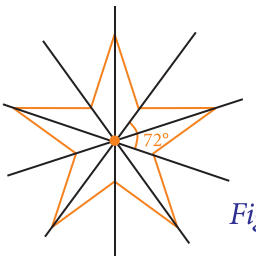


Fig. 9.51

Example : Which of the following figures have more than one angle of symmetry?

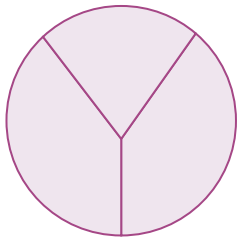
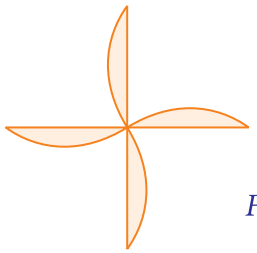
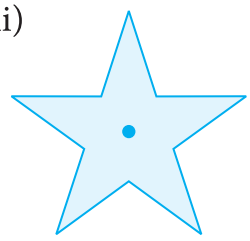
(i)  (ii)  (iii) 

Fig. 9.52

Solution:

Figure (i) has only one angle of symmetry

Figure (ii) has 4 angles of symmetry (90°, 180°, 270°, 360°)

Figure(iii) has 5 angles of symmetry (72°, 144°, 216, 288°, 360°)

Exercise 9.3

Knowledge Application

1. Which of the following figures have rotational symmetry of order more than 1:

(a) (b) (c) (d) (e) (f)

2. Provide the missing information in the blanks:

(a) A square has _____ lines of symmetry.

(b) A rectangle has rotational symmetry of _____ degrees.

(c) A circle has _____ lines of symmetry.

(d) The number of orders of rotational symmetry of a square is _____.

(e) An equilateral triangle has rotational symmetry at _____ degrees.

(f) A figure with radial arms has rotational symmetry at _____ degrees for each arm.

3. Name three shapes that have only rotational symmetry and no line symmetry.

4. Name three shapes that have both line symmetry and rotational symmetry, but with different numbers of symmetries.

5. A shape has rotational symmetry at 90° and 180° but no symmetry at 270°. How many orders of rotational symmetry does this shape have?

6. If the smallest angle of symmetry in a figure is 72°, how many total angles of symmetry does this figure have, and what are they?

Think Tank

Gap Analyzer™
Take a Test

1. Tick (✓) the correct answer:

a. How many lines of symmetry does a square have?

(i) 1 ☐ (ii) 2 ☐ (iii) 4 ☐ (iv) 8 ☐

b. A figure with only one line of symmetry is:

(i) Rectangle ☐ (ii) Equilateral triangle ☐

(iii) Isosceles triangle ☐ (iv) Circle ☐

c. Which of the following letters has no line of symmetry?

(i) A ☐ (ii) B ☐ (iii) C ☐ (iv) Z ☐

d. Which shape has an infinite number of lines of symmetry?

(i) Square ☐ (ii) Circle ☐ (iii) Triangle ☐ (iv) Pentagon ☐

e. What is the angle of rotational symmetry for a rectangle?

(i) 90° ☐ (ii) 180° ☐ (iii) 360° ☐ (iv) 45° ☐

2. Provide the missing information in the blanks:

a. A line that divides a figure into two identical halves is called the _____.

b. A circle has _____ lines of symmetry.

c. The angle of rotational symmetry for a square is _____ degrees.

d. An equilateral triangle has _____ lines of symmetry.

e. A figure is said to be symmetrical if one half is the _____ of the other half.

3. A rectangular sheet of paper is folded in half along its width. When unfolded, it forms two identical halves. How many lines of symmetry does the rectangle have? Explain.

4. A butterfly is often used as an example of symmetry. What type of symmetry does a butterfly have? Draw a butterfly and show its symmetry line.

Draw here

5. Match the Columns:

Column A	Column B
a) Circle	i) 4 lines of symmetry
b) Square	ii) Infinite lines of symmetry
c) Rectangle	iii) 3 lines of symmetry
d) Equilateral Triangle	iv) 2 lines of symmetry

Custom Learning Path
Scan to Create Your Own Learning Path

Assertion and Reason

Experiential Learning

Each question has two statements, Assertion (A) and Reason (R). Choose the correct option:

A: Both A and R are true, and R is the correct explanation of A.

B: Both A and R are true, but R is not the correct explanation of A.

C: A is true, but R is false.

D: A is false, but R is true.

1. **Assertion (A):** A square has four lines of symmetry.
   Reason (R): A square can be divided into identical halves along both diagonals and midlines.
2. **Assertion (A):** A rectangle has rotational symmetry of 180°.
   Reason (R): A rectangle looks the same after a half turn.
3. **Assertion (A):** A circle has infinite rotational symmetry.
   Reason (R): Every point on a circle is equidistant from its center.
4. **Assertion (A):** An isosceles triangle has two lines of symmetry.
   Reason (R): An isosceles triangle has two equal sides.
5. **Assertion (A):** The letter "X" has two lines of symmetry.
   Reason (R): The letter "X" is symmetrical about its diagonals.

HOTS (Higher Order Thinking Skills)

Critical Thinking

1. A student folds a square sheet of paper diagonally and notices that the two halves overlap completely. How can the student use this observation to explain the line of symmetry in a square?
2. A clock shows 9:15. Does the clock face have symmetry? If yes, what type of symmetry does it have?

Case Study

Critical Thinking

A teacher gave a group of students some cutouts of different geometric shapes: squares, circles, triangles, and rectangles. The students were asked to fold the shapes to find their lines of symmetry and then record their observations in a table. The following table shows their findings:

Shape	Square	Circle	Equilateral Triangle	Rectangle
Number of Lines of Symmetry	4	Infinite	3	2

1. Based on the table, which shape has the highest number of lines of symmetry?
2. Why does a circle have infinite lines of symmetry?
3. If the students fold a rectangle along its diagonal, will it form identical halves? Why or why not?
4. Can the equilateral triangle be folded along any line to form two identical halves? Why?
5. Identify one shape from the table that has rotational symmetry but no line of symmetry.