UNIQUE STUDY POINT

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Class: VI	**Subject:** Mathematics	**Session:** 2025-26
Chapter: 09 - Symmetry	**Time:** 1½ Hours	**Max. Marks:** 40

General Instructions:

1. All questions are compulsory.
2. This question paper contains 20 questions divided into five sections A, B, C, D and E.
3. Section A contains 10 MCQs of 1 mark each.
4. Section B contains 4 questions of 2 marks each.
5. Section C contains 3 questions of 3 marks each.
6. Section D contains 1 question of 5 marks.
7. Section E contains 2 Case Study Based questions of 4 marks each.

SECTION A - Multiple Choice Questions (1 mark each)

Q1. Which triangle has no line of symmetry?

(a) Equilateral triangle

(b) Isosceles triangle

(c) Scalene triangle

(d) Right-angled triangle

Q2. The smallest angle of rotational symmetry of a regular heptagon (7 sides) is approximately:

(a) 45°

(b) 51.4°

(c) 60°

(d) 72°

Q3. Mirror halves are created when a figure is folded along:

(a) Any line

(b) A curved line

(c) A line of symmetry

(d) A diagonal

Q4. How many lines of symmetry does an isosceles triangle have?

(a) 0

(b) 1

(c) 2

(d) 3

Q5. Every figure will have which angle as an angle of symmetry?

(a) 90°

(b) 180°

(c) 270°

(d) 360°

Q6. A kite has how many lines of symmetry?

(a) 0

(b) 1

(c) 2

(d) 4

Q7. Which English capital letter has point symmetry but no line symmetry?

(a) A

(b) H

(c) S

(d) T

Q8. A regular polygon with n sides has how many lines of symmetry?

(a) n/2

(b) n

(c) 2n

(d) n^2

Q9. If the smallest angle of symmetry is 45°, then the order of rotational symmetry is:

(a) 4

(b) 6

(c) 8

(d) 12

Q10. A parallelogram has rotational symmetry of:

(a) 90°

(b) 180°

(c) 270°

(d) No rotational symmetry

SECTION B - Short Answer Questions (2 marks each)

Q11. Draw two different figures (other than circle and square) that have exactly 4 lines of symmetry.

Q12. In a figure, 45° is an angle of symmetry. List all angles of symmetry up to 360°. How many are there?

Q13. Explain with an example why the diagonal of a rectangle is not a line of symmetry.

Q14. Can we have a rotational symmetry figure whose smallest angle is 17°? Justify your answer.

SECTION C - Short Answer Questions (3 marks each)

Q15. A paper is folded twice (first vertically, then horizontally) and a triangular piece is cut from the corner where all folds meet. Describe and draw what shape will appear when the paper is completely unfolded.

Q16. Complete the following figure on a dot grid by adding two more lines such that the resulting figure has exactly one line of symmetry. Show the line of symmetry clearly.

Q17. Compare the symmetries of:

(a) A regular hexagon and a circle

(b) An equilateral triangle and a scalene triangle

(c) A square and a rectangle (not square)

SECTION D - Long Answer Question (5 marks)

Q18. Consider a regular hexagon ABCDEF with vertices labeled in order.

(a) How many lines of symmetry does it have? Draw and label them all.

(b) What is the smallest angle of rotational symmetry?

(c) If we rotate the hexagon by 60° clockwise, where will vertex A move? Where will all other vertices move?

(d) Does the hexagon have both reflection symmetry and rotational symmetry? Explain.

(e) List all angles of rotational symmetry and find the relationship between the number of sides and the smallest angle.

SECTION E - Case Study Based Questions (4 marks each)

Q19. Case Study 1: Taj Mahal Architecture

The Taj Mahal is known for its perfect symmetry. When viewed from the front, the structure appears identical on both sides of an imaginary vertical line passing through the center. The building has four minarets at the corners, a central dome, and identical decorative elements on both sides.

Based on the above information, answer the following:

(a) How many lines of symmetry does the front view of Taj Mahal have? (1 mark)

(b) Does the Taj Mahal have rotational symmetry when viewed from above? If yes, what is the smallest angle? (1 mark)

(c) If you fold an image of the Taj Mahal along its line of symmetry, what will happen? (1 mark)

(d) Why do you think architects use symmetry in designing monuments? Give one reason. (1 mark)

Q20. Case Study 2: Snowflake Pattern

A snowflake is a natural ice crystal that forms in clouds. Most snowflakes have six-fold symmetry, meaning they have 6 identical branches radiating from the center. When rotated or reflected along certain lines, the snowflake appears unchanged.

Based on the above information, answer the following:

(a) How many lines of symmetry does a typical snowflake with 6 branches have? (1 mark)

(b) What is the smallest angle of rotational symmetry for such a snowflake? (1 mark)

(c) List all the angles of rotational symmetry for the snowflake. (1 mark)

(d) If a snowflake has 8 identical branches instead of 6, what would be its smallest angle of rotational symmetry? (1 mark)

DETAILED ANSWER KEY - PAPER 03

SECTION A - Answers to MCQs

Q1. (c) Scalene triangle

A scalene triangle has all sides and angles different, so it has no line of symmetry.

Q2. (b) 51.4°

For a regular heptagon: 360° ÷ 7 ≈ 51.4° or 51⅖°.

Q3. (c) A line of symmetry

When a figure is folded along a line of symmetry, the two halves overlap exactly creating mirror halves.

Q4. (b) 1

An isosceles triangle has one line of symmetry passing through the vertex angle and the midpoint of the base.

Q5. (d) 360°

Every figure returns to its original position after a complete rotation of 360°.

Q6. (b) 1

A kite has one line of symmetry along one of its diagonals.

Q7. (c) S

The letter S has point symmetry (180° rotation) but no line of symmetry.

Q8. (b) n

A regular polygon with n sides has exactly n lines of symmetry.

Q9. (c) 8

Order of rotational symmetry = 360° ÷ 45° = 8.

Q10. (b) 180°

A parallelogram has rotational symmetry of 180° about its center.

SECTION B - Answers to Short Answer Questions

Q11.

Two examples of figures with exactly 4 lines of symmetry:

1. **Regular Octagon** - Has 8 lines of symmetry (more than 4, so this won't work)

Correct Answer:

1. **Plus sign (+)** - Has 4 lines of symmetry (horizontal, vertical, and two diagonals)
2. **Cross (×)** - Has 4 lines of symmetry (vertical, horizontal, and two diagonal lines)

Drawings should show both figures with all 4 lines marked.

Q12.

If 45° is an angle of symmetry, all angles are multiples of 45°:

Angles of symmetry:

45°, 90°, 135°, 180°, 225°, 270°, 315°, 360°

Total number of angles = 8

Q13.

Example: Consider a rectangle ABCD (not a square).

Explanation:

- When we fold the rectangle along diagonal AC, the two halves do not overlap exactly
- The vertices B and D do not coincide
- The sides are of different lengths (length ≠ width)
- Therefore, the diagonal is NOT a line of symmetry

Only the horizontal and vertical lines through the center are lines of symmetry for a rectangle.

Q14.

No, we cannot have a rotational symmetry figure with smallest angle of 17°.

Justification:

- For rotational symmetry, the smallest angle must be a factor of 360°
- 360° ÷ 17 = 21.176... (not a whole number)
- Since 17 does not divide 360° evenly, we cannot have a regular figure with 17° as the smallest angle of symmetry

SECTION C - Answers to Short Answer Questions

Q15.

When paper is folded twice and a triangle is cut from the corner where all folds meet:

Result: The unfolded paper will have **4 identical triangular holes**, one in each quadrant.

Description:

- The cut creates 4 layers at the folded corner
- Each layer gets an identical triangular cut
- When unfolded, these appear as 4 triangular holes symmetrically placed
- The figure has 2 lines of symmetry (vertical and horizontal fold lines)

Drawing should show a square paper with 4 triangular cuts at the four corners.

Q16.

To create a figure with exactly one line of symmetry:

- Add two lines that mirror each other across one axis only
- Ensure the completed figure is symmetric along one line only
- Mark the line of symmetry clearly

Drawing should show a completed asymmetric figure with one clear line of symmetry marked.

Q17.

(a) **Regular Hexagon vs Circle:**

- Regular hexagon: 6 lines of symmetry, smallest angle = 60°
- Circle: Infinite lines of symmetry, every angle is an angle of symmetry
- Circle has more symmetry

(b) **Equilateral Triangle vs Scalene Triangle:**

- Equilateral triangle: 3 lines of symmetry, 3 angles of rotation (120°, 240°, 360°)
- Scalene triangle: 0 lines of symmetry, no rotational symmetry
- Equilateral triangle has complete symmetry, scalene has none

(c) **Square vs Rectangle:**

- Square: 4 lines of symmetry, smallest angle = 90°
- Rectangle: 2 lines of symmetry, smallest angle = 180°
- Square has more lines of symmetry and smaller rotational angle

SECTION D - Answer to Long Answer Question

Q18.

(a) **Lines of symmetry = 6**

- 3 lines connecting opposite vertices (through vertices A-D, B-E, C-F)
- 3 lines connecting midpoints of opposite sides
- Drawing should show hexagon ABCDEF with all 6 lines marked

(b) **Smallest angle of rotational symmetry = 60°**
Calculation: 360° ÷ 6 = 60°

(c) **After 60° clockwise rotation:**

- Vertex A moves to position of vertex B
- Vertex B moves to position of vertex C
- Vertex C moves to position of vertex D
- Vertex D moves to position of vertex E
- Vertex E moves to position of vertex F
- Vertex F moves to position of vertex A

(d) **Yes**, the hexagon has both reflection symmetry and rotational symmetry.

- Reflection symmetry: It has 6 lines of symmetry
- Rotational symmetry: It looks the same after rotations of 60°, 120°, 180°, 240°, 300°, and 360°

(e) **All angles of rotational symmetry:** 60°, 120°, 180°, 240°, 300°, 360°

Relationship: Smallest angle = 360° ÷ number of sides = 360° ÷ 6 = 60°

SECTION E - Answers to Case Study Based Questions

Q19. Case Study 1: Taj Mahal Architecture

(a) **Number of lines of symmetry = 1**
The front view has one vertical line of symmetry through the center.

(b) **Yes**, when viewed from above, the Taj Mahal has rotational symmetry.
Smallest angle = 90° (due to its four-fold symmetry with 4 minarets at corners)

(c) When folded along the line of symmetry, the left and right halves will **overlap exactly**, showing perfect symmetry in design.

(d) Architects use symmetry because:

- It creates visual balance and harmony
- It appears aesthetically pleasing to the eye
- It represents perfection and order

- It makes structures more stable

(Any one reason is acceptable)

Q20. Case Study 2: Snowflake Pattern

(a) **Number of lines of symmetry = 6**
Each line passes through opposite branches and the center.

(b) **Smallest angle of rotational symmetry = 60°**
Calculation: 360° ÷ 6 = 60°

(c) **All angles of rotational symmetry:**
60°, 120°, 180°, 240°, 300°, 360°

(d) **For 8 branches, smallest angle = 45°**
Calculation: 360° ÷ 8 = 45°
