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# NCERT Solutions for Class 6 Maths Chapter 9: Symmetry – Free PDF Download

Chapter 9 of the Class 6 Maths textbook Ganita Prakash is Symmetry. Unlike older NCERT editions, which split this topic across two grades, this chapter covers both line (reflection) symmetry and rotational symmetry together, before ending with the special case of symmetry in a circle. These solutions walk through th...

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Chapter 9 of the Class 6 Maths textbook *Ganita Prakash* is Symmetry. Unlike older NCERT editions, which split this topic across two grades, this chapter covers both line (reflection) symmetry **and** rotational symmetry together, before ending with the special case of symmetry in a circle. These solutions walk through the chapter's questions the way they appear in the book, section by section.

## 9.1 Line of Symmetry

A figure is **symmetrical** if it can be divided by a line into two halves that are mirror images of each other. This line is called the **line of symmetry** (or axis of symmetry). A figure can have no line of symmetry, exactly one, several, or even infinitely many (like a circle).

**Q1. Do you see any line of symmetry in the figures at the start of the chapter? What about the picture of the cloud?**
Ans: Most of the patterned figures shown (like the rangoli and butterfly-style figures) do have line symmetry — some have a single vertical line of symmetry, others (like a symmetric flower motif) have several lines of symmetry radiating out from the centre. The picture of the cloud is **not** symmetrical — its outline is irregular, so no line can divide it into two mirror-image halves.

**Q2. Identify the line(s) of symmetry in the given figures.**
Ans: For each figure, fold it (mentally or physically) along a candidate line and check whether the two halves match exactly. Regular, evenly balanced shapes (like an isosceles triangle, a rectangle, a square) will show one or more clean lines of symmetry; irregular shapes will show none.

### How many lines of symmetry do these shapes have?

A useful reference while solving these questions:

- Line segment — 2 lines of symmetry (along itself, and the perpendicular bisector)
- Isosceles triangle (not equilateral) — 1 line of symmetry
- Equilateral triangle — 3 lines of symmetry
- Scalene triangle — 0 lines of symmetry
- Square — 4 lines of symmetry
- Rectangle (non-square) — 2 lines of symmetry
- Rhombus (non-square) — 2 lines of symmetry (its diagonals)
- Regular pentagon — 5 lines of symmetry
- Regular hexagon — 6 lines of symmetry
- Circle — infinite lines of symmetry

**Common mistake to avoid:** students often assume every rectangle behaves like a square. A non-square rectangle's *diagonal* is not a line of symmetry — folding along a diagonal does not make the two halves overlap exactly. Only a square's diagonals work that way.

### Generating shapes with lines of symmetry (paper folding and cutting)

These questions ask you to predict, then verify, what shape a folded-and-cut (or folded-and-punched) piece of paper will make when unfolded:

> If a single hole is punched through paper folded once, unfolding gives **two** symmetric holes, reflected across the fold line.
>
> If the paper is folded **twice** (into quarters) before punching, unfolding gives **up to four** symmetric holes — students often forget this and predict only two.
>
> To design a specific shape (like a hole exactly in the centre), work backwards: figure out what a quarter of the final shape looks like, since that quarter is what actually gets cut.

**Draw a triangle with:**

> (a) exactly 1 line of symmetry — an isosceles triangle (two equal sides)
>
> (b) exactly 3 lines of symmetry — an equilateral triangle (all sides equal)
>
> (c) no line of symmetry — a scalene triangle (all sides different)

**Is a triangle with exactly 2 lines of symmetry possible?** No. If a triangle has 2 lines of symmetry, it is forced to have all 3 sides equal, which means it automatically has a 3rd line of symmetry too — so "exactly 2" can never happen for a triangle.

## 9.2 Rotational Symmetry

A figure has **rotational symmetry** if, when rotated about a fixed point (the **centre of rotation**) by some angle less than 360°, it looks exactly the same as before. That angle is called the **angle of symmetry**. Every figure automatically matches itself after a full 360° turn, but that alone does not count as rotational symmetry — there must be at least one smaller angle that also works.

**Q1. Find the angle of symmetry for the given figures about the marked point.**
Ans: Look for the smallest angle through which the figure can be turned and still look identical. Typical answers for common shapes: a square turned about its centre matches itself every 90°; an equilateral-triangle-based figure every 120°; a figure with no rotational symmetry only matches itself at the trivial 360°.

**Q2. Which figures have more than one angle of symmetry?**
Ans: Any figure with rotational symmetry of order more than 1 has multiple angles of symmetry — all multiples of its smallest angle, up to 360°. For example, a figure with smallest angle 90° also has angles of symmetry at 180°, 270°, and 360°.

**Q3. Give the order of rotational symmetry for each figure.**
Ans: The **order of rotational symmetry** is simply how many angles of symmetry the figure has (equivalently, how many times it matches itself in one full turn). A figure whose smallest angle of symmetry is 90° has order 4 (since 360 ÷ 90 = 4); one with no rotational symmetry beyond the trivial 360° has order 1.

## Symmetries of a Circle

A circle is the most symmetric plane figure of all: every diameter is a line of symmetry, so it has **infinite lines of symmetry**, and it looks identical after a rotation by *any* angle about its centre, so it has **infinite angles of symmetry** too.

**60° is the smallest angle of symmetry of a figure — what are its other angles of symmetry?**
Ans: All whole-number multiples of 60° up to 360°: 120°, 180°, 240°, 300°, and 360°.

**60° is an angle of symmetry, and there are two smaller angles of symmetry — find the smallest one.**
Ans: If 60° is one of several equally spaced angles of symmetry and two smaller ones exist below it, the smallest angle is 60° ÷ 3 = **20**°.

**Can the smallest angle of symmetry be (a) 45°? (b) 17°?**
Ans: (a) Yes — 360 ÷ 45 = 8, a whole number, so a figure with order-8 rotational symmetry is possible. (b) No — 360 ÷ 17 is not a whole number, so 17° cannot be a valid smallest angle of symmetry. **Rule to remember:** the smallest angle of symmetry must always be a whole-number factor of 360°.

**The new Parliament Building, Delhi:** Its outer boundary has 3 lines of symmetry, and it has rotational symmetry with angles of symmetry at 120°, 240°, and 360° (order 3) — consistent with its triangular ground plan.

**Ashoka Chakra (24 spokes):** It has 12 lines of symmetry (since the 24 spokes pair up across the centre), and its smallest angle of symmetry is 360° ÷ 24 = 15°, with further angles of symmetry at every multiple of 15° up to 360°.

**Linking back to Chapter 1:** the regular-polygon sequence and the Koch Snowflake pattern from Chapter 1 (Patterns in Mathematics) reappear here — a regular polygon with *n* sides has exactly *n* lines of symmetry and *n* angles of symmetry, so the “number of sides” and “number of lines/angles of symmetry” sequences match exactly as the polygon grows from triangle to square to pentagon and beyond.

**See also:** Chapter 1 | Chapter 2 | Chapter 3 | Chapter 4 | Chapter 5 | Chapter 6 | Chapter 7 | Chapter 8

**Practice more:** Chapter 1 | Chapter 2 | Chapter 3 | Chapter 4 | Chapter 5 | Chapter 6 | Chapter 7 | Chapter 8 | Chapter 9

**Quick revision:** Chapter 1 | Chapter 2 | Chapter 3 | Chapter 4 | Chapter 5 | Chapter 6 | Chapter 7 | Chapter 8 | Chapter 9