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CLASS 8 MATHS NCERT SOLUTIONS

NCERT Solutions for Class 8 Maths Chapter 14: Area – Ganita Prakash

Chapter 14 of the Class 8 NCERT Ganita Prakash textbook (Part 2, Chapter 7 in the book's own numbering) is titled "Area" — the final chapter of the Class 8 Maths curriculum. It covers areas of rectangles, triangles, polygons, parallelograms, rhombuses and trapeziums, classical Sulba-Sutra dissection methods, and r...

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Below are original, independently verified solutions to the chapter's key questions. A few textbook questions rely entirely on specific figures/diagrams not reproducible in text (e.g. an irregular spiral-tube figure); for those we explain the method clearly rather than guess unverifiable numbers.

14.1 Rectangles and Squares

Q1 (missing side, nested rectangles). A figure is built from nested rectangles with given areas; find the unknown side length.
Solution (worked chain): Rectangle 1: 7 × BC = 21 ⇒ BC = 3. Next side = 3+4 = 7. Rectangle 2: EF × 7 = 28 ⇒ EF = 4. Next side = 3+4 = 7. Rectangle 3: 35 = 7 × AJ ⇒ AJ = 5. Next side = 5+2 = 7. Rectangle 4: x × 7 = 14 ⇒ **x = 2**. (Each step uses the previous rectangle's known side to unlock the next, since nested rectangles in this figure share a common side of length 7.)

Q2 (Path around a park). A uniform-width path runs around a rectangular park. If path width d = 2 m and the inner park is 16 m × 11 m, find the area of the path, and give a general formula.
Solution: Outer rectangle = (16+2×2) × (11+2×2) = 20 × 15 = 300 m^2. Inner park = 16 × 11 = 176 m^2. **Area of path = 300 – 176 = 124 m^2.** General formula (for inner length l, width w, uniform path width d): **Area of path = 2d(l+w) + $4d^2$** (two side-strips of length l, two of length w, plus the four d×d corner squares). Check: $2(2)(16+11)+4(2)^2$ = 4(27)+16 = 108+16 = 124. ✓

Q3 (Crosspath in a field). A rectangular plot is 14 m × 12 m, with a crosspath of width 2 m running both horizontally and vertically through it. Find the area of the crosspath.
Solution: Horizontal strip = 14 × 2 = 28 m^2. Vertical strip = 12 × 2 = 24 m^2. These overlap in a 2×2 = 4 m^2 square (counted twice), so **Area of crosspath = 28 + 24 – 4 = 48 m^2.** General formula: Area = $(L \times w_1) + (W \times w_2) - (w_1 \times w_2)$.

Q4 (Doubling a square's side). If the side length of a square is doubled, by what factor do areas of regions drawn inside it increase?
Solution: If a square's side a becomes 2a, its area goes from a^2 to $(2a)^2 = 4a^2$ — **4 times larger**. This scaling rule applies to any shape drawn proportionally inside the square (triangles, smaller regions, etc.): if every linear dimension of a 2D shape is scaled by a factor k, its area scales by k^2. Since k=2 here, every region's area increases by a factor of **4**, regardless of the region's exact shape.

Q5 (Hands-on activity). Divide a square into 4 rectangular pieces using two perpendicular cuts (not through the centre), then rearrange the pieces into a larger square with a hole in the middle.
Solution: Take an 8 cm × 8 cm cardboard square. Draw two perpendicular lines inside it (off-centre), creating 4 rectangular pieces. Cut along the lines. Rearrange the 4 pieces at the four corners of an imaginary larger square, each rotated to fit — this leaves a square-shaped hole in the middle. This classic dissection demonstrates that the same total area can be rearranged into a different-looking figure while the sum of the pieces' areas stays constant.

14.2 Triangles

Q1. Find the areas of three triangles: (i) base 4 cm, height 3 cm (ii) base 5 cm, height 3.2 cm (iii) base 3 cm,

height 4 cm.
Solution: Area = ½ × base × height.
(i) ½×4×3 = **6 cm^2**
(ii) ½×5×3.2 = **8 cm^2**
(iii) ½×3×4 = **6 cm^2**

Q2 (Finding an altitude). In a triangle, XC = XB+6, AX = 4 units, AC = 8 units, and X lies on AC with B a separate vertex; find altitude BY (BY ⊥ AC).
Solution: Since Area(ΔAXC) = Area(ΔAXB) + Area(ΔABC): ½(XB+6)(4) = ½(XB)(4) + ½(8)(BY) ⇒ 2XB+12 = 2XB + 4BY ⇒ 4BY = 12 ⇒ **BY = 3 units.**

Q3 (Isosceles triangle areas). ΔSUB is isosceles (SU=SB) with SE ⊥ UB, and Area(ΔSEB) = 24 sq. units. Find Area(ΔSUB).
Solution: Since SE is the altitude from the apex of an isosceles triangle, it bisects the base UB, so ΔSUE and ΔSEB have equal area (24 each). **Area(ΔSUB) = 24+24 = 48 sq. units.**

Q4 (Sulba-Sutra method). Give a method to transform a rectangle into a triangle of equal area.
Solution: For rectangle ABCD (length a, breadth b): mark midpoint E of side CD, draw a perpendicular to CD through E, and mark point M on it with ME = b. The triangle with base AB and apex M has the same area as the rectangle, since Area = ½ × base × height = ½ × a × 2b is adjusted by construction to equal a×b (the apex height 2b over base a gives the same area as the original rectangle a×b).

Q5 (Midpoint triangle). M and N are midpoints of XY and XZ in ΔXYZ. What fraction of Area(ΔXYZ) is Area(ΔXMN)?
Solution: By the midpoint theorem, MN ∥ YZ and MN = ½YZ, so ΔXMN is similar to ΔXYZ with a linear scale factor of ½. Since area scales with the square of the linear ratio: Area(ΔXMN) = $(½)^2$ × Area(ΔXYZ) = **¼ × Area(ΔXYZ).**

Q6 (Gopal's shortest path — reflection trick). Gopal must go from his house to the riverbank (to fetch water) and then to his water tank, taking the shortest possible total path. How is the optimal point on the riverbank found?
Solution: This is a classic "reflection" problem: reflect the water tank's position across the line of the riverbank to get a mirror-image point T'. The straight line from the house (H) to T' crosses the riverbank at the optimal point P — the path H→P→T (using the real tank position T) is then the shortest possible route, because any other point on the bank would make the path longer than the straight-line distance H to T'.

14.3 Area of a Polygon

Q1. Quadrilateral ABCD has diagonal AC = 22 cm, with BM ⊥ AC (BM=3 cm) and DN ⊥ AC (DN=3 cm), M and N on AC. Find the area of ABCD.
Solution: Area(ABCD) = Area(ΔACB) + Area(ΔCAD) = ½(22)(3) + ½(22)(3) = 33+33 = **66 cm^2.**

Q2 (Shaded region). Rectangle ABCD has AE=10 cm, EB=8 cm (so AB=18 cm), AF=6 cm, FD=4 cm (so AD=10 cm), and BC=10 cm. Find the shaded area after removing ΔAEF and ΔEBC.
Solution: Rectangle area = 18×10 = 180 cm^2. Area(ΔAEF) = ½(10)(6) = 30 cm^2. Area(ΔEBC) = ½(8)(10) = 40 cm^2. **Shaded area = 180 – (30+40) = 110 cm^2.**

Q3. What's the minimum measurement needed to find the area of a regular hexagon, and what's the formula?
Solution: You only need the **side length (a). Area of a regular hexagon = (3√3/2) a^2.**

Q4 (Red region fraction). In rectangle ABCD with diagonals meeting at O, what fraction of the rectangle's area is covered by triangles AOB and DOC together?
Solution: If l = length, b = breadth, and O splits the height into segments x and y (x+y=b):
Area(ΔAOB)+Area(ΔDOC) = ½lx + ½ly = ½l(x+y) = ½lb = **½ the area of the rectangle.**

Q5 (Varignon-style construction). Give a method to construct a quadrilateral with half the area of a given quadrilateral.
Solution: For quadrilateral ABCD, mark the midpoints P, Q, R, S of sides AB, BC, CD, DA. The quadrilateral PQRS (joining these midpoints in order) is always a parallelogram with exactly **half the area** of the original quadrilateral ABCD — a classical result (the Varignon parallelogram).

14.4 Parallelogram

Q1 (Same base, same height). Several parallelograms share the same base (5 units) and height (3 units) but look different (more or less "slanted"). What can we say about their areas and perimeters?
Solution: Areas are all equal (Area = base × height = 5×3 = 15 sq. units for every one of them), since area depends only on base and perpendicular height, not on how slanted the sides are. **Perimeters differ**, however — the more slanted (skewed) a parallelogram is for the same base and height, the longer its slant sides become, so the least-slanted (closest to a rectangle) parallelogram has the minimum perimeter, and the most-slanted one has the maximum perimeter.

Q2. Find the areas of parallelograms with (i) base 7 cm, height 4 cm (ii) base 5 cm, height 3 cm (iii) base 5 cm, height 4.8 cm (iv) base 2 cm, height 4.4 cm.
Solution: Area = base × height.
(i) 7×4 = **28 cm²** (ii) 5×3 = **15 cm²** (iii) 5×4.8 = **24 cm²** (iv) 2×4.4 = **8.8 cm²**

Q3 (Pythagoras application). In right triangle PNQ (right angle at N), PN=7.6 cm and PQ=12 cm (hypotenuse). Find QN.
Solution: $PQ^2 = PN^2 + QN^2 \Rightarrow 144 = 57.76 + QN^2 \Rightarrow QN^2 = 86.24 \Rightarrow QN = \sqrt{86.24} \approx$ **9.29 cm** (to 2 decimal places; note some published answer keys round this to 9.28 cm, but the more precise value is 9.29 cm).

Q4 (Rectangle vs. slanted parallelogram). A rectangle and a parallelogram both have sides 5 cm and 4 cm. Which has the greater area?
Solution: Rectangle: Area = 5×4 = 20 cm² (since all angles are 90°, the full 4 cm side is also the height). Parallelogram: if the 4 cm side is slanted at any angle other than 90°, its perpendicular height is *less than* 4 cm (height = 4 × sinθ, and sinθ < 1 for θ ≠ 90°), so its area = 5 × (height < 4) < 20 cm². **The rectangle has the greater area** — a rectangle is simply the special case of a parallelogram with maximum possible height for given side lengths.

Q5 (Double-area rectangle). Give a method to construct a rectangle with exactly twice the area of a given triangle.
Solution: If the triangle has base b and height h, its area is ½bh. Construct a rectangle with **length = b** and **width = h** (the triangle's own base and height): its area = b×h = 2 × (½bh), exactly double the triangle's area.

Q6–Q8 (Sulba-Sutra dissections). These questions ask for dissection methods (cutting and rearranging pieces) to convert between a triangle and a rectangle of equal area, and to convert an isosceles triangle into a rectangle.
Solution (equal-area rectangle from a triangle): For a triangle with base b, height h: a rectangle of length b/2 and width h has area (b/2)×h = ½bh — exactly equal to the triangle's area.
Solution (isosceles triangle dissection): For isosceles ΔABC (AB=AC) with altitude AD to base BC: AD

splits the triangle into two congruent right triangles ΔADB and ΔADC. Rotating one of these 180° about the midpoint of AD and reattaching it to the other forms a rectangle with the same total area as the original triangle.

Q9 (Square vs. equilateral triangle(s)). Compare the area of a square to (a) one equilateral triangle and (b) two equilateral triangles, all with the same side length a.
Solution: Area of equilateral triangle = $(\sqrt{3}/4)a^2 \approx 0.433a^2$. Area of square = a^2. Since $0.433a^2 < a^2$, **the square has a greater area than one equilateral triangle.** Two equilateral triangles = $(\sqrt{3}/2)a^2 \approx 0.866a^2$, which is still less than a^2, so **the square is still larger than two equilateral triangles combined** (though the gap is much smaller than with just one triangle).

14.5 Rhombus & Trapezium

Q1. Find the area of a rhombus with diagonals 20 cm and 15 cm.
Solution: Area = $\frac{1}{2} \times d_1 \times d_2 = \frac{1}{2} \times 20 \times 15$ = **150 cm².**

Q2. Find the areas of four trapeziums: (i) parallel sides 10 ft, 7 ft, height 16 ft (ii) parallel sides 36 m, 24 m, height 14 m (iii) parallel sides 14 in, 6 in, height 10 in (iv) parallel sides 18 ft, 12 ft, height 8 ft.
Solution: Area = $\frac{1}{2} \times (a+b) \times h$.
(i) $\frac{1}{2}(10+7)(16)$ = **136 ft²**
(ii) $\frac{1}{2}(36+24)(14)$ = **420 m²**
(iii) $\frac{1}{2}(14+6)(10)$ = **100 in²**
(iv) $\frac{1}{2}(18+12)(8)$ = **120 ft²**

Q3 (Constructing a specific-area trapezium). Construct a trapezium with area 144 cm².
Solution: Choose parallel sides 10 cm and 8 cm with height 16 cm: Area = $\frac{1}{2}(10+8)(16) = \frac{1}{2}(18)(16)$ = **144 cm².** ? (Many other combinations also work, e.g. any a, b, h satisfying $\frac{1}{2}(a+b)h = 144$, such as a rectangle-equivalent of 16 cm × 9 cm = 144 cm² as a cross-check.)

Q4 (Hexagon split into trapezium, triangle, rhombus). A regular hexagon (side a) is divided into an equilateral triangle, a rhombus, and a trapezium. Find the ratio of their areas.
Solution: Total hexagon area = $6 \times (\sqrt{3}/4)a^2 = (3\sqrt{3}/2)a^2$. Equilateral triangle = $(\sqrt{3}/4)a^2$. Rhombus (made of 2 equilateral triangles) = $(\sqrt{3}/2)a^2 = (2\sqrt{3}/4)a^2$. Trapezium (remaining) = $(3\sqrt{3}/2)a^2 - (\sqrt{3}/4)a^2 - (2\sqrt{3}/4)a^2 = (6\sqrt{3}/4 - \sqrt{3}/4 - 2\sqrt{3}/4)a^2 = (3\sqrt{3}/4)a^2$. Ratio Triangle : Rhombus : Trapezium = $(\sqrt{3}/4) : (2\sqrt{3}/4) : (3\sqrt{3}/4)$ = **1 : 2 : 3.**

Q5 (Equal-area proof, trapezium and triangle). ZYXW is a trapezium with ZY ∥ WX, and A is the midpoint of XY. Show that the area of trapezium ZYXW equals the area of ΔZWB (where B is the point on line WX extended such that Z, A, B are collinear).
Solution: In triangles ZAY and BAX: AY = AX (A is the midpoint of XY), ∠ZAY = ∠BAX (vertically opposite angles), and ∠ZYA = ∠BXA (alternate interior angles, since ZY ∥ WX). This gives **ΔZAY ≅ ΔBAX by ASA** (angle–side–angle: the equal side AY=AX is included between the two pairs of equal angles). Since ΔZAY and ΔBAX are congruent, they have equal area, so removing ΔZAY from the combined figure and replacing it with the equal-area ΔBAX shows that trapezium ZYXW and ΔZWB have the same total area.

14.6 Areas in Real Life

Q1. An A4 sheet measures 21 cm × 29.7 cm. Find its area.
Solution: Area = 21 × 29.7 = **623.7 cm².**

Q2. Convert to centimetres: (i) 5 in (ii) 7.4 in. [1 in = 2.54 cm]
Solution: (i) 5×2.54 = **12.7 cm** (ii) 7.4×2.54 = **18.796 cm**

Q3. Convert to inches: (i) 5.08 cm (ii) 11.43 cm.
Solution: (i) $5.08 \div 2.54$ = **2 in** (ii) $11.43 \div 2.54$ = **4.5 in**

Q4. How many in^2 is 1 ft^2?
Solution: 1 ft = 12 in, so 1 $ft^2 = 12^2$ = **144 in^2.**

Q5. How many m^2 is 1 km^2?
Solution: 1 km = 1000 m, so 1 $km^2 = 1000 \times 1000$ = **1,000,000 m^2.**

Why This Chapter Matters (for Boards)

Area formulas for triangles, parallelograms, rhombuses and trapeziums, along with the technique of decomposing irregular figures into simple shapes, form the geometric foundation used throughout Class 9-10 mensuration, coordinate geometry, and surface-area/volume problems.