TYBA COACHING CENTRE, AJMER

RMS / RMC CLASS VI MATHEMATICS • CHAPTER 18: GEOMETRY: CIRCLES & QUADRILATERALS (वृत्त एवं चतुर्भुज) — MASTER NOTES

Director: Narayan Prajapati (Narayan Sir) • Helpline: 6367029449 • Near Teja Chowk, Kotra, Ajmer • 100% Bilingual

1. CIRCLES — DEFINITIONS & COMPONENTS (वृत्त एवं उसके भाग) — Section 1

1.1 What is a Circle? (वृत्त क्या है?): A circle is the set of all points in a plane that are at a fixed distance from a fixed point. The fixed point is the **Centre (O)**, and the fixed distance is the **Radius (r)**.
• **Diameter (व्यास, d):** A line segment passing through the centre with both ends on the circle. **d = 2r** and **r = d ÷ 2**.
• **Chord (जीवा):** A line segment joining any two points on the circle. Note: **Diameter is the longest chord of a circle!**
• **Arc (चाप):** Any continuous part of the boundary (circumference) of a circle (Minor Arc < Semicircle < Major Arc).

केंद्र से परिधि तक की दूरी त्रिज्या (r) है। व्यास = 2 × त्रिज्या और यह वृत्त की सबसे बड़ी जीवा होती है। परिधि का एक भाग चाप (Arc) कहलाता है।

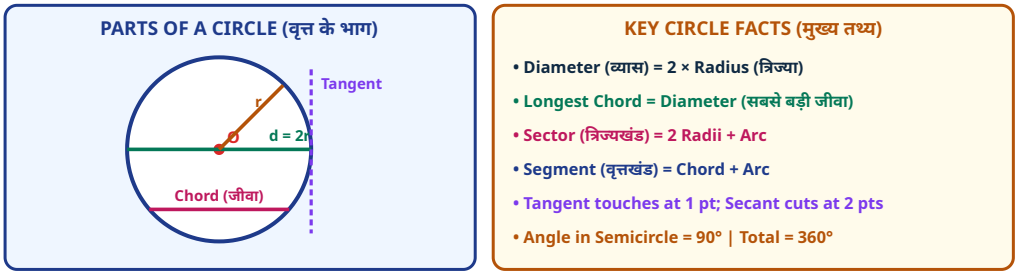

Figure 1: Circle Components — Radius, Diameter, Chord, Tangent & Sector

1.2 Sector, Segment, Secant & Tangent:
• **Sector (त्रिज्यखंड):** Region enclosed by **two radii and an arc** (like a pizza slice).
• **Segment (वृत्तखंड):** Region enclosed by a **chord and an arc**.
• **Secant (छेदक रेखा):** A straight line that cuts a circle at **two distinct points**.
• **Tangent (स्पर्श रेखा):** A straight line that touches a circle at **exactly one point**. Radius at the point of contact is perpendicular (90°) to the tangent!
• **Concentric Circles (संकेंद्रीय वृत्त):** Two or more circles having the **same centre** but different radii.

दो त्रिज्याओं व चाप से घिरा क्षेत्र त्रिज्यखंड (Sector), और जीवा व चाप से घिरा क्षेत्र वृत्तखंड (Segment) कहलाता है। स्पर्श रेखा त्रिज्या के साथ 90° बनाती है।

2. CIRCLE FORMULAS & SOLVED EXAMPLES (वृत्त के सूत्र व उदाहरण) — Section 2

2.1 Circumference & Area Formulas: Take **π = 22/7** (or 3.14).
• **Circumference (परिधि):** C = **2πr = πd** | **Radius from C:** r = C ÷ (2π).
• **Area of Circle (क्षेत्रफल):** A = **πr²** | **Area of Semicircle:** ½πr² | **Perimeter of Semicircle:** πr + 2r.
• **Area of Ring (Annulus):** π($R^2 - r^2$) where R = outer radius, r = inner radius.

परिधि = 2πr; क्षेत्रफल = πr^2; अर्धवृत्त का परिमाप = πr + 2r; वलय (Ring) का क्षेत्रफल = π($R^2 - r^2$)।

Solved Example 1 (Radius ↔ Diameter): If the radius of a circle is 8.5 cm, find its diameter. If diameter is 34 cm, find radius.
Solution: (i) d = 2 × 8.5 = **17 cm**. (ii) r = 34 ÷ 2 = **17 cm**.

हल: (i) व्यास = 2 × 8.5 = 17 सेमी; (ii) त्रिज्या = 34 ÷ 2 = 17 सेमी।

Solved Example 2 (Circumference & Area): Find the circumference and area of a circle of radius 21 cm.
Solution: C = 2 × (22/7) × 21 = 2 × 22 × 3 = **132 cm**. Area = (22/7) × 21 × 21 = 22 × 3 × 21 = **1,386 sq. cm**.

हल: परिधि = 2 × (22/7) × 21 = 132 सेमी; क्षेत्रफल = (22/7) × 21 × 21 = 1,386 वर्ग सेमी।

Solved Example 3 (Radius from Circumference): The circumference of a circular garden is 88 m. Find its radius and area.
Solution: 2 × (22/7) × r = 88 ⇒ r = (88 × 7) ÷ 44 = **14 m**. Area = (22/7) × 14 × 14 = **616 sq. m**.

हल: r = (88 × 7)/44 = 14 मी; क्षेत्रफल = (22/7) × 14 × 14 = 616 वर्ग मी।

Solved Example 4 (Area of Circular Ring): Two concentric circles have radii 10 cm and 7 cm. Find the area between them (π = 22/7).
Solution: Area = π($R^2 - r^2$) = (22/7) × ($10^2 - 7^2$) = (22/7) × (100 − 49) = (22/7) × 51 = 1122/7 = **160.29 sq. cm**.

हल: वलय का क्षेत्रफल = (22/7) × (100 − 49) = 160.29 वर्ग सेमी।

3. QUADRILATERALS — BASICS & ANGLE SUM PROPERTY Section 3

3.1 What is a Quadrilateral? (चतुर्भुज क्या है?): A closed polygon bounded by **4 line segments**. It has:
• **4 Sides**, **4 Vertices**, **4 Interior Angles**, and **2 Diagonals**.
• **Angle Sum Property:** The sum of all 4 interior angles of ANY quadrilateral is always **360°**.
• **Exterior Angle Sum:** The sum of all 4 exterior angles of any convex quadrilateral is also **360°**.

चतुर्भुज में 4 भुजाएँ, 4 शीर्ष, 4 कोण और 2 विकर्ण होते हैं। इसके चारों अंतः कोणों का योग सदैव 360° होता है।

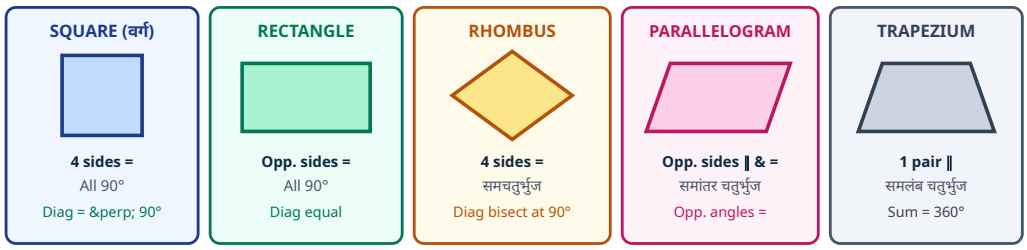

Figure 2: Five Major Quadrilaterals & Their Properties (चतुर्भुज के प्रकार)

Solved Example 5 (Fourth Angle): Three angles of a quadrilateral are 75°, 110°, and 85°. Find the fourth angle.
Solution: Fourth angle = 360° − (75° + 110° + 85°) = 360° − 270° = **90°**.

हल: चौथा कोण = 360° − 270° = 90°।

Solved Example 6 (Ratio of Angles): The four angles of a quadrilateral are in the ratio 1 : 2 : 3 : 4. Find all four angles.
Solution: 1x + 2x + 3x + 4x = 360° ⇒ 10x = 360° ⇒ x = 36°. Angles are **36°, 72°, 108°, 144°**.

हल: 10x = 360° ⇒ x = 36°। कोण क्रमशः 36°, 72°, 108° और 144° हैं।

Solved Example 7 (Equal Angles): Two angles of a quadrilateral are 68° and 112°, and the remaining two angles are equal. Find each equal angle.
Solution: 68 + 112 + 2x = 360 ⇒ 180 + 2x = 360 ⇒ 2x = 180 ⇒ x = **90°**.

हल: 180° + 2x = 360° ⇒ 2x = 180° ⇒ प्रत्येक समान कोण = 90°।

4. SPECIAL QUADRILATERALS & COMPARISON TABLE Section 4

Property (गुणधर्म)	Square (वर्ग)	Rectangle (आयत)	Rhombus (समचतुर्भुज)	Parallelogram (समांतर)
All 4 sides equal?	Yes	No (Opp. equal)	Yes	No (Opp. equal)

Property (गुणधर्म)	Square (वर्ग)	Rectangle (आयत)	Rhombus (समचतुर्भुज)	Parallelogram (समांतर)
Opposite sides parallel?	Yes	Yes	Yes	Yes
All angles 90°?	Yes	Yes	No (Opp. equal)	No (Opp. equal)
Diagonals equal?	Yes	Yes	No	No
Diagonals bisect at 90°?	Yes	No	Yes	No

4.1 Trapezium & Kite (समलंब व पतंग):
• **Trapezium (समलंब चतुर्भुज):** Has **exactly one pair** of opposite parallel sides. **Area = ½ × (sum of parallel sides) × height**.
• **Kite (पतंग):** Two pairs of equal **adjacent** sides; diagonals intersect at **90°**.
• **Area of Parallelogram:** base × height | **Area of Rhombus:** ½ × d_1 × d_2.

समलंब का क्षेत्रफल = ½ × (समांतर भुजाओं का योग) × ऊँचाई; समांतर चतुर्भुज = आधार × ऊँचाई; समचतुर्भुज = ½ × d_1 × d_2।

Solved Example 8 (Area of Rhombus): Find the area of a rhombus whose diagonals are 16 cm and 12 cm.
Solution: Area = ½ × d_1 × d_2 = ½ × 16 × 12 = 8 × 12 = **96 sq. cm**.

हल: क्षेत्रफल = ½ × 16 × 12 = 96 वर्ग सेमी।

Solved Example 9 (Area of Parallelogram): Find the height of a parallelogram of area 144 sq. cm and base 18 cm.
Solution: Height = Area ÷ base = 144 ÷ 18 = **8 cm**.

हल: ऊँचाई = 144 ÷ 18 = 8 सेमी।

Solved Example 10 (Area of Trapezium): Parallel sides of a trapezium are 14 cm and 10 cm, and height is 6 cm. Find its area.
Solution: Area = ½ × (14 + 10) × 6 = ½ × 24 × 6 = **72 sq. cm**.

हल: क्षेत्रफल = ½ × (14 + 10) × 6 = 72 वर्ग सेमी।

5. PARALLELOGRAM & RHOMBUS ANGLE PROBLEMS (EXAMPLES 11–18) Section 5

Solved Example 11 (Parallelogram Angles): One angle of a parallelogram is 70°. Find all other three angles.
Solution: Opposite angle = **70°**. Adjacent angles are supplementary: 180° − 70° = **110°**. So angles are **70°, 110°, 70°, 110°**.

हल: सम्मुख कोण = 70°; आसन्न कोण = 180° − 70° = 110°। अतः चारों कोण 70°, 110°, 70°, 110° होंगे।

Solved Example 12 (Adjacent Angles Ratio): Two adjacent angles of a parallelogram are in the ratio 4 : 5. Find both angles.
Solution: Adjacent angles sum to 180°: 4x + 5x = 180° ⇒ 9x = 180° ⇒ x = 20°. Angles = **80°** and **100°**.

हल: 4x + 5x = 180° ⇒ x = 20°। कोण = 80° और 100°।

Solved Example 13 (Side of Rhombus from Diagonals): Diagonals of a rhombus are 6 cm and 8 cm. Find the length of each side.
Solution: Diagonals bisect at 90°, forming right triangles with legs 6÷2 = 3 cm and 8÷2 = 4 cm. Side = √(3^2 + 4^2) = √25 = **5 cm**.

हल: अर्ध-विकर्ण 3 सेमी व 4 सेमी हैं। भुजा = √(3^2 + 4^2) = √25 = 5 सेमी।

Solved Example 14 (Rhombus Perimeter): Find the perimeter of the rhombus in Example 13.
Solution: Perimeter = 4 × side = 4 × 5 = **20 cm**.

हल: परिमाप = 4 × 5 = 20 सेमी।

Solved Example 15 (Circle Angle in Semicircle): AB is a diameter of a circle and C is a point on the circle. If ∠CAB = 35°, find ∠CBA.
Solution: Angle in a semicircle ∠ACB = 90°. So ∠CBA = 180° − (90° + 35°) = **55°**.

हल: अर्धवृत्त में कोण ∠ACB = 90°; अतः ∠CBA = 180° − 125° = 55°।

Solved Example 16 (Cyclic Quadrilateral): In a cyclic quadrilateral ABCD (all 4 vertices on a circle), if ∠A = 85°, find ∠C.
Solution: Opposite angles of a cyclic quadrilateral sum to 180°. ∠C = 180° − 85° = **95°**.

हल: चक्रीय चतुर्भुज के सम्मुख कोणों का योग 180° होता है, अतः ∠C = 180° − 85° = 95°।

Solved Example 17 (Diameter from Area): The area of a circle is 154 sq. cm. Find its diameter.
Solution: $(22/7)r^2 = 154 \Rightarrow r^2 = (154 \times 7)/22 = 49 \Rightarrow r = 7$ cm. Diameter = 2 × 7 = **14 cm**.

हल: $r^2 = 49 \Rightarrow r = 7$ सेमी; व्यास = 14 सेमी।

Solved Example 18 (Quadrilateral True/False Logic): Is every square a rectangle? Is every rectangle a square?
Solution: Every square IS a rectangle (all angles 90°, opp. sides equal), but every rectangle is NOT a square (adjacent sides may differ).

हल: प्रत्येक वर्ग एक आयत होता है, परंतु प्रत्येक आयत वर्ग नहीं होता।

6. RMS CET ADVANCED WORD PROBLEMS & SYMMETRY (EXAMPLES 19–24) Section 6

Solved Example 19 (Semicircle Perimeter): Find the perimeter of a semicircular park of radius 7 m.
Solution: Perimeter = πr + 2r = (22/7)×7 + 14 = 22 + 14 = **36 m**.

हल: अर्धवृत्त का परिमाप = πr + 2r = 22 + 14 = 36 मीटर।

Solved Example 20 (Lines of Symmetry): State the number of lines of symmetry for: (a) Square (b) Rectangle (c) Rhombus (d) Circle.
Solution: (a) Square = **4**; (b) Rectangle = **2**; (c) Rhombus = **2**; (d) Circle = **Infinite**.

हल: सममित रेखाएँ: वर्ग = 4, आयत = 2, समचतुर्भुज = 2, वृत्त = अनंत।

Solved Example 21 (Ratio of Radii → Circumference & Area): Two circles have radii in the ratio 2 : 3. Find the ratio of their circumferences and areas.
Solution: Circumference ratio = **2 : 3**; Area ratio = $2^2 : 3^2$ = **4 : 9**.

हल: परिधि का अनुपात = 2 : 3; क्षेत्रफल का अनुपात = 4 : 9।

Solved Example 22 (Tangent & Radius Angle): A tangent PQ touches a circle with centre O at point P. What is ∠OPQ?
Solution: Radius is always perpendicular to the tangent at the point of contact, so ∠OPQ = **90°**.

हल: स्पर्श बिंदु पर त्रिज्या स्पर्श रेखा पर लंब होती है, अतः ∠OPQ = 90°।

Solved Example 23 (Quadrilateral Angles Algebra): Angles of a quadrilateral are x°, (x+10)°, (x+20)°, and (x+30)°. Find x.
Solution: 4x + 60 = 360 ⇒ 4x = 300 ⇒ x = **75°**.

हल: 4x + 60° = 360° ⇒ 4x = 300° ⇒ x = 75°।

Solved Example 24 (Wheel Distance): A wheel has diameter 70 cm. How far does it travel in 10 rotations?
Solution: Circumference = πd = (22/7)×70 = 220 cm. 10 rotations = 220 × 10 = 2,200 cm = **22 m**.

हल: 1 चक्कर = 220 सेमी; 10 चक्कर = 2,200 सेमी = 22 मीटर।

7. COMMON EXAM TRAPS & 100% SCORE CHECKLIST — Section 7

Common RMS Exam Mistake (सामान्य गलती)	Correct Rule (सही नियम)
Calling radius the longest chord of a circle	**Diameter** is the longest chord (not radius)
Thinking a rectangle's diagonals bisect at 90°	Only **Square** and **Rhombus** diagonals bisect at 90°
Confusing Sector with Segment	**Sector** uses 2 radii; **Segment** uses a chord
Using πr for Semicircle perimeter	Add the diameter too: Perimeter = **πr + 2r**

8. EXTRA RMS CET SOLVED BANK & QUICK FORMULA FLASHCARDS (EX 25–28) — Section 8

Solved Example 25 (Concentric Circles Width): Two concentric circles have circumferences 88 cm and 44 cm. Find the width of the ring between them.
Solution: Outer R = 88 ÷ (2 × 22/7) = 14 cm; Inner r = 44 ÷ (2 × 22/7) = 7 cm. Width = R − r = 14 − 7 = **7 cm**.

हल: बाहरी त्रिज्या R = 14 सेमी; भीतरी त्रिज्या r = 7 सेमी। वलय की चौड़ाई = 14 − 7 = 7 सेमी।

Solved Example 26 (Kite Perimeter & Area): A kite has adjacent sides 9 cm and 15 cm, and diagonals 16 cm and 12 cm. Find its perimeter and area.
Solution: Perimeter = 2(9 + 15) = **48 cm**. Area = ½ × d_1 × d_2 = ½ × 16 × 12 = **96 sq. cm**.

हल: परिमाप = 2(9 + 15) = 48 सेमी; क्षेत्रफल = ½ × 16 × 12 = 96 वर्ग सेमी।

Solved Example 27 (Quadrilateral Missing Angles): In a parallelogram ABCD, ∠A = (2x + 15)° and ∠C = (3x − 10)°. Find x and ∠A.
Solution: Opposite angles are equal: 2x + 15 = 3x − 10 ⇒ x = **25°**. ∠A = 2(25) + 15 = **65°**.

हल: सम्मुख कोण बराबर हैं: 2x + 15 = 3x − 10 ⇒ x = 25°; ∠A = 65°।

Solved Example 28 (Central Angle of Sector): What is the area of a quadrant (1/4 circle) of radius 14 cm?
Solution: Area of quadrant = ¼ × πr² = ¼ × (22/7) × 14 × 14 = ¼ × 616 = **154 sq. cm**.

हल: चतुर्थांश का क्षेत्रफल = ¼ × 616 = 154 वर्ग सेमी।

Figure (आकृति)	Lines of Symmetry (सममित रेखाएँ)	Diagonals Property (विकर्ण)
Square (वर्ग)	4	Equal & perpendicular bisectors
Rectangle (आयत)	2	Equal & bisect each other
Rhombus (समचतुर्भुज)	2	Unequal & perpendicular bisectors
Circle (वृत्त)	Infinite (अनंत)	Infinite diameters (all equal)

9. HIGH-YIELD ONE-LINER MEMORY BANK & EXTRA EXAMPLES (EX 29–32) — Section 9

Solved Example 29 (Trapezium Parallel Side): The area of a trapezium is 90 sq. cm, its height is 6 cm, and one parallel side is 12 cm. Find the other parallel side.
Solution: 90 = ½ × (12 + b) × 6 ⇒ 90 = 3(12 + b) ⇒ 12 + b = 30 ⇒ b = **18 cm**.

हल: 90 = 3(12 + b) ⇒ 12 + b = 30 ⇒ दूसरी समांतर भुजा = 18 सेमी।

Solved Example 30 (Cost of Fencing Circular Park): Find the cost of fencing a circular park of radius 35 m at ₹10 per metre (π = 22/7).
Solution: Circumference = 2 × (22/7) × 35 = 220 m. Cost = 220 × 10 = **₹2,200**.

हल: परिधि = 220 मी; बाड़ लगाने का खर्च = 220 × 10 = ₹2,200।

Solved Example 31 (Rhombus Angles): One angle of a rhombus is 50°. Find the other three angles.
Solution: Opposite angle = **50°**. Adjacent angles = 180° − 50° = **130°** each. Angles are **50°, 130°, 50°, 130°**.

हल: सम्मुख कोण = 50°; आसन्न कोण = 180° − 50° = 130°।

9.1 Quick RMS CET One-Liner Facts (परीक्षा के महत्वपूर्ण तथ्य):
• A circle divides a plane into **3 parts**: Interior, On the Circle, and Exterior.
• **Chord** passing through the centre is the **Diameter** (longest chord).
• **Equilateral Triangle** has 3 lines of symmetry; **Regular Pentagon** has 5; **Regular Hexagon** has 6.
• If a square and a rhombus have the same side, the **square** always has a larger or equal area.

वृत्त तल को 3 भागों में बाँटता है। समान भुजा वाले वर्ग का क्षेत्रफल समचतुर्भुज से बड़ा या बराबर होता है।

Narayan Sir's Final Revision Mantra: (1) Circle has **infinite** lines of symmetry and **infinite** diameters. (2) Every quadrilateral's 4 angles sum to **360°**. (3) Cyclic quadrilateral opposite angles sum to **180°**. (4) Angle in a semicircle is always **90°**!

अंतिम मंत्र: (1) वृत्त में अनंत सममित रेखाएँ होती हैं। (2) चतुर्भुज के चारों कोणों का योग 360° होता है। (3) अर्धवृत्त में कोण 90° होता है!