CLASS 10 · MATHEMATICS · CHAPTER 10

Circles - Exercise 10.2

Exercise 10.2 with independently verified solutions.

CHAPTER	RESOURCE	SOURCE
Circles	NCERT Exercises	NCERT Mathematics, Reprint 2026-27

PART 1

Verified NCERT questions and solutions

Verified NCERT questions and solutions

Solutions are checked independently and follow the supplied NCERT chapter edition.

QUESTION

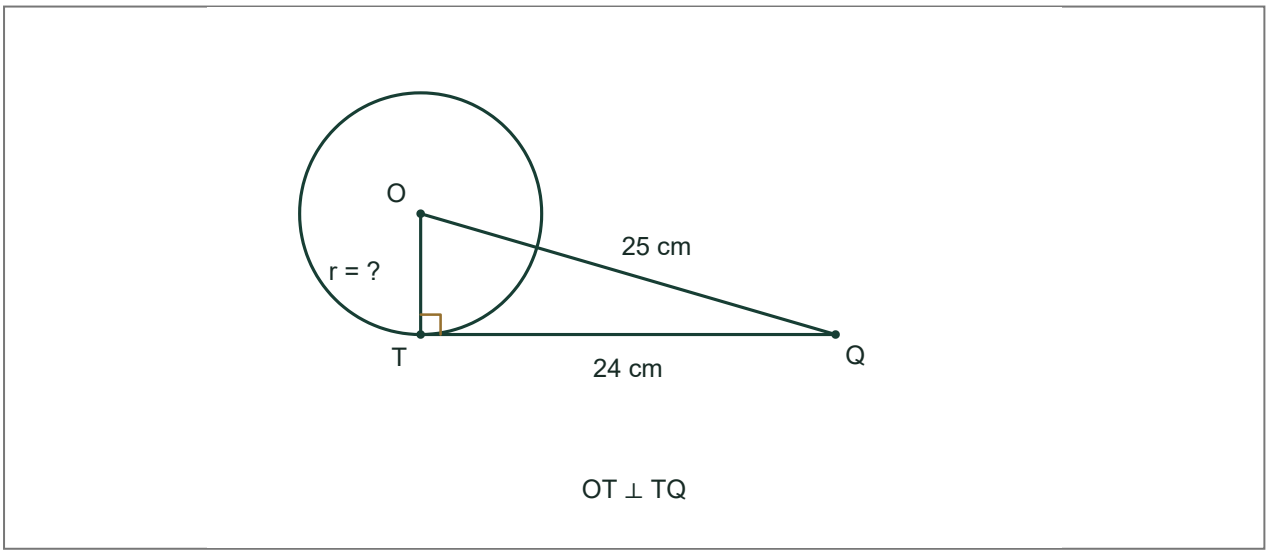
Question 1

multiple choice · radius

From a point Q, a tangent to a circle has length 24 cm and the distance from Q to the centre is 25 cm. Find the radius. Options: (A) 7 cm, (B) 12 cm, (C) 15 cm, (D) 24.5 cm.

Solution

Board-exam working:



Radius and tangent form a right triangle — solution sketch (not to scale).

Let QT = 24 cm be the tangent and OQ = 25 cm. Radius OT is perpendicular to QT.

$$OT^2 = OQ^2 - QT^2$$

$$= 25^2 - 24^2$$

$$= 625 - 576 = 49$$

$$OT = 7 \text{ cm}$$

Final answer

Option (A): 7 cm.

QUESTION

Question 2

multiple choice · angle between tangents

In Figure 10.11, TP and TQ are tangents to a circle with centre O and ∠POQ = 110°. Find ∠PTQ. Options: (A) 60°, (B) 70°, (C) 80°, (D) 90°.

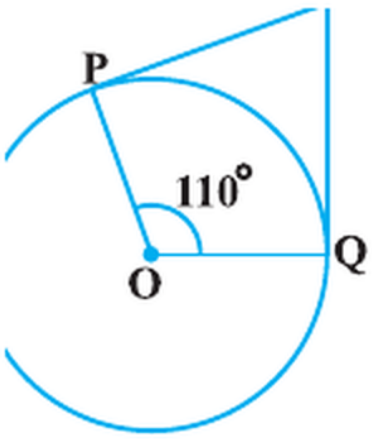


Fig. 10.11

Figure 10-11 from the supplied NCERT chapter.

Solution

Board-exam working:

Radii OP and OQ are perpendicular to tangents TP and TQ.

$$\angle OPT = \angle OQT = 90^\circ$$

In quadrilateral OPTQ:

$$\angle PTQ + \angle POQ + 90^\circ + 90^\circ = 360^\circ$$

$$\angle PTQ + 110^\circ = 180^\circ$$

$$\angle PTQ = 70^\circ$$

Final answer

Option (B): 70°.

QUESTION

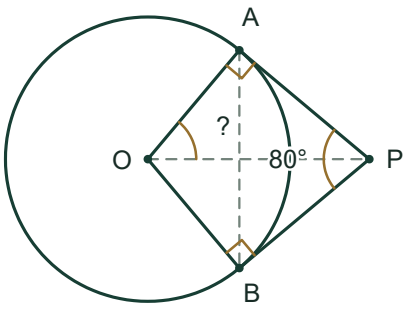
Question 3

multiple choice · angle bisector

Tangents PA and PB from a point P to a circle with centre O are inclined at 80°. Find ∠POA. Options: (A) 50°, (B) 60°, (C) 70°, (D) 80°.

Solution

Board-exam working:



Find ∠POA

Two tangents from one external point — solution sketch (not to scale).

Radii OA and OB are perpendicular to the tangents.

$$\angle OAP = \angle OBP = 90^\circ$$

In quadrilateral OAPB:

$$\angle AOB + 80^\circ + 90^\circ + 90^\circ = 360^\circ$$

$$\angle AOB = 100^\circ$$

Triangles OAP and OBP are congruent, so OP bisects ∠AOB.

$$\angle POA = \frac{100^\circ}{2} = 50^\circ$$

Final answer

Option (A): 50°.

QUESTION

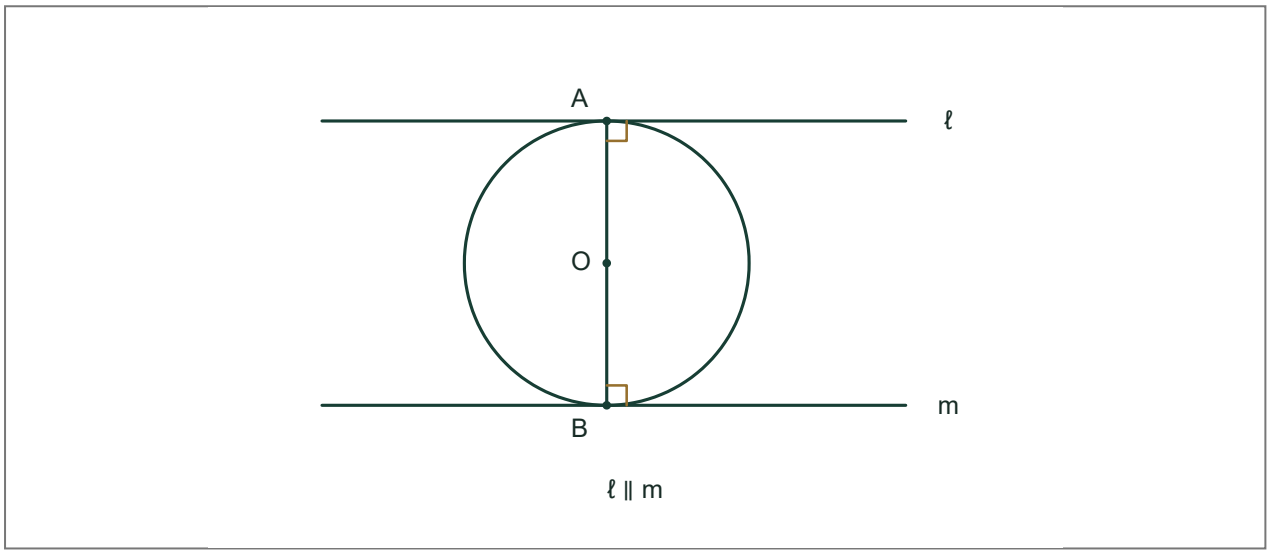
Question 4

diameter · parallel tangents

Prove that the tangents drawn at the ends of a diameter of a circle are parallel.

Solution

Board-exam working:



Tangents at opposite ends of a diameter — solution sketch (not to scale).

Let AB be a diameter. Let lines ℓ and m be the tangents at A and B.

A tangent is perpendicular to the radius through its point of contact.

$$\ell \perp OA$$

$$m \perp OB$$

OA and OB lie on the same straight line AB.

Two lines perpendicular to the same line are parallel.

$$\therefore \ \ell \parallel m$$

Final answer

Hence, the tangents at the ends of a diameter are parallel.

QUESTION

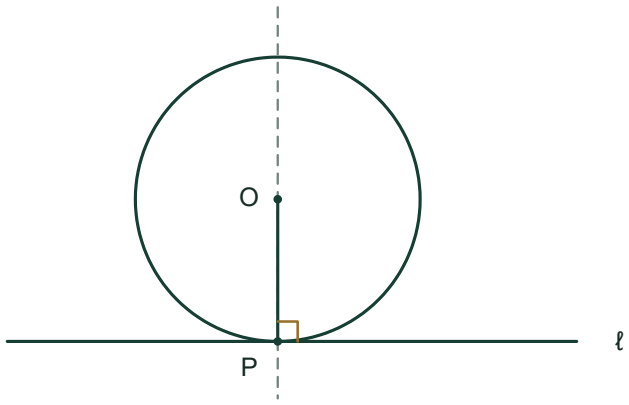
Question 5

point of contact · radius

Prove that the perpendicular at the point of contact to the tangent to a circle passes through the centre.

Solution

Board-exam working:



OP is the perpendicular at P

Perpendicular through the point of contact — solution sketch (not to scale).

Let line ℓ touch the circle at P and let O be the centre.

By the tangent-radius theorem, the radius through the point of contact is perpendicular to the tangent.

$$OP \perp \ell$$

Through a given point P, only one line can be drawn perpendicular to ℓ.

Therefore, the perpendicular to ℓ at P is the line OP itself.

$$\therefore \text{ the perpendicular passes through } O$$

Final answer

Hence proved.

QUESTION

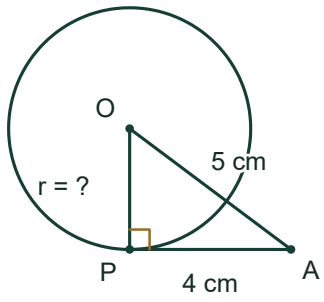
Question 6

tangent length · radius

The length of a tangent from point A, which is 5 cm from the centre of a circle, is 4 cm. Find the radius.

Solution

Board-exam working:



$OP \perp PA$

Radius and tangent form a right triangle — solution sketch (not to scale).

Let AP = 4 cm be the tangent, O the centre and OP = r.

$$OP \perp AP$$

In right triangle OPA:

$$OA^2 = OP^2 + AP^2$$

$$5^2 = r^2 + 4^2$$

$$r^2 = 25 - 16 = 9$$

$$r = 3 \text{ cm}$$

Final answer

The radius is 3 cm.

QUESTION

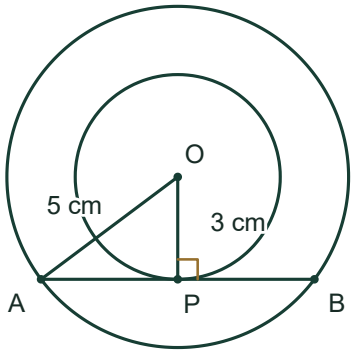
Question 7

concentric circles · chord length

Two concentric circles have radii 5 cm and 3 cm. Find the length of a chord of the larger circle that touches the smaller circle.

Solution

Board-exam working:



AP = PB; find AB

Chord touching the inner concentric circle — solution sketch (not to scale).

Let chord AB of the larger circle touch the smaller circle at P. Join OP.

$$OP \perp AB$$

The perpendicular from the centre bisects the chord, so AP = PB.

In right triangle OPA, OA = 5 cm and OP = 3 cm.

$$AP = \sqrt{OA^2 - OP^2}$$

$$= \sqrt{5^2 - 3^2} = \sqrt{16} = 4 \text{ cm}$$

$$AB = 2AP = 2 \times 4 = 8 \text{ cm}$$

Final answer

The chord is 8 cm long.

QUESTION

Question 8

tangential quadrilateral · equal tangents

A quadrilateral ABCD circumscribes a circle as shown in Figure 10.12. Prove that AB + CD = AD + BC.

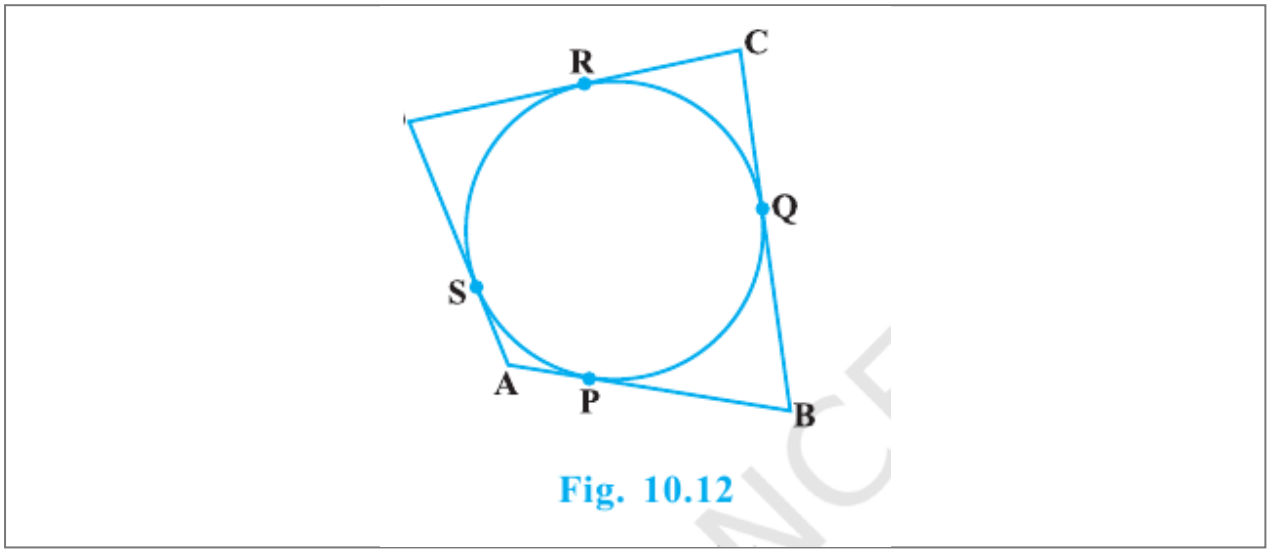


Fig. 10.12

Figure 10-12 from the supplied NCERT chapter.

Solution

Board-exam working:

Let the circle touch AB, BC, CD and DA at P, Q, R and S respectively.

Tangents from the same external point are equal.

$$AP = AS$$

$$BP = BQ$$

$$CQ = CR$$

$$DR = DS$$

Now add the lengths of opposite sides:

$$AB + CD = (AP + PB) + (CR + RD)$$

$$= AS + BQ + CQ + DS$$

$$= (AS + SD) + (BQ + QC)$$

$$= AD + BC$$

Final answer

Hence, AB + CD = AD + BC.

QUESTION

Question 9

parallel tangents · angle bisectors

In Figure 10.13, XY and X′Y′ are parallel tangents to a circle with centre O. Another tangent AB touches at C and meets XY at A and X′Y′ at B. Prove that ∠AOB = 90°.

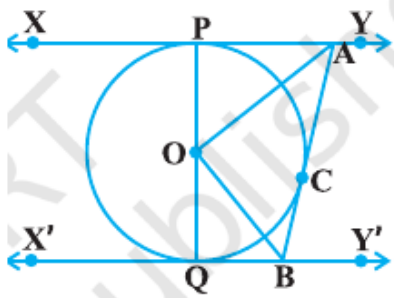


Fig. 10.13

Figure 10-13 from the supplied NCERT chapter.

Solution

Board-exam working:

Let P, C and Q be the points of contact of the tangents through A and B.

From A, AP and AC are equal tangents. Therefore, AO bisects ∠PAC.

$$\angle OAB = \frac{1}{2}\angle PAC$$

From B, BQ and BC are equal tangents. Therefore, BO bisects ∠CBQ.

$$\angle ABO = \frac{1}{2}\angle CBQ$$

Since XY is parallel to X′Y′ and AB is a transversal:

$$\angle PAC + \angle CBQ = 180^\circ$$

$$\angle OAB + \angle ABO = \frac{1}{2}(180^\circ) = 90^\circ$$

In triangle AOB:

$$\angle AOB = 180^\circ - 90^\circ = 90^\circ$$

Final answer

Hence, ∠AOB = 90°.

QUESTION

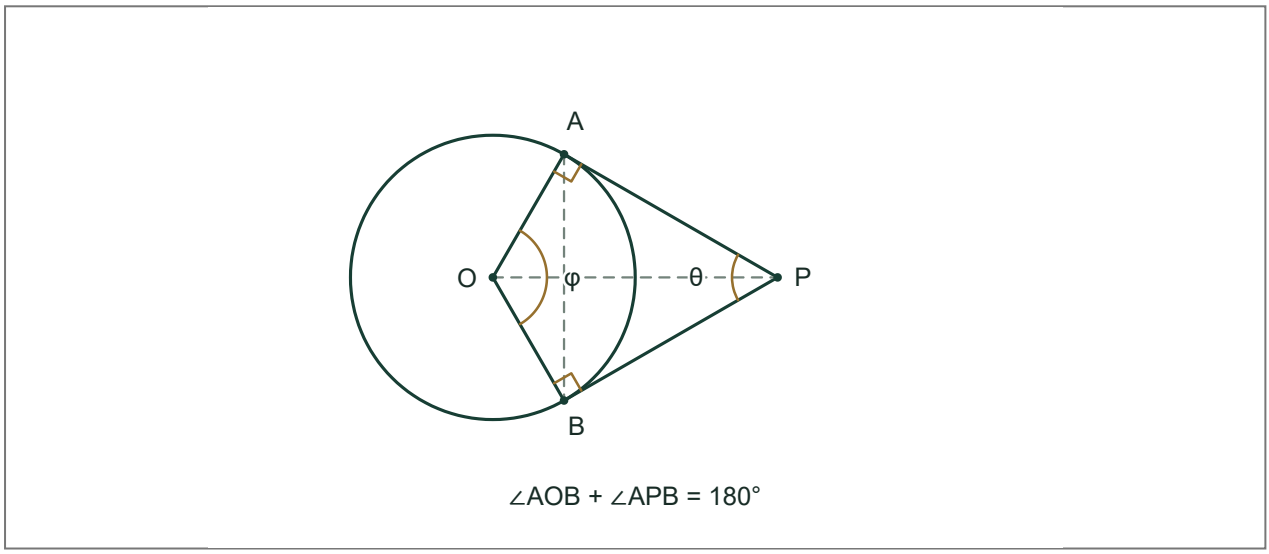
Question 10

two tangents · supplementary angles

Prove that the angle between two tangents drawn from an external point is supplementary to the angle subtended at the centre by the segment joining the points of contact.

Solution

Board-exam working:



Two tangents from one external point — solution sketch (not to scale).

Let PA and PB be tangents from external point P to a circle with centre O.

The radii are perpendicular to the tangents.

$$\angle OAP = \angle OBP = 90^\circ$$

In quadrilateral OAPB:

$$\angle AOB + \angle APB + 90^\circ + 90^\circ = 360^\circ$$

$$\angle AOB + \angle APB = 180^\circ$$

Thus the angle between the tangents and the central angle subtended by AB are supplementary.

Final answer

Hence proved.

QUESTION

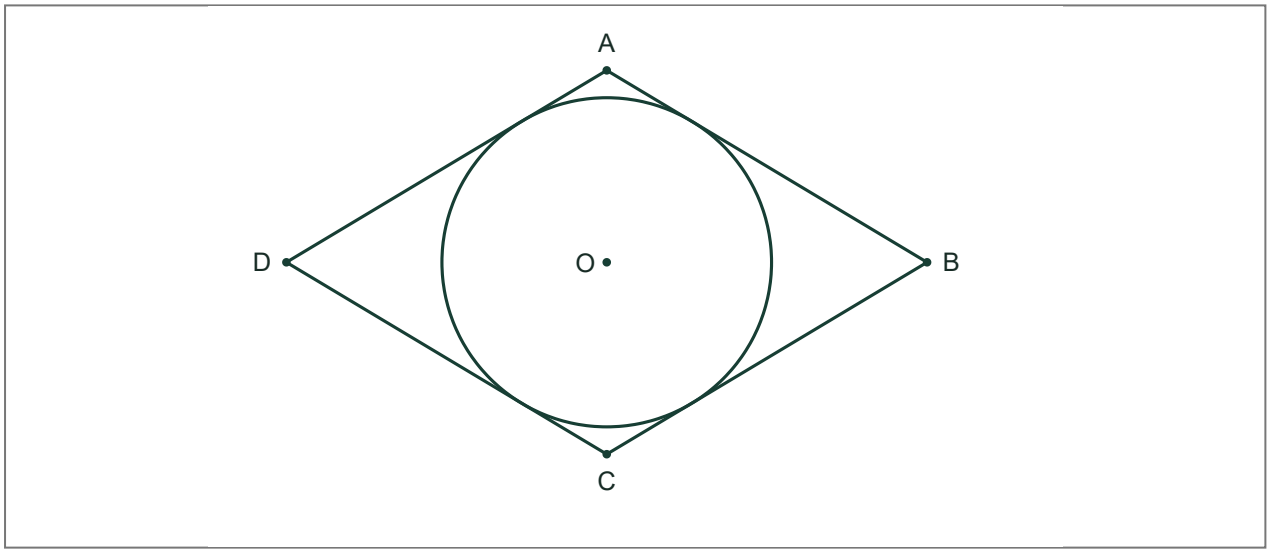
Question 11

circumscribed parallelogram · rhombus

Prove that a parallelogram circumscribing a circle is a rhombus.

Solution

Board-exam working:



Parallelogram circumscribing a circle — solution sketch (not to scale).

Let parallelogram ABCD circumscribe a circle.

For any quadrilateral circumscribing a circle:

$$AB + CD = AD + BC$$

Opposite sides of a parallelogram are equal.

$$AB = CD \quad \text{and} \quad AD = BC$$

Substitute these equalities:

$$AB + AB = AD + AD$$

$$2AB = 2AD$$

$$AB = AD$$

A parallelogram with two adjacent sides equal has all four sides equal.

$$AB = BC = CD = DA$$

Final answer

Therefore, the parallelogram is a rhombus.

QUESTION

Question 12

circumscribed triangle · Heron's formula

Triangle ABC circumscribes a circle of radius 4 cm. The point of contact D divides BC into BD = 8 cm and DC = 6 cm. Find AB and AC.

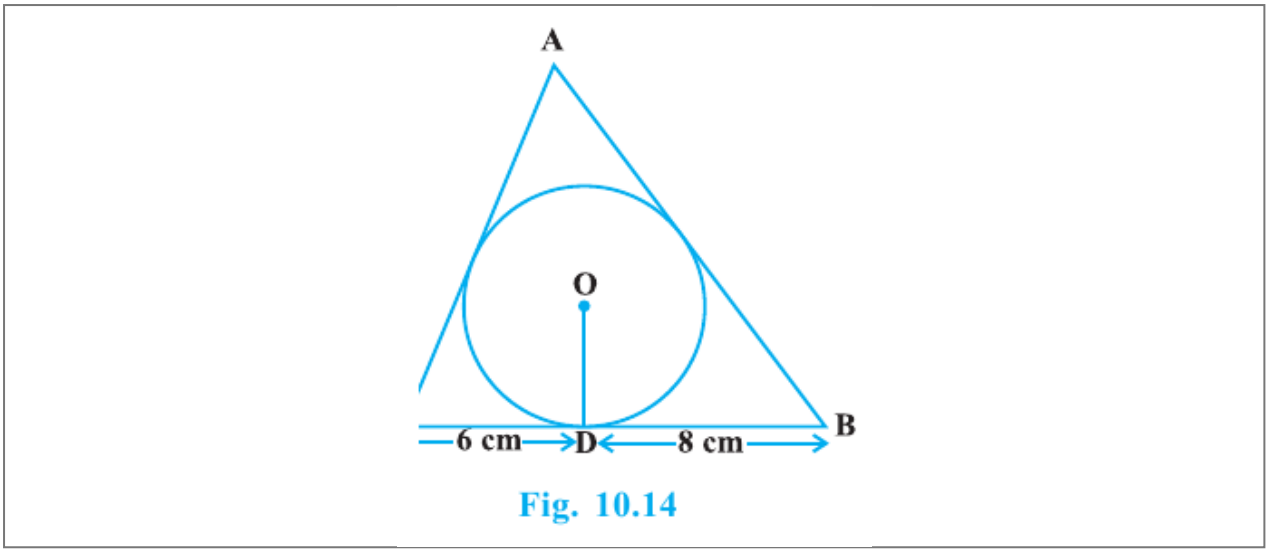


Figure 10-14 from the supplied NCERT chapter.

Solution

Board-exam working:

Let the circle touch AB and AC at F and E. Tangents from the same point are equal.

$$BF = BD = 8 \text{ cm}$$

$$CE = CD = 6 \text{ cm}$$

Let AF = AE = x cm.

$$AB = x + 8, \qquad AC = x + 6, \qquad BC = 14$$

The semiperimeter is:

$$s = \frac{(x+8) + (x+6) + 14}{2} = x + 14$$

Area using the inradius r = 4 cm:

$$\Delta = rs = 4(x + 14)$$

Area using Heron's formula:

$$\Delta = \sqrt{s(s - AB)(s - AC)(s - BC)}$$

$$= \sqrt{(x+14)(6)(8)(x)}$$

Equating the two expressions and squaring:

$$16(x+14)^2 = 48x(x+14)$$

$$x + 14 = 3x$$

$$x = 7$$

$$AB = x + 8 = 15 \text{ cm}$$

$$AC = x + 6 = 13 \text{ cm}$$

Final answer

AB = 15 cm and AC = 13 cm.

QUESTION

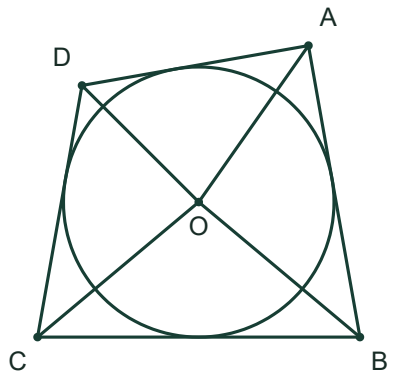
Question 13

tangential quadrilateral · angle bisectors

Prove that opposite sides of a quadrilateral circumscribing a circle subtend supplementary angles at the centre.

Solution

Board-exam working:



∠AOB + ∠COD = 180°

Opposite sides subtend supplementary central angles — solution sketch (not to scale).

Let quadrilateral ABCD circumscribe a circle with centre O.

The line joining a vertex to O bisects the angle between the two tangents from that vertex.

$$\angle OAB = \frac{A}{2}, \quad \angle OBA = \frac{B}{2}$$

In triangle AOB:

$$\angle AOB = 180^\circ - \frac{A+B}{2}$$

Similarly, in triangle COD:

$$\angle COD = 180^\circ - \frac{C+D}{2}$$

Since the angle sum of a quadrilateral is 360°:

$$A + B + C + D = 360^\circ$$

$$\angle AOB + \angle COD = 360^\circ - \frac{A+B+C+D}{2}$$

$$= 360^\circ - 180^\circ = 180^\circ$$

Similarly:

$$\angle BOC + \angle DOA = 180^\circ$$

Final answer

Hence, each pair of opposite sides subtends supplementary angles at O.