Class 10 Mathematics · Chapter 10: Circles

Answer key and marking scheme · 20 marks · about 40 minutes · based on NCERT

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1. A chord PQ of a circle with centre O is equal in length to the radius. The tangents at P and Q meet at T. Then ∠PTQ is [1]

(a) 60° (b) 120°
(c) 90° (d) 150°

Answer: (b) OP = OQ = PQ, so ΔOPQ is equilateral and ∠POQ = 60°. ∠PTQ and ∠POQ are supplementary: ∠PTQ = 180° − 60° = 120°.

2. A straight cycle track runs past a circular pond and shares exactly one point K with the pond's edge. With respect to the circle of the pond's edge, the track is [1]

(a) a secant (b) a chord
(c) a tangent (d) a diameter

Answer: (c) A line that meets a circle in exactly one point is a tangent, and K is its point of contact.

3. A point P is 6 cm from the centre of a circle of radius 6 cm. The number of tangents to the circle that pass through P is [1]

(a) 0 (b) 1
(c) 2 (d) 3

Answer: (b) OP = 6 cm equals the radius, so P lies on the circle. At a point on the circle there is exactly one tangent.

4. A straight lane from a tea stall K just touches a circular running track of radius 35 m, and the stretch of lane from K to the point of contact is 12 m long. The distance of K from the centre of the track is [1]

(a) 23 m (b) 37 m
(c) 47 m (d) $\sqrt{1081}$ m

Answer: (b) The radius to the point of contact is perpendicular to the lane, so the distance from K to the centre is the hypotenuse: $\sqrt{(35^2 + 12^2)} = \sqrt{1369} = 37$ m. ($\sqrt{(35^2 - 12^2)}$ treats the distance as a leg.)

5. PT is a tangent at P to a circle with centre O, and T is a point on the tangent. If ∠TOP = 52°, then ∠OTP is [1]

(a) 38° (b) 52°
(c) 48° (d) 128°

Answer: (a) The tangent is perpendicular to the radius, so ∠OPT = 90°. In ΔOPT, ∠OTP = 180° − 90° − 52° = 38°.

6. PA and PB are tangents from P to a circle with centre O. Using Pythagoras' theorem alone, without congruent triangles, show that PA = PB. [2]

∠OAP = ∠OBP = 90°. In right ΔOAP, $PA^2 = OP^2 - OA^2$; in right ΔOBP, $PB^2 = OP^2 - OB^2$. OA = OB (radii), so $PA^2 = PB^2$ and PA = PB.

- $PA^2 = OP^2 - OA^2$ and $PB^2 = OP^2 - OB^2$ (1)
- OA = OB, so PA = PB (1)

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7. TP and TQ are the tangents from T to a circle with centre O, and OT meets PQ at M. Prove that OT is the perpendicular bisector of PQ. [2]

TP = TQ and $\angle PTO = \angle QTO$ ($\Delta OPT \cong \Delta OQT$ by RHS). In ΔTPM and ΔTQM, TP = TQ, $\angle PTM = \angle QTM$ and TM is common, so they are congruent (SAS). Hence PM = QM and $\angle TMP = \angle TMQ = 90°$, as the two angles are equal and add to 180°.

- TP = TQ, $\angle PTM = \angle QTM$, $\Delta TPM \cong \Delta TQM$ (SAS) (1)
- PM = QM and $\angle TMP = \angle TMQ = 90°$ (1)

8. The tangents at two points A and B of a circle with centre O are parallel. Show that AB is a diameter. [2]

OA $\perp$ tangent at A and OB $\perp$ tangent at B. The tangents are parallel, so OA and OB are both perpendicular to the same direction and both pass through O; they lie on one line through O. Hence A, O, B are collinear and AB is a diameter.

- OA and OB perpendicular to the two parallel tangents (1)
- so OA, OB lie on one line through O: AB is a diameter (1)

9. From a point P, the tangent PA to a circle with centre O is 56 m long, and the point of the circle nearest to P is 32 m from P. Find the radius of the circle. [3]

The nearest point C lies on PO, so OP = r + 32. $\angle OAP = 90°$, so $(r + 32)^2 = r^2 + 56^2$. Then $64r + 1024 = 3136$, $64r = 2112$, r = 33 m.

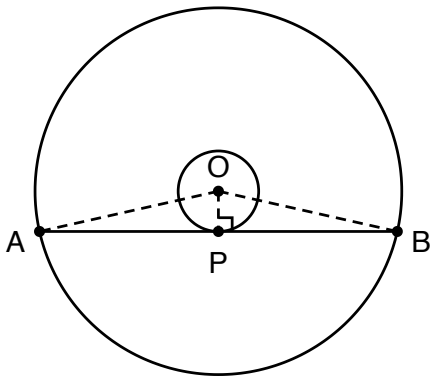
- OP = r + 32 (1)
- $(r + 32)^2 = r^2 + 56^2$ with the right angle at A (1)
- r = 33 m (1)

10. The tangents at the ends of a chord PQ of a circle with centre O meet at T. If $\angle TPQ = 62°$, find $\angle PTQ$, $\angle POQ$ and $\angle OPQ$. [3]

TP = TQ, so $\angle TQP = 62°$ and $\angle PTQ = 180° - 124° = 56°$. $\angle POQ = 180° - 56° = 124°$. $\angle OPQ = 90° - 62° = 28°$.

- $\angle PTQ = 56°$ (1)
- $\angle POQ = 124°$ (supplementary) (1)
- $\angle OPQ = 28°$ (1)

11. Two concentric circles with centre O have radii 41 cm and 9 cm. A chord AB of the larger circle touches the smaller circle at P, as in the figure. Find AB and the area of ΔOAB. [3]



OP $\perp$ AB, so P is the midpoint of AB: $AP = \sqrt{(41^2 - 9^2)} = \sqrt{1600} = 40$ cm and AB = 80 cm. OP is the height of ΔOAB on the base AB, so its area = ½ × 80 × 9 = 360 cm^2.

- OP $\perp$ AB, AP = 40 cm (1)
- P bisects AB, AB = 80 cm (1)
- area = ½ × AB × OP = 360 cm^2 (1)