

RD SHARMA
Solutions
Class 10 Maths
Chapter 10
Ex 10.1

1. Fill in the blanks:

(i) The common point of tangent and the circle is called _____.

Soln: point of contact.

(ii) A circle may have _____ parallel tangent.

Soln : two

(iii) A tangent to a circle intersects it in _____ point.

Soln: one

(iv) A line intersecting a circle in two points is called a _____

Soln: secant.

(v) The angle between tangent at a point P on circle and radius through the point is _____

Soln: 90° .

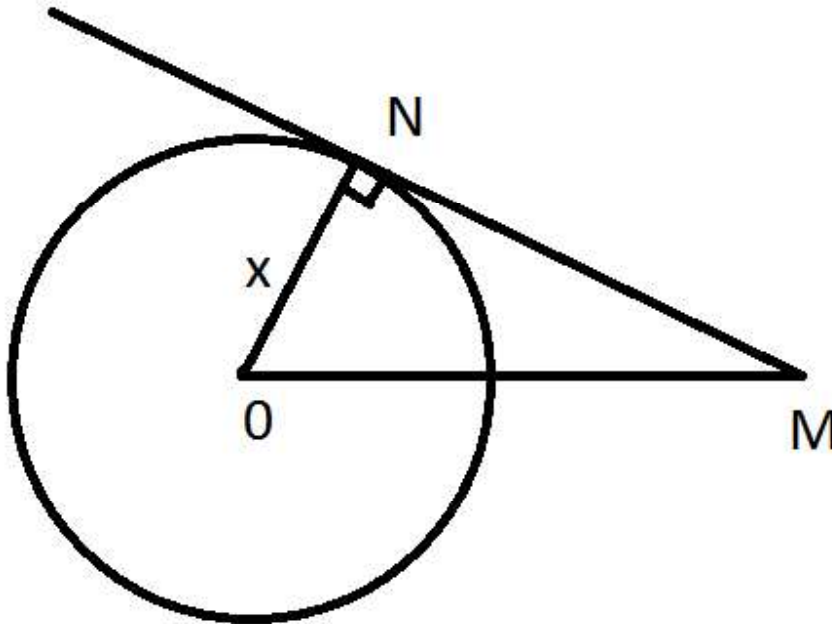
Q 2. How many tangents can a circle have?

Ans:

Tangent: a line intersecting circle in one point is called a tangent

As there are infinite number of points on the circle , a circle has many (infinite) tangents.

Q 3. 'O' is the centre the circle shown below with a radius of 8 cm. The circle cuts the tangent AB through O at B such that AB = 15 cm. Find OB.



Ans:

Given data : AB = 15 cm

OA = 8 cm (radius of the circle)

We know that : the tangent cuts the circle at 90 degrees. Therefore, OA is the hypotenuse of the triangle OAB . Hence, the longest side can be found by using pythagoras Theorem.

We have,

OB = 17 cm

Therefore, OB = 17 cm

Q 4. If the tangent at point P to the circle with centre O cuts a line through O at Q such that PQ = 24 cm and OQ = 25 cm . find the radius of the circle.

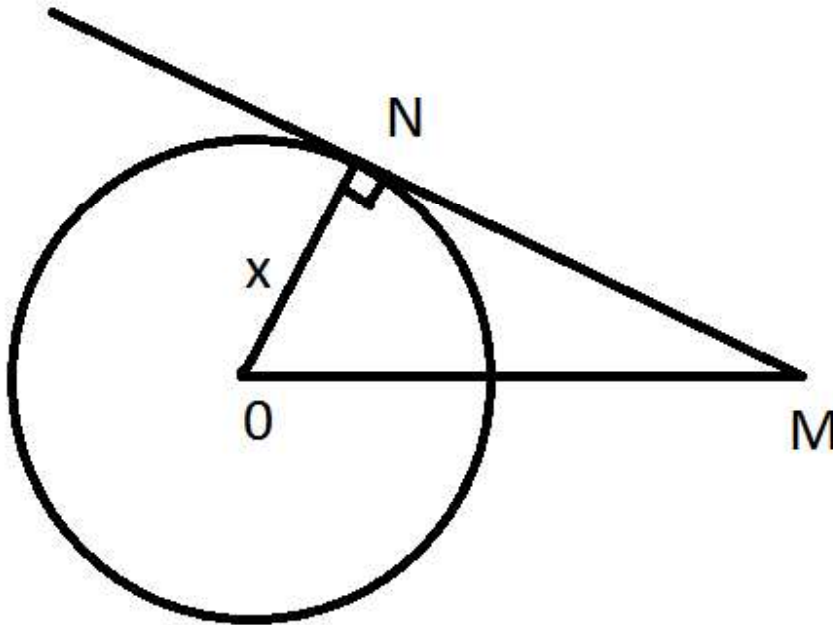
Ans :

given data:
CAREER POINT

$$PQ = 24 \text{ cm}$$

$$OQ = 25 \text{ cm}$$

$$OP = \text{radius} = ?$$



P is a point of contact , at point of contact , tangent and radius are perpendicular to each other.

Therefore triangle is right angled triangle angle $OPQ = 90^\circ$

BY pythagoras theorem,

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

Therefore , $OP = \text{radius} = 7 \text{ cm}$

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Ex10. 2

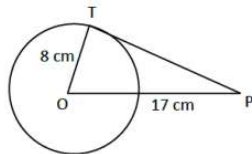
1. If PT is a tangent at T to a circle whose center is O and $OP = 17$ cm, $OT = 8$ cm. Find the length of tangent segment PT .

Sol:

$OT = \text{radius} = 8$ cm

$OP = 17$ cm

$PT = \text{length of tangent} = ?$



T is point of contact. We know that at point of contact tangent and radius are perpendicular.

$\therefore \triangle OTP$ is right angled triangle $\angle OTP = 90^\circ$, from Pythagoras theorem $OT^2 + PT^2 = OP^2$

$$8^2 + PT^2 = 17^2$$

$$PT = \sqrt{17^2 - 8^2} = \sqrt{289 - 64}$$

$$= \sqrt{225} = 15 \text{ cm}$$

$\therefore PT = \text{length of tangent} = 15$ cm.

2. Find the length of a tangent drawn to a circle with radius 5 cm, from a point 13 cm from the center of the circle.

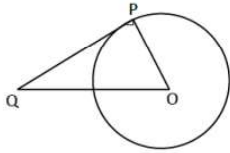
Sol:

Consider a circle with center O.

OP = radius = 5 cm.

A tangent is drawn at point P, such that line through O intersects it at Q, OQ = 13 cm.

Length of tangent PQ = ?



At P, we know that tangent and radius are perpendicular.

$\triangle OPQ$ is right angled triangle, $\angle OPQ = 90^\circ$

By pythagoras theorem, $OQ^2 = OP^2 + PQ^2$

$$\Rightarrow 13^2 = 5^2 + PQ^2$$

$$\Rightarrow PQ^2 = 169 - 25 = 144$$

$$\Rightarrow PQ = \sqrt{144} = 12 \text{ cm}$$

Length of tangent = 12 cm

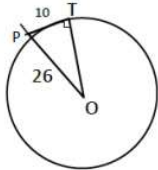
3. A point P is 26 cm away from O of circle and the length PT of the tangent drawn from P to the circle is 10 cm. Find the radius of the circle.

Sol:

Given OP = 26 cm

PT = length of tangent = 10 cm

radius = OT = ?



At point of contact, radius and tangent are perpendicular $\angle OTP = 90^\circ$, $\triangle OTP$ is right angled triangle.

By Pythagoras theorem, $OP^2 = OT^2 + PT^2$

$$26^2 = OT^2 + 10^2$$

$$OT^2 = (\sqrt{676 - 100})^2$$

$$OT = \sqrt{576}$$

$$= 24 \text{ cm}$$

OT = length of tangent = 24 cm

4. If from any point on the common chord of two intersecting circles, tangents be drawn to circles, prove that they are equal.

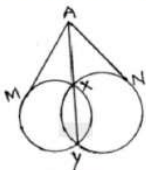
Sol:

Let the two circles intersect at points X and Y.

XY is the common chord.

Suppose 'A' is a point on the common chord and AM and AN be the tangents drawn A to the circle

We need to show that AM = AN.



In order to prove the above relation, following property will be used.

"Let PT be a tangent to the circle from an external point P and a secant to the circle through P intersects the circle at points A and B, then $PT^2 = PA \times PB$ "

Now AM is the tangent and AXY is a secant $\therefore AM^2 = AX \times AY \dots (i)$

AN is a tangent and AXY is a secant $\therefore AN^2 = AX \times AY \dots (ii)$

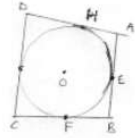
From (i) & (ii), we have $AM^2 = AN^2$

$\therefore AM = AN$

5. If the quadrilateral sides touch the circle prove that sum of pair of opposite sides is equal to the sum of other pair.

Sol:

Consider a quadrilateral ABCD touching circle with center O at points E, F, G and H as in figure.



We know that

The tangents drawn from same external points to the circle are equal in length.

1. Consider tangents from point A [AM & AE]

$$AH = AE \dots (i)$$

2. From point B [EB & BF]

$$BF = EB \dots (ii)$$

3. From point C [CF & GC]

$$FC = CG \dots (iii)$$

4. From point D [DG & DH]

$$DH = DG \dots (iv)$$

Adding (i), (ii), (iii), & (iv)

$$(AH + BF + FC + DH) = [(AC + CB) + (CG + DG)]$$

$$\Rightarrow (AH + DH) + (BF + FC) = (AE + EB) + (CG + DG)$$

$$\Rightarrow AD + BC = AB + DC \quad [\text{from fig.}]$$

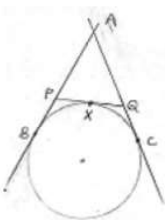
Sum of one pair of opposite sides is equal to other.

6. If AB, AC, PQ are tangents in Fig. and AB = 5cm find the perimeter of $\triangle APQ$.

Sol:

Perimeter of $\triangle APQ$, (P) = AP + AQ + PQ

$$= AP + AQ + (PX + QX)$$



We know that

The two tangents drawn from external point to the circle are equal in length from point A,

$$AB = AC = 5 \text{ cm}$$

From point P, $PX = PB$

From point Q, $QX = QC$

$$\text{Perimeter (P)} = AP + AQ + (PB + QC)$$

$$= (AP + PB) + (AQ + QC)$$

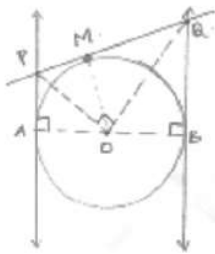
$$= AB + AC = 5 + 5$$

$$= 10 \text{ cms.}$$

7. Prove that the intercept of a tangent between two parallel tangents to a circle subtends a right angle at center.

Sol:

Consider circle with center 'O' and has two parallel tangents through A & B at ends of diameter.



Let tangents through M intersect the tangents parallel at P and Q required to prove is that $\angle POQ = 90^\circ$.

From fig. it is clear that ABQP is a quadrilateral

$\angle A + \angle B = 90^\circ + 90^\circ = 180^\circ$ [At point of contact tangent & radius are perpendicular]

$\angle A + \angle B + \angle P + \angle Q = 360^\circ$ [Angle sum property]

$\angle P + \angle Q = 360^\circ - 180^\circ = 180^\circ \dots\dots(i)$

At P & Q $\angle APO = \angle OPQ = \frac{1}{2} \angle P$

$\angle BQO = \angle PQO = \frac{1}{2} \angle Q$ in (i)

$2\angle OPQ + 2\angle PQO = 180^\circ$

$\angle OPQ + \angle PQO = 90^\circ \dots\dots(ii)$

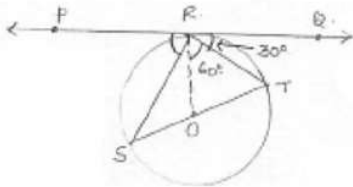
In $\triangle OPQ$, $\angle OPQ + \angle PQO + \angle POQ = 180^\circ$ [Angle sum property]

$90^\circ + \angle POQ = 180^\circ$ [from (ii)]

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

$\therefore \angle POQ = 90^\circ$

8. In Fig below, PQ is tangent at point R of the circle with center O. If $\angle TRQ = 30^\circ$. Find $\angle PRS$.



Sol:

Given $\angle TRQ = 30^\circ$.

At point R, $OR \perp RQ$.

$\angle ORQ = 90^\circ$

$\Rightarrow \angle TRQ + \angle ORT = 90^\circ$

$\Rightarrow \angle ORT = 90^\circ - 30^\circ = 60^\circ$

ST is diameter, $\angle SRT = 90^\circ$ [\because Angle in semicircle = 90°]

$\angle ORT + \angle SRO = 90^\circ$

$$\angle SRO + \angle PRS = 90^\circ$$

$$\angle PRS = 90^\circ - 30^\circ = 60^\circ$$

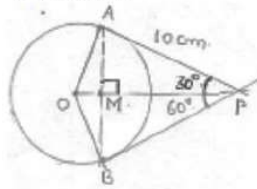
9. If PA and PB are tangents from an outside point P, such that PA = 10 cm and $\angle APB = 60^\circ$.
Find the length of chord AB.

Sol:

$$AP = 10 \text{ cm } \angle APB = 60^\circ$$

Represented in the figure

We know that



A line drawn from center to point from where external tangents are drawn divides or bisects the angle made by tangents at that point $\angle APO = \angle OPB = \frac{1}{2} \times 60^\circ = 30^\circ$

The chord AB will be bisected perpendicularly

$$\therefore AB = 2AM$$

In $\triangle AMP$,

$$\sin 30^\circ = \frac{\text{opp.side}}{\text{hypotenuse}} = \frac{AM}{AP}$$

$$AM = AP \sin 30^\circ$$

$$= \frac{AP}{2} = \frac{10}{2} = 5 \text{ cm}$$

$$AP = 2 AM = 10 \text{ cm}$$

---- Method (i)

In $\triangle AMP$, $\angle AMP = 90^\circ$, $\angle APM = 30^\circ$

$$\angle AMP + \angle APM + \angle MAP = 180^\circ$$

$$90^\circ + 30^\circ + \angle MAP = 180^\circ$$

$$\angle MAP = 180^\circ$$

In $\triangle PAB$, $\angle MAP = \angle BAP = 60^\circ$, $\angle APB = 60^\circ$

We also get, $\angle PBA = 60^\circ$

$\therefore \triangle PAB$ is equilateral triangle

$$AB = AP = 10 \text{ cm.}$$

-----Method (ii)