

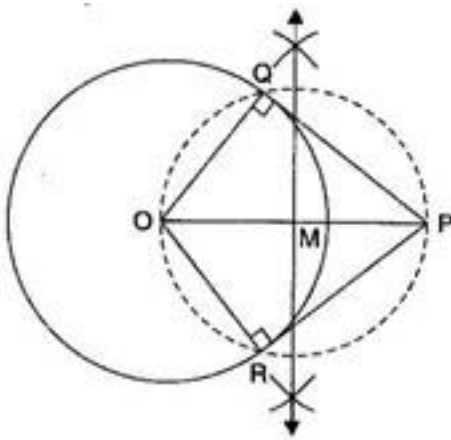
**Exercise 11.2**

In each of the following, give the justification of the construction also:

1. Draw a circle of radius 6 cm. From a point 10 cm away from its centre, construct the pair of tangents to the circle and measure their lengths.

**Ans. Given:** A circle whose centre is O and radius is 6 cm and a point P is 10 cm away from its centre.

**To construct:** To construct the pair of tangents to the circle and measure their lengths.



**Steps of Construction:**

- (a) Join PO and bisect it. Let M be the mid-point of PO.
- (b) Taking M as centre and MO as radius, draw a circle. Let it intersects the given circle at the points Q and R.
- (c) Join PQ and PR.

Then PQ and PR are the required two tangents.

By measurement,  $PQ = PR = 8$  cm

**Justification:** Join OQ and OR.

Since  $\angle OQP$  and  $\angle ORP$  are the angles in semicircles.

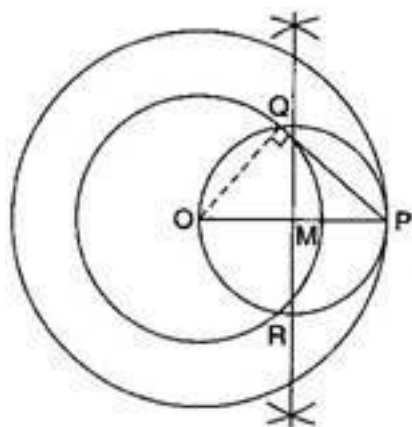
$$\therefore \angle OQP = 90^\circ = \angle ORP$$

Also, since OQ, OR are radii of the circle, PQ and PR will be the tangents to the circle at Q and R respectively.

$\therefore$  We may see that the circle with OP as diameter intersects the given circle in two points. Therefore, only two tangents can be drawn.

**2. Construct a tangent to a circle of radius 4 cm from a point on the concentric circle of radius 6 cm and measure its length. Also verify the measurement by actual calculation.**

**Ans. To construct:** To construct a tangent to a circle of radius 4 cm from a point on the concentric circle of radius 6 cm and measure its length. Also to verify the measurements by actual calculation.



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**Steps of Construction:**

- (a) Join PO and bisect it. Let M be the mid-point of PO.
- (b) Taking M as centre and MO as radius, draw a circle. Let it intersect the given circle at the point Q and R.
- (c) Join PQ.

Then PQ is the required tangent.

By measurement,  $PQ = 4.5$  cm

By actual calculation,

$$PQ = \sqrt{(OP)^2 + (OQ)^2}$$

$$= \sqrt{6^2 - 4^2} = \sqrt{36 - 16}$$

$$= \sqrt{20} = 4.47 \text{ cm} = 4.5 \text{ cm}$$

**Justification:** Join OQ. Then  $\angle$  PQO is an angle in the semicircle and therefore,

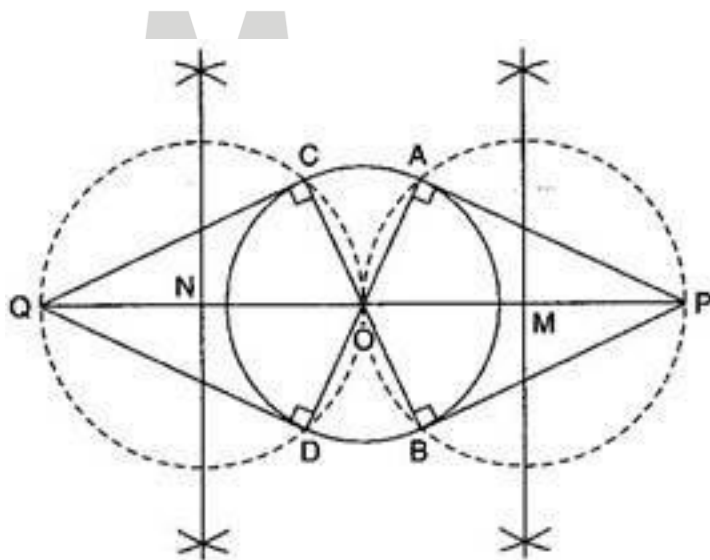
$$\angle \text{PQO} = 90^\circ$$

$$\Rightarrow \text{PQ} \perp \text{OQ}$$

Since, OQ is a radius of the given circle, PQ has to be a tangent to the circle.

**3. Draw a circle of radius 3 cm. Take two points P and Q on one of its extended diameter each at a distance of 7 cm from its centre. Draw tangents to the circle from these two points P and Q.**

**Ans. To construct:** A circle of radius 3 cm and take two points P and Q on one of its extended diameter each at a distance of 7 cm from its centre and then draw tangents to the circle from these two points P and Q.



**Steps of Construction:**

- (a) Bisect PO. Let M be the mid-point of PO.
- (b) Taking M as centre and MO as radius, draw a circle. Let it intersects the given circle at the points A and B.
- (c) Join PA and PB. Then PA and PB are the required two tangents.
- (d) Bisect QO. Let N be the mid-point of QO.

(e) Taking N as centre and NO as radius, draw a circle. Let it intersects the given circle at the points C and D.

(f) Join QC and QD.

Then QC and QD are the required two tangents.

**Justification:** Join OA and OB.

Then  $\angle PAO$  is an angle in the semicircle and therefore  $\angle PAO = 90^\circ$ .

$$\Rightarrow PA \perp OA$$

Since OA is a radius of the given circle, PA has to be a tangent to the circle. Similarly, PB is also a tangent to the circle.

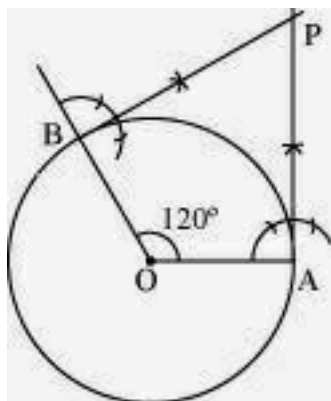
Again join OC and OD.

Then  $\angle QCO$  is an angle in the semicircle and therefore  $\angle QCO = 90^\circ$ .

Since OC is a radius of the given circle, QC has to be a tangent to the circle. Similarly, QD is also a tangent to the circle.

**4. Draw a pair of tangents to a circle of radius 5 cm which are inclined to each other at an angle of  $60^\circ$ .**

**Ans. To construct:** A pair of tangents to a circle of radius 5 cm which are inclined to each other at an angle of  $60^\circ$ .



**Steps of Construction:**

- (a) Draw a circle of radius 5 cm and with centre as O.
- (b) Take a point A on the circumference of the circle and join OA. Draw a perpendicular to OA at point A with the help of compass.
- (c) Draw a radius OB, making an angle of  $120^\circ$  ( $180^\circ - 60^\circ$ ) with OA.
- (d) Draw a perpendicular to OB at point B with the help of compass. Let both the perpendiculars intersect at point P. PA and PB are the required tangents at an angle of  $60^\circ$ .

**Justification:** The construction can be justified by proving that  $\angle APB = 60^\circ$

By our construction

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

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

$$\text{And } \angle AOB = 120^\circ$$

We know that the sum of all interior angles of a quadrilateral =  $360^\circ$

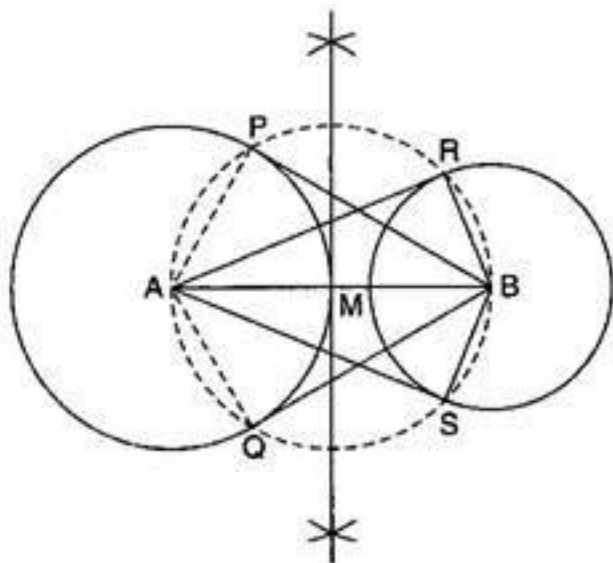
$$\angle OAP + \angle AOB + \angle OBP + \angle APB = 360^\circ$$

$$90^\circ + 120^\circ + 90^\circ + \angle APB = 360^\circ$$

$$\angle APB = 60^\circ$$

**5. Draw a line segment AB of length 8 cm. Taking A as centre, draw a circle of radius 4 cm and taking B as centre, draw another circle of radius 3 cm. Construct tangents to each circle from the centre of the other circle.**

**Ans. To construct:** A line segment of length 8 cm and taking A as centre, to draw a circle of radius 4 cm and taking B as centre, draw another circle of radius 3 cm. Also, to construct tangents to each circle from the centre to the other circle.



### Steps of Construction:

- (a) Bisect BA. Let M be the mid-point of BA.
- (b) Taking M as centre and MA as radius, draw a circle. Let it intersects the given circle at the points P and Q.
- (c) Join BP and BQ. Then, BP and BQ are the required two tangents from B to the circle with centre A.
- (d) Again, Let M be the mid-point of AB.
- (e) Taking M as centre and MB as radius, draw a circle. Let it intersects the given circle at the points R and S.
- (f) Join AR and AS.

Then, AR and AS are the required two tangents from A to the circle with centre B.

**Justification:** Join BP and BQ.

Then  $\angle APB$  being an angle in the semicircle is  $90^\circ$ .

$$\Rightarrow BP \perp AP$$

Since AP is a radius of the circle with centre A, BP has to be a tangent to a circle with centre A. Similarly, BQ is also a tangent to the circle with centre A.

Again join AR and AS.

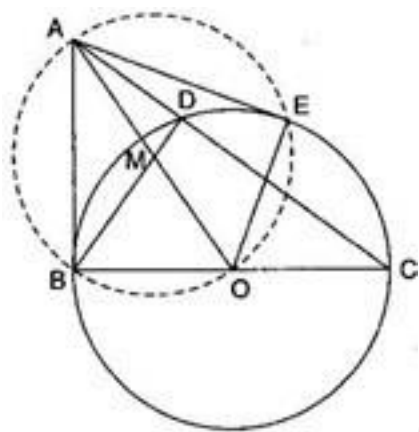
Then  $\angle ARB$  being an angle in the semicircle is  $90^\circ$ .

$$\Rightarrow AR \perp BR$$

Since BR is a radius of the circle with centre B, AR has to be a tangent to a circle with centre B. Similarly, AS is also a tangent to the circle with centre B.

**6. Let ABC be a right triangle in which AB = 6 cm, BC = 8 cm and  $\angle B = 90^\circ$ . BD is the perpendicular from B on AC. The circle through B, C, D is drawn. Construct the tangents from A to this circle.**

**Ans. To construct:** A right triangle ABC with AB = 6 cm, BC = 8 cm and  $\angle B = 90^\circ$ . BD is the perpendicular from B on AC and the tangents from A to this circle.



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**Steps of Construction:**

- (a) Draw a right triangle ABC with AB = 6 cm, BC = 8 cm and  $\angle B = 90^\circ$ . Also, draw perpendicular BD on AC.
- (b) Join AO and bisect it at M (here O is the centre of circle through B, C, D).
- (c) Taking M as centre and MA as radius, draw a circle. Let it intersects the given circle at the points B and E.
- (d) Join AB and AE.

Then AB and AE are the required two tangents.

**Justification:** Join OE.

Then,  $\angle AEO$  is an angle in the semicircle.

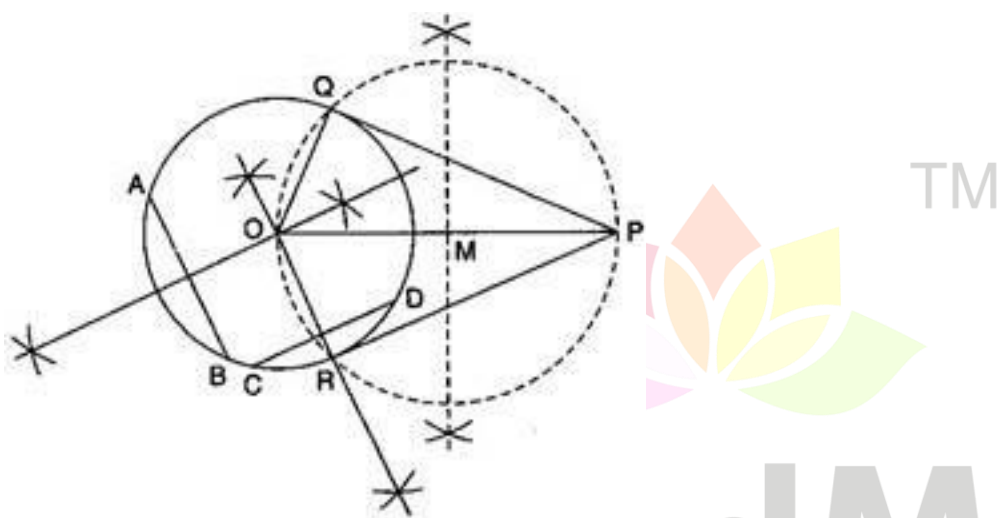
$$\Rightarrow \angle AEO = 90^\circ$$

$$\Rightarrow AE \perp OE$$

Since OE is a radius of the given circle, AE has to be a tangent to the circle. Similarly, AB is also a tangent to the circle.

**7. Draw a circle with the help of a bangle. Take a point outside the circle. Construct the pair of tangents from this point to the circle.**

**Ans. To construct:** A circle with the help of a bangle. Take a point outside the circle. Construct the pair of tangents from this point to the circle.



**Steps of Construction:**

- (a) Draw a circle with the help of a bangle.
- (b) Take two non-parallel chords AB and CD of this circle.
- (c) Draw the perpendicular bisectors of AB and CD. Let these intersect at O. Then O is the centre of the circle draw.
- (d) Take a point P outside the circle.
- (e) Join PO and bisect it. Let M be the mid-point of PO.
- (f) Taking M as centre and MO as radius, draw a circle. Let it intersects the given circle at the points Q and R.
- (g) Join PQ and PR.

Then PQ and PR are the required two tangents.

**Justification:** Join OQ and OR.



Then,  $\angle P Q O$  is an angle in the semicircle.

$$\Rightarrow \angle P Q O = 90^\circ$$

$$\Rightarrow P Q \perp O Q$$

Since  $O Q$  is a radius of the given circle,  $P Q$  has to be a tangent to the circle. Similarly,  $P R$  is also a tangent to the circle.



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