CBSE Class–10 Mathematics

NCERT solution

Chapter - 11

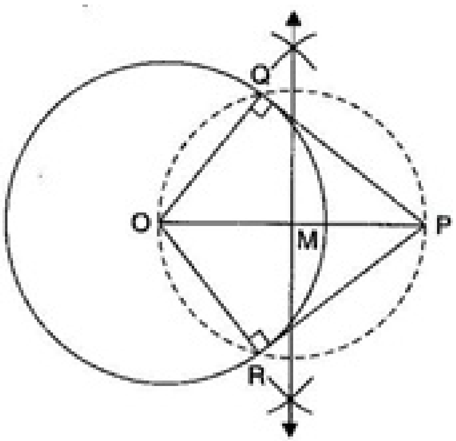
Constructions - Exercise 11.2

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.

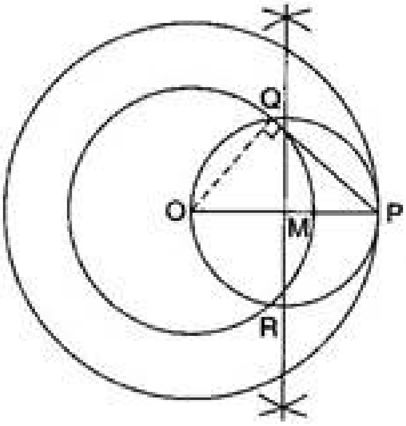
$\therefore \angle OQP = 90^\circ = \angle ORP$

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 increases the given circle in two points. Therefore, only two tangents can be draw.

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 lengths. Also to verify the measurements by actual calculation.



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 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 cm = 4.5 cm

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

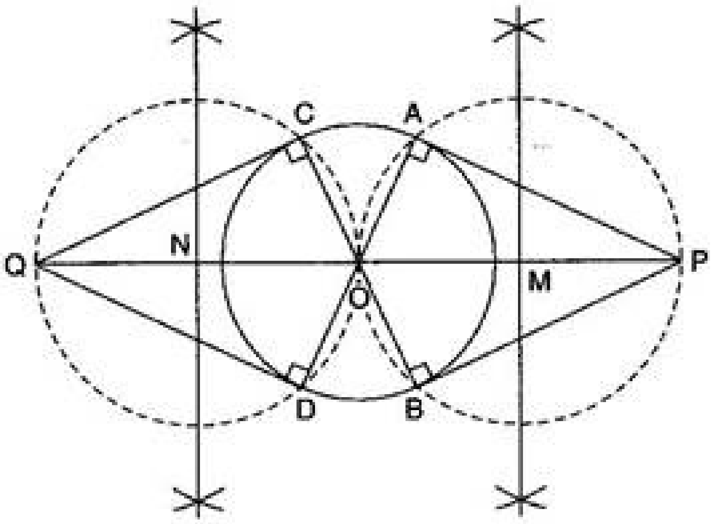
$\angle$ PQO = 90°

$\Rightarrow$ PQ $\perp$ 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°.

$\Rightarrow$ 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°.

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.

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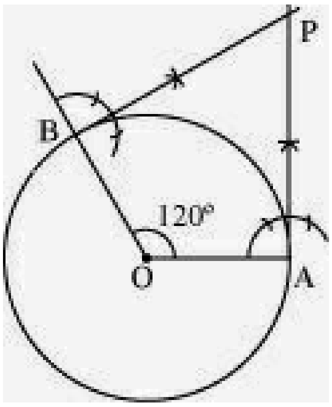
4. Draw a pair of tangents to a circle of radius 5 cm which are inclined to each other at an angle of 60°.

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°.



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° (180° − 60°) 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°.

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

By our construction

$\angle OAP = 90°$

$\angle OBP = 90°$

And $\angle AOB = 120°$

We know that the sum of all interior angles of a quadrilateral = 360°

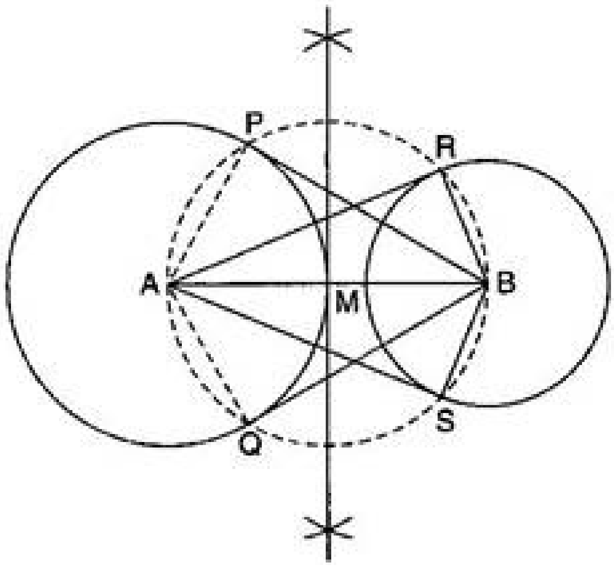
$\angle OAP + \angle AOB + \angle OBP + \angle APB = 360°$

$90° + 120° + 90° + \angle APB = 360°$

$\angle APB = 60°$

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°.

$\Rightarrow$ 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.

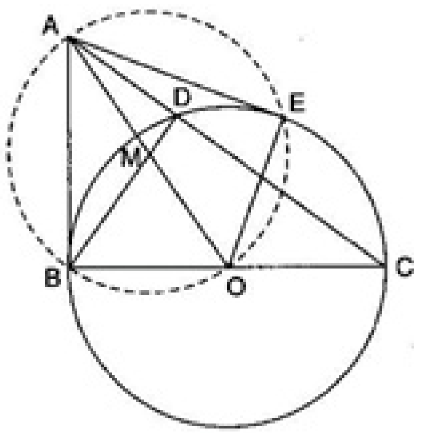
Then $\angle$ ARB being an angle in the semicircle is 90°.

$\Rightarrow$ 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°. 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°. BD is the perpendicular from B on AC and the tangents from A to this circle.



Steps of Construction:
(a) Draw a right triangle ABC with AB = 6 cm, BC = 8 cm and $\angle$ B = 90°. 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.

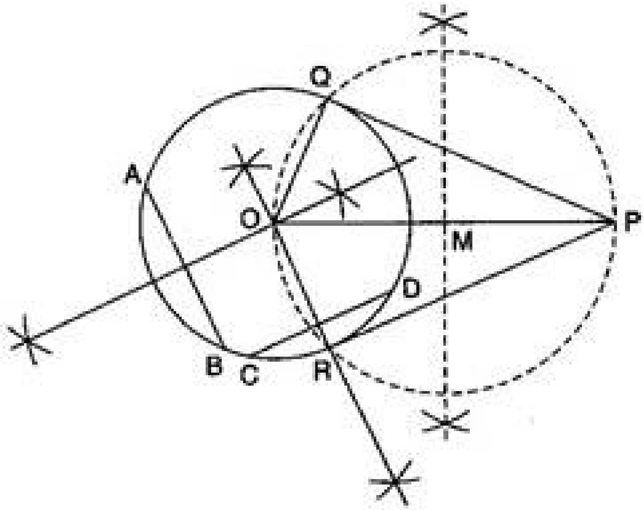
$\Rightarrow \angle$ AEO = 90°

$\Rightarrow$ 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, $\angle$ PQO is an angle in the semicircle.

$\Rightarrow \angle$ PQO = 90°

$\Rightarrow$ PQ $\perp$ OQ

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