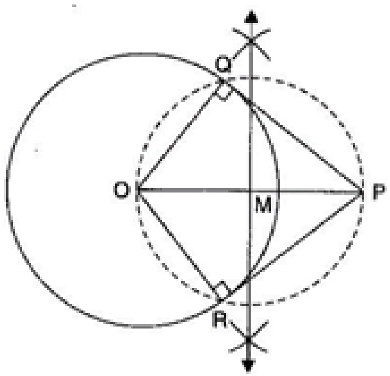
In each of the following, give the justification of the construction also:

Q1. 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.

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

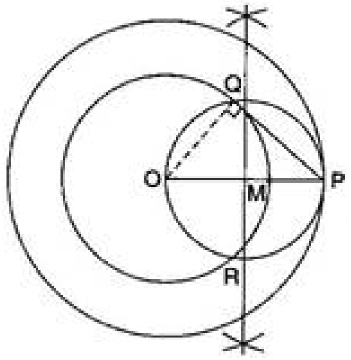
Also, since OQ, OR are radii of the circle, PQ and PR will be the tangents to the circle at Q and R respectively.

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

Q2. 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,

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

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

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

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

$\angle PQO = 90^\circ$

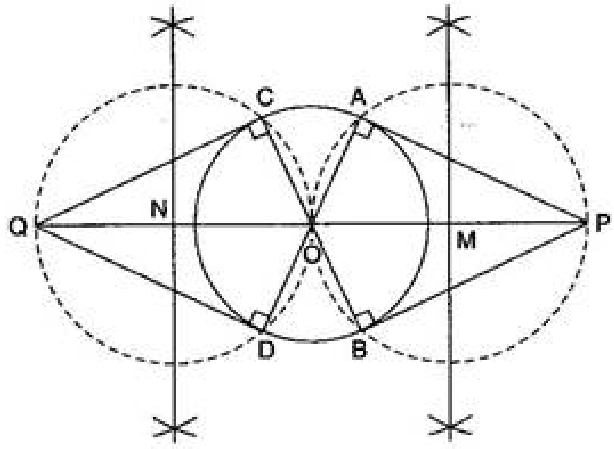
$\Rightarrow PQ \perp OQ$

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

Q3. 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.

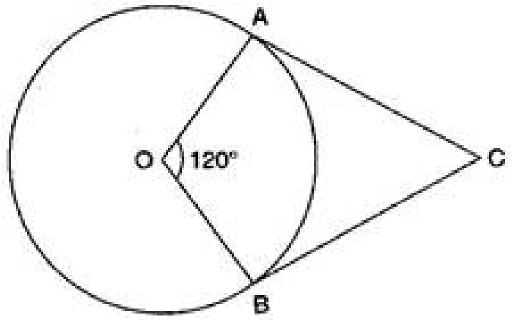
Then $\angle$ QCO is an angle in the semicircle and therefore $\angle$ QCO = 90°.

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.

Q4. 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 with centre O.

(b) Draw an angle AOB of 120°.

(c) At A and B, draw 90° angles which meet at C.

Then AC and BC are the required tangents which are inclined to each other at an angle of 60°.

Justification:

$\because \angle OAC = 90^\circ$ and OA is a radius.

[By construction]

$\therefore$ AC is a tangent to the circle.

$\because \angle OBC = 90^\circ$ and OB is a radius.

[By construction]

$\therefore$ BC is a tangent to the circle.

Now, in quadrilateral OACB,

$\angle AOB + \angle OAC + \angle OBC + \angle ACB = 360^\circ$

[Angle sum property of a quadrilateral]

$\Rightarrow 120^\circ + 90^\circ + 90^\circ + \angle ACB = 360^\circ$

$\Rightarrow 300^\circ + \angle ACB = 360^\circ$

*********** END **********