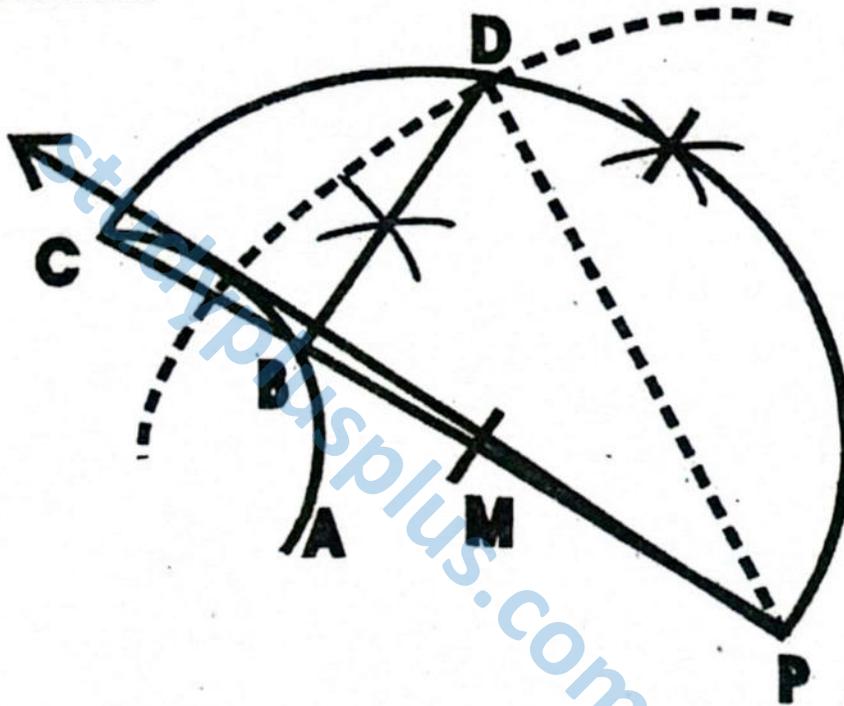1. In an arc ABC the length of the chord $|\overline{BC}| = 2cm$. Draw a secant $|\overline{PBC}| = 8cm$, where P is the point outside the arc. Draw a tangent through pint P to the arc.

Solution:

Steps of construction:

(i)   Draw an arc $\overset{\frown}{ABC}$

(ii) Take a chord $\overline{BC} = 2cm$

(iii) Produce $\overline{CB}$ toward B and take point P that $\overline{PBC}$ secant is 8 cm.

(iv) Find M, the mid point of $\overline{CP}$.

(v)   Take M as centre and draw a semi circle.

(vi) Draw $\overline{DB} \perp \overline{CP}$ which meets the semi cirle at point D.

(vii) Take P as centre and draw an arc ofo radius $m\overline{PD}$, this arc inrtesects the given arc at T.
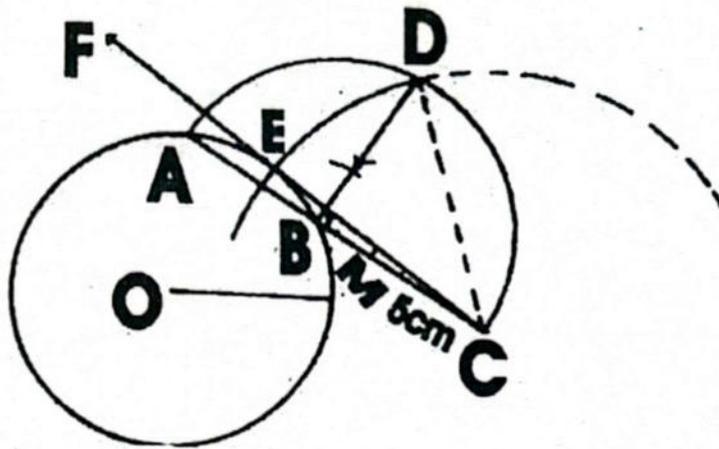
(viii) Join P to T and Produce it.

Result:

$\overline{PT}$ is the required tangent it.

2. Construct a circle with diameter 8 cm. Indicate a point C, 5 cm away from its circumference. Draw a tangent from point C to the circle without using its centre.

Solution:

Steps of construction:

(i)   Draw a circle of radius $\frac{8}{2}$ 4cm with centre at O.

(ii) Take a secant $\overline{ABC}$ such that point C is 5cm awaya from circumference of the circle .

(iii) Find M, the mid point of $\overline{AC}$.

(iv) Draw a semi circle of radius $|\overline{AM}| = |\overline{CM}|$ with centre at M.

(v)   Draw a perpendicular at point B which meets the semi circle at D.

(vi) Draw an arc of radius $|\overline{CD}|$ with centre at C . This arc cuts the given cicrcle at point E.

(vii) Join C with E.

RESULT:

$\overrightarrow{CEF}$ is the required tangent.

3.   Construct a circle of radius 2cm. Draw two tangents making an angle of $60°$ with each other.

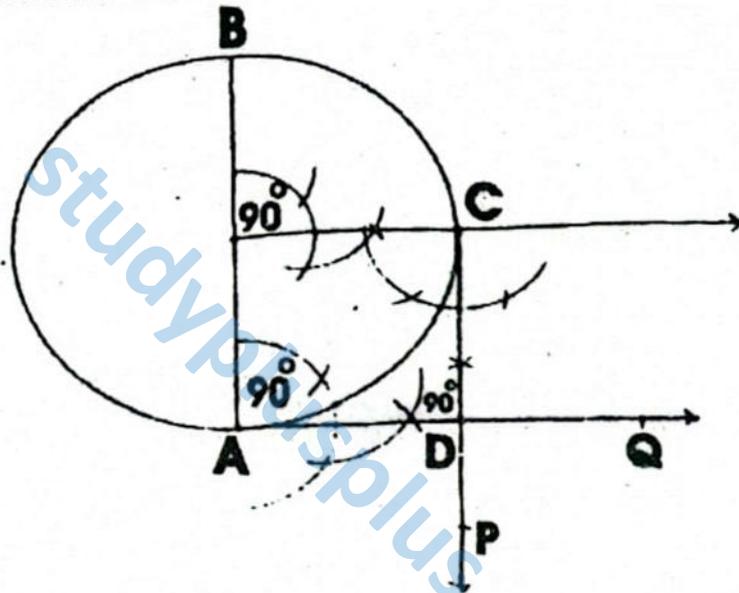**Solution:**
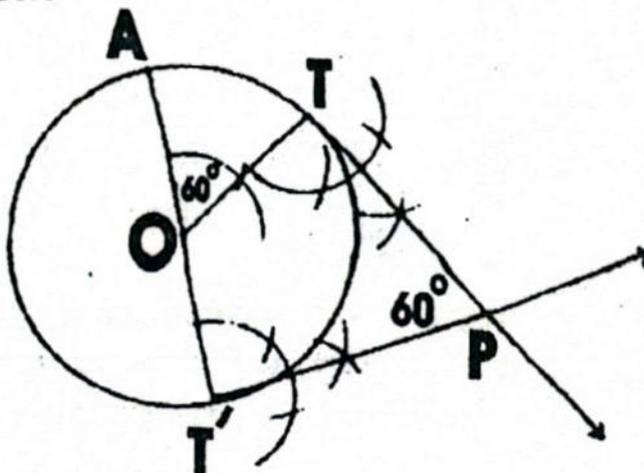
Step of construction:

(i)   *Take a point O.*

(ii)   *Take O as centre and draw a circle with radius 2 cm.*

(iii)   *Draw $\overline{AOT'}$ any diameter.*

(iv)   *Draw $\angle AOT = 60°$*

(v)   *Draw $\overline{TP}$ and $\overline{T'P}$ tangents at T, T', that intersects at P.*

RESULT:

    $\overrightarrow{TP}$ and $T'P$ are the required tangents.

4.   **Draw two perpendicular tangents to a circle of radius 3cm.**

    Solution:
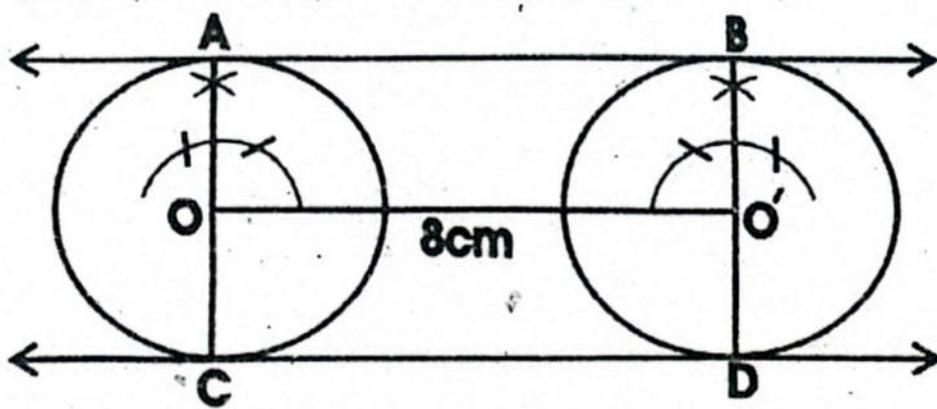

Steps of construction:

(i)   *Take a point O.*

(ii)   *Take O as centre and a circle of radius 3 cm.*

(iii)   *Take $\overline{AOB}$ any diameter of the circle.*

(iv)   *Draw $m\angle BOC = 90°$.*

(v)   *Draw tangents at point A, C.*

       these are $\overrightarrow{CP}, \overrightarrow{AQ}$

RESULT:

    $\overline{AQ}, \overline{CP}$ are the required tangents that meet at point D at $90°$.

5.   **Two equal circles are at 8 cm apart. Draw two direct common tangents of their pair of circles.**

    Solution:

Steps of construction:

(i) Draw $OO' = 8$ cm.

(ii) Draw two circles of equal size on O and O'.

(iii) Draw $\overline{OA} \perp OO'$ and Produce toward O. $\overline{OA}$ produced meets the circle at C,

(iv) Draw $\overline{O'B} \perp OO'$ and produce it toward O'. $\overline{BO'}$ produced meets the circle at D.

(v) Join A with B and produce it both sides.

(vi) Join C with D and produce both sides.

Results:

$\overleftrightarrow{AB}$ and $\overleftrightarrow{CD}$ are the common external tangents.

6. Draw two equal circles of each radius 2.4 cm. If the distance between their centres is 6cm then draw their transverse tangents.

Solution:

Steps of Construction:

(i) Draw $mOO' = 7$cm.
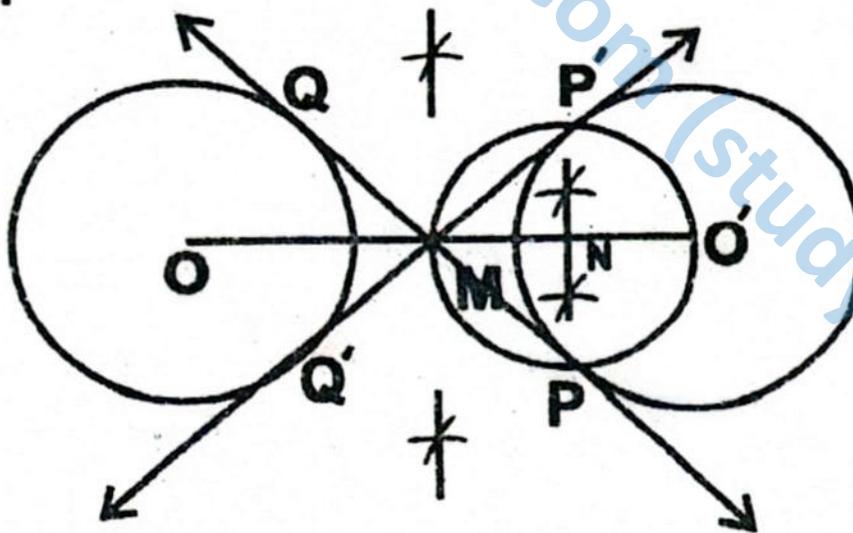
(ii) Draw two circles of 2.4 cm radius on O and O'.

(iii) Find M, the mid points of OO'.

(iv) Find N, the mid point of $\overline{MO'}$.

(v) Draw a circle with centre at N and of radius $\overline{NO'}$, This

circle intersects the circle at P and P'.

(vi) Join P' with M and produce towards M, it touch the second circle at Q'.

(vii) Join P with M and produce toward M.
$\overline{PM}$ produced touches the second circle at Q.
$\overrightarrow{PQ}$ $\overrightarrow{P'Q'}$ are the required tangents.

7. **Draw two circles with radii 2.5 cm and 3 cm. If their centres are 6.5 cm apart, then draw two direct common tangents.**

Solution:
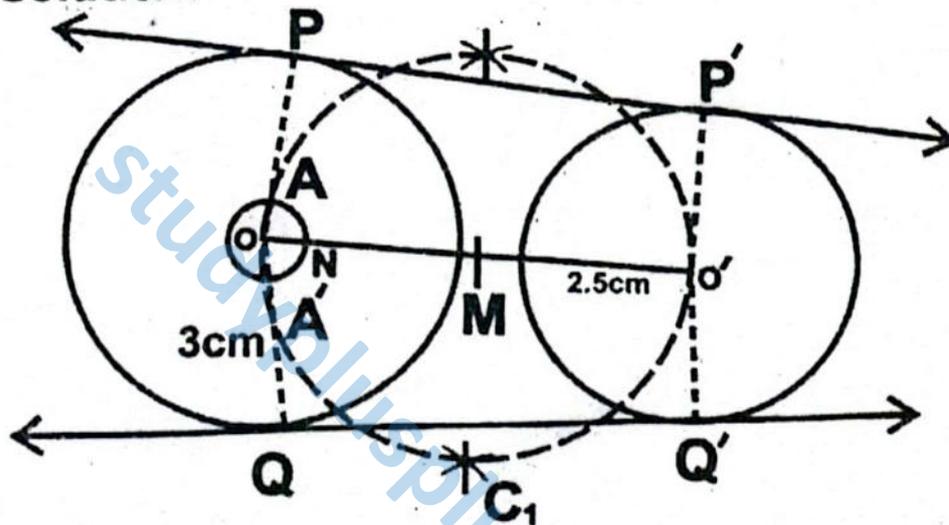
Steps of construction:

(i) Draw $\overline{OO'}$ of length 6.5 cm.

(ii) Take O as centre and draw a circle with radius 3 cm.

(iii) Take O' as centre and draw a circle with radius 2.5 cm.

(iv) Find M, mid − point of $\overline{OO'}$. Take M as centre and draw a circle with radius m$\overline{MO'}$.

(v) Cut m$\overline{ON}$ = 3 − 2.5 = 0.5 cm and take O as centre, draw the circle with radius m$\overline{ON}$. This circle intersects the circle C, at point A, A'.

(vi) Join O with A, A' and produce on both sides, $\overline{OA}$ and $\overline{OA'}$ produced intersects the larger circle at P and Q.

(vii) Draw O'P' ∥ $\overline{O'P'}$ and $\overline{OP}$ and $\overline{O'Q'}$ ∥ $\overline{OQ}$

(viii) Join P with P' and Q with Q'.

RESULT:

$\overrightarrow{PP}$ and $\overrightarrow{QQ}$ are the required tangents.

8. **Draw two circles with radii 3.5cm and 2cm. If their centres are 6cm apart, then draw two transverse common tangents.**
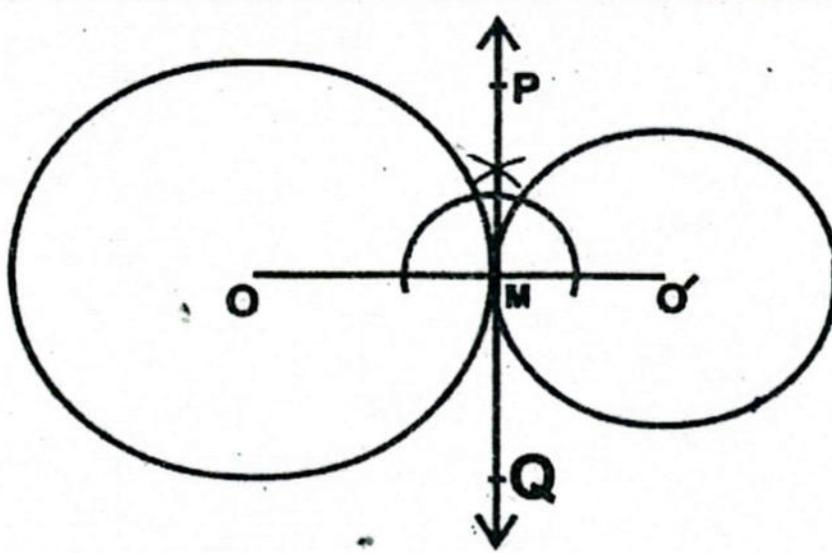
Solution:
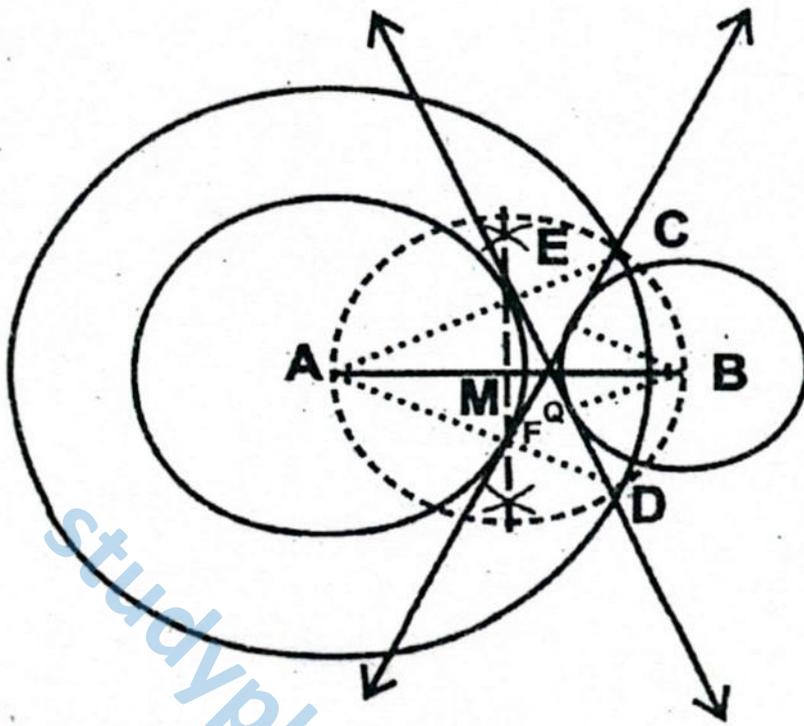
Steps of Construction:
(i)   Take a line segment of measure $\overline{AB} = 6\ cm$.
(ii)   Draw two circles of radii 3.5 and 2 cm with centres at A and B respectively.
(iii)   Taking A as centre draw a circle of radius $3.5 + 2 = 5.5\ cm$.
(iv)   Bisect the line segment $\overline{AB}$ at point M.
(v)   Take M as centre and draw a circle of radius $\overline{MA}$ which intersects the big circle at points C and D.
(vi)   Join A with C and D to produce $\overline{AD}$ and $\overline{AC}$. $\overline{AD}$ and $\overline{AC}$ meets the inner circle at E and F.
(vii)   Draw $\overline{BQ}\ \|\ \overline{AE}$ and $\overline{BP}\ \|\ \overline{AF}$.
(viii) Join E with Q and produce on both sides.
RESULT:
     $\overline{EQ}$ and $\overline{FP}$ are the required tangents.

9.   Draw two common tangents to two touching circles of radii 2.5cm and 3.5cm.
        Solution:
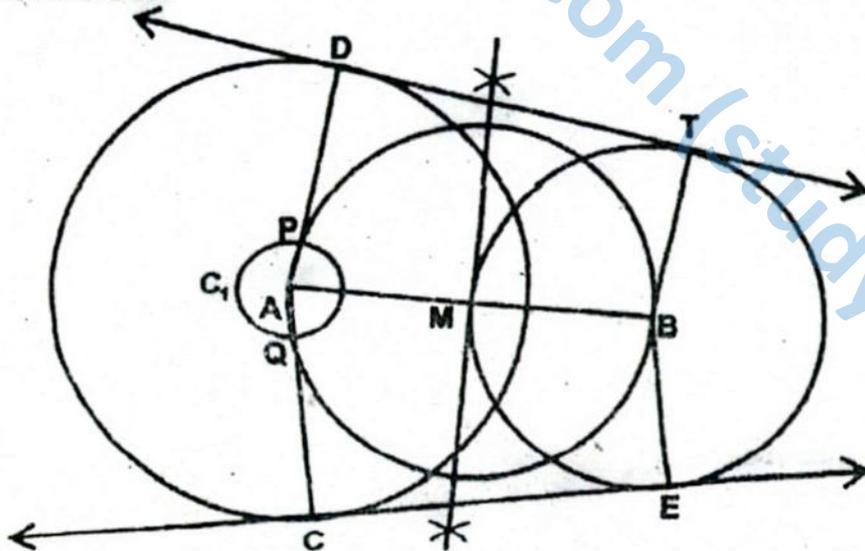
Steps of construction:

(i) Draw s line segment $\overline{OO'}$ of measure $2.5 + 3.5 = 6.0\ cm^r$

(ii) Take O as centre and draw a circle with radius $m\overline{OM} = 3.5\ cm$.

(iii) Take O' as centre and draw a circle with radius $2.5\ cm$. These circles touch each other at point M.

(iv) Draw $\overleftrightarrow{PQ} \perp OO'$.

RESULT:

$\overleftrightarrow{PQ}$ is the required common tangents.

10. **Draw two common tangents to two intersecting circle of radii 3cm and 4cm.**

Solution:

Steps of Construction:

(i) Take a line segment $\overline{AB}$ that $m\overline{AB} = 3 + 4 = 7\ cm$.

(ii) Draw two circles of radii 4cm, 3 cm with centres at A, B.

(iii) Taking A as centre draw a circle with radius $4 - 3 = 1\ cm$

(iv)   Bisects the line segments $\overline{AB}$ at point M.

(v)   Take M as centre and draw a circle of radius m$\overline{MB}$, this circle intersects . Circle C , at P , Q.

(vi)   Join A with P and Q and produce $\overline{AP}$, $\overline{AQ}$ to meet the larger circle at D, C.

(vii)   Draw $\overline{BT}$ ‖ $\overline{AD}$ and $\overline{BE}$ ‖ $\overline{AC}$.

(viii)   Join D with T and produce both sides.

(ix)   Join C with E and produce both sides.
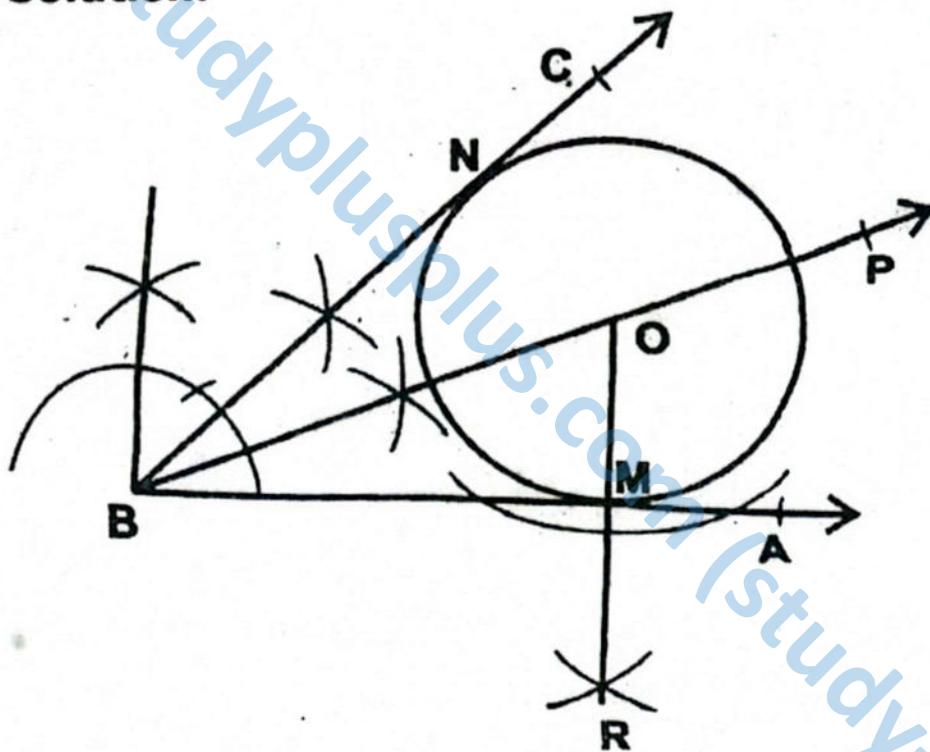
RESULT:

$\overleftrightarrow{DT}$ and $\overleftrightarrow{CE}$ are the required tangents.

11.   **Draw circle which touches both the arms of angles**

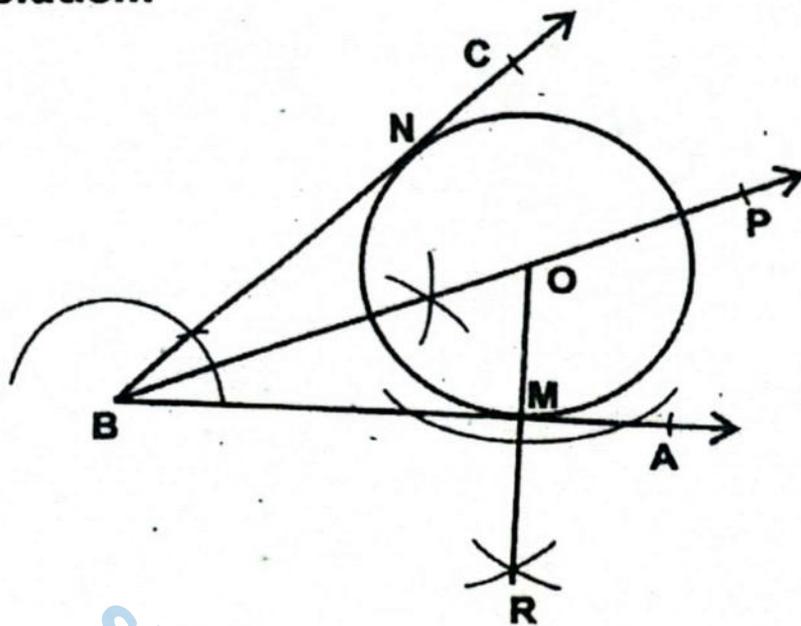(i) $45°$ (ii) $60°$

11. (i) Solution:

Steps of Construction:

(i)   Draw an angle ABC of $45°$.

(ii)   Draw $\overrightarrow{BP}$ bisector of angle $\angle ABC$.

(iii)   Take any point O on $\overrightarrow{BP}$.

(iv)   Drop $\overline{OM} \perp \overline{BA}$.

(v)   Take O as centre and draw a circle with radius m$\overline{OM}$. This circle touches arm $\overrightarrow{BC}$ at N also.

11. (ii) Solution:

Steps of Construction:

(i) Draw an angle ∠ABC of 60°

(ii) Draw $\overrightarrow{BP}$ bisector of angle ∠ABC.

(iii) Take a point O on $\overrightarrow{BP}$.

(iv) Drop $\overline{OM} \perp \overline{BA}$.

(v) Take O as centre and draw a circle with radius $m\overline{OM}$. This circle touches arm $\overline{BC}$ at N also.