Constructions

NCERT TEXTBOOK QUESTIONS SOLVED

EXERCISE 11.1

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

Q. 1. *Draw a line segment of length 7.6 cm and divide it in the ratio 5 : 8. Measure the two parts.*

Sol. Steps of construction:

I. Draw a line segment AB = 7.6 cm.

II. Draw a ray AX making an acute angle with AB.

III. Mark 13 (8 + 5) equal points on AX, and mark them as X_1, X_2, X_3, ..., X_{13}.

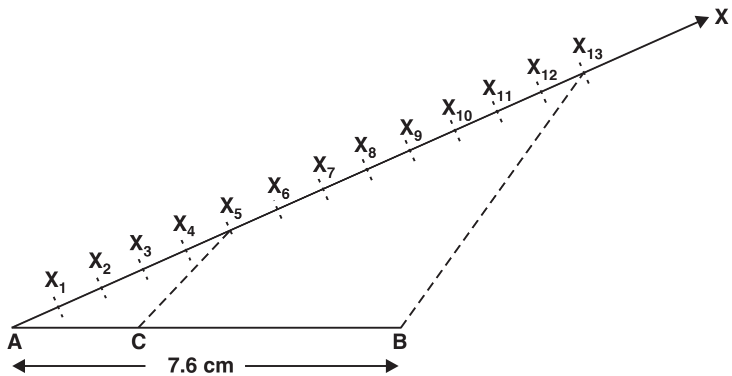
IV. Join 'point X_{13}' and B.

V. From 'point X_5', draw $X_5C \parallel X_{13}B$, which meets AB at C.

Thus, C divides AB in the ratio 5 : 8

On measuring the two parts, we get:

$$AC = 4.7 \text{ cm} \quad \text{and} \quad BC = 2.9 \text{ cm}$$



Justification:

In $\Delta\ ABX_{13}$ and $\Delta\ ACX_5$, we have

$$CX_5 \parallel BX_{13}$$

$$\therefore \quad \frac{AC}{CB} = \frac{AX_5}{X_5X_{13}} = \frac{5}{8}$$

$$\Rightarrow \quad AC : CB = 5 : 8.$$

Q. 2. *Construct a triangle of sides 4 cm, 5 cm and 6 cm and then a triangle similar to it whose sides are $\frac{2}{3}$ of the corresponding sides of the first triangle.* *[CBSE 2012]*

Sol. Steps of construction:

I. Draw a $\Delta\ ABC$ such that $BC = 6$ cm, $AC = 5$ cm and $AB = 4$ cm.

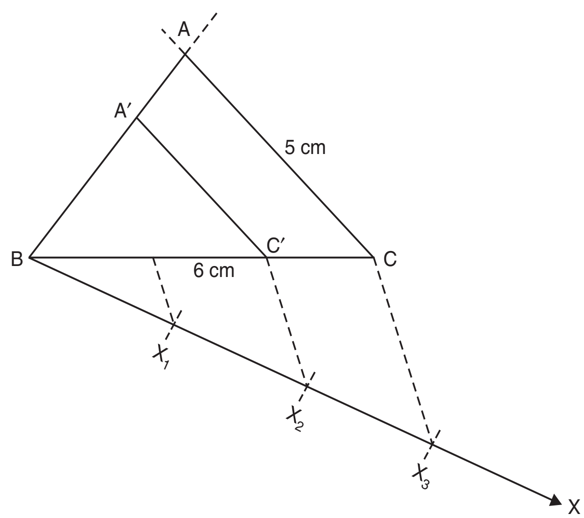
II. Draw a ray BX making an acute angle $\angle CBX$.

III. Mark three points X_1, X_2, X_3 on BX such that $BX_1 = X_1X_2 = X_2X_3$.

IV. Join $X_3\ C$.

V. Draw a line through X_2 such that it is parallel to $X_3\ C$ and meets BC at C'.

VI. Draw a line through C' parallel to CA to intersect BA at A'.



Thus, $A'BC'$ is the required triangle.

Justification:

By construction, we have:

$$X_3C \parallel X_2C'$$

$$\Rightarrow \quad \frac{BX_2}{X_2X_3} = \frac{BC'}{C'C} \qquad [\textit{Using BPT}]$$

$$\text{But} \quad \frac{BX_2}{X_2X_3} = \frac{2}{1}$$

$$\Rightarrow \quad \frac{BC'}{C'C} = \frac{2}{1}$$

$$\Rightarrow \quad \frac{C'C}{BC'} = \frac{1}{2}$$

Adding, 1 to both sides, we get

$$\frac{C'C}{BC'} + 1 = \frac{1}{2} + 1$$

$$\Rightarrow \quad \frac{C'C + BC'}{BC'} = \frac{1+2}{2}$$

$\Rightarrow \qquad \dfrac{BC}{BC'} = \dfrac{3}{2}$

Now, in $\Delta\ BC'A'$ and $\Delta\ BCA$

we have $\qquad CA \parallel C'A'$

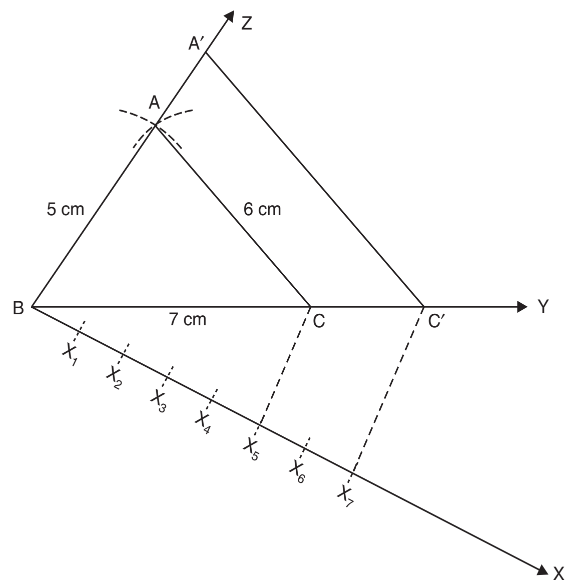
$\therefore$ Using AA similarity, we have:

$$\Delta\ BC'A' \sim \Delta\ BCA$$

$\Rightarrow \qquad \dfrac{A'B}{AB} = \dfrac{A'C'}{AC} = \dfrac{BC'}{BC}. \qquad \left[\text{each equal to } \dfrac{2}{3}\right]$

Q. 3. *Construct a triangle with sides 5 cm, 6 cm and 7 cm and then another triangle whose sides are $\frac{7}{5}$ of the corresponding sides of the first triangle.*

Sol. Steps of construction:



I. Construct a $\Delta\ ABC$ such that AB = 5 cm, BC = 7 cm and AC = 6 cm.

II. Draw a ray BX such that $\angle CBX$ is an acute angle.

III. Mark 7 points of $X_1, X_2, X_3, X_4, X_5, X_6$ and X_7 on BX such that $BX_1 = X_1X_2 = X_2X_3 = X_3X_4 = X_4X_5 = X_5X_6 = X_6X_7$

IV. Join X_5 to C.

V. Draw a line through X_7 intersecting BC (produced) at C' such that $X_5C \parallel X_7C'$

VI. Draw a line through C' parallel to CA to intersect BA (produced) at A'. Thus, $\Delta\ A'BC'$ is the required triangle.

Justification:

By construction, we have

$$C'A' \parallel CA$$

$\therefore$ Using AA similarity, $\Delta\ ABC \sim \Delta\ A'BC'$

$$\frac{A'B}{AB} = \frac{A'C'}{AC} = \frac{BC'}{BC}$$

Also $\qquad X_7C' \parallel X_5C \qquad$ [By construction]

$\therefore \qquad \Delta\ BX_7C' \sim \Delta\ BX_5C \Rightarrow \dfrac{BC}{BC'} = \dfrac{BX_5}{BX_7}$

$\therefore \qquad \dfrac{BX_5}{BX_7} = \dfrac{5}{7} \Rightarrow \dfrac{BC}{BC'} = \dfrac{5}{7}$ or $\dfrac{BC'}{BC} = \dfrac{7}{5}$

$\therefore \qquad \dfrac{A'B}{AB} = \dfrac{A'C'}{AC} = \dfrac{BC'}{BC} = \dfrac{7}{5}.$

Q. 4. *Construct an isosceles triangle whose base is 8 cm and altitude 4 cm and then another triangle whose sides are $1\frac{1}{2}$ times the corresponding sides of the isosceles triangle.*

Sol. Steps of construction:

I. Draw BC = 8 cm

II. Draw the perpendicular bisector of BC which intersects BC at D.

III. Mark a point A on the above perpendicular such that DA = 4 cm.

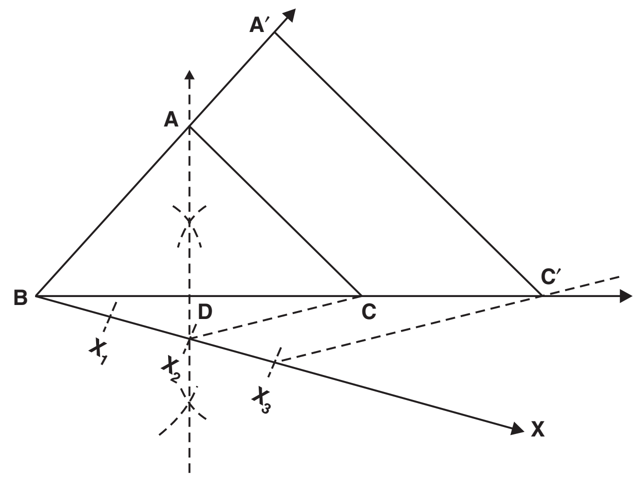
IV. Join AB and AC.

Thus, ΔABC is the required isosceles triangle.

V. Now, draw a ray BX such that $\angle CBX$ is an acute angle.

VI. On BX, mark three points X_1, X_2 and X_3 such that:

$$BX_1 = X_1X_2 = X_2X_3$$



VII. Join X_2 to C.

VIII. Draw a line through X_3 parallel to X_2 C and intersecting BC (extended) *to* C'.

IX. Draw a line through C' parallel to CA intersecting BA (extended) at A', thus, $\Delta A'BC'$ is the required triangle.

Justification:

We have $C'A' \parallel CA$ [*By construction*]

$\therefore$ Using AA similarity, $\Delta ABC \sim \Delta A'BC'$

$$\Rightarrow \quad \frac{A'B}{AB} = \frac{A'C'}{AC} = \frac{BC'}{BC'}$$

Since, $X_3C' \parallel X_2C$ [*By construction*]

$$\Rightarrow \quad \Delta BX_3C' \sim \Delta BX_2C$$

$$\Rightarrow \quad \frac{BC'}{BC} = \frac{BX_3}{BX_2} \qquad \text{[By BPT]}$$

But $$\frac{BX_3}{BX_2} = \frac{3}{2}$$

$$\Rightarrow \quad \frac{BC'}{BC} = \frac{3}{2}$$

Thus, $$\frac{A'B}{AB} = \frac{A'C'}{AC} = \frac{BC'}{BC} = \frac{3}{2}.$$

Q. 5. *Draw a triangle ABC with side BC = 6 cm, AB = 5 cm and $\angle ABC = 60°$. Then construct a triangle whose sides are $\frac{3}{4}$ of the corresponding sides of the triangle ABC.* [CBSE 2011, 2012]

Sol. **Steps of construction:**

I. Construct a $\Delta\ ABC$ such that BC = 6 cm, AB = 5 cm and $\angle ABC$ = 60°.

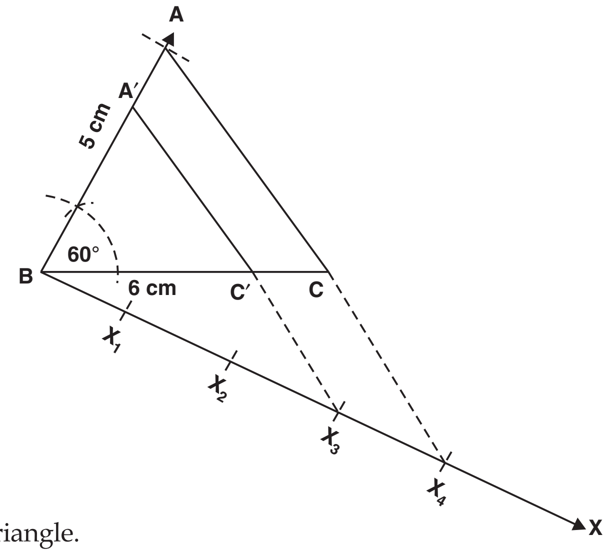
II. Draw a ray $\overrightarrow{BX}$ such that $\angle CBX$ is an acute angle.

III. Mark four points X_1, X_2, X_3 and X_4 on BX such that $BX_1 = X_1X_2 = X_2X_3 = X_3X_4$

IV. Join X_4C and draw $X_3C' \parallel X_4C$ such that C' is on BC.

V. Also draw another line through C' and parallel to CA to intersect BA at A'.

Thus, $\Delta\ A'BC'$ is the required triangle.



Justification:

By construction, we have:

$$X_4C \parallel X_3C'$$

$\therefore$ $$\frac{BX_3}{BX_4} = \frac{BC'}{BC}$$ [By BPT]

But $$\frac{BX_3}{BX_4} = \frac{3}{4}$$ [By construction]

$\Rightarrow$ $$\frac{BC'}{BC} = \frac{3}{4} \quad ...(1)$$

Now, we also have

$$CA \parallel C'A'$$ [By construction]

$\therefore$ $$\Delta\ BC'A' \sim \Delta\ BCA$$ [using AA similarity]

$\Rightarrow$ $$\frac{A'B}{AB} = \frac{A'C}{AC} = \frac{BC'}{BC} = \frac{3}{4}.$$ [From (1)]

Q. 6. *Draw a triangle ABC with side BC = 7 cm, ∠B = 45°, ∠A = 105°. Then, construct a triangle whose sides are* $\frac{4}{3}$ *times the corresponding sides of Δ ABC.*

Sol. **Steps of construction:**

I. Construct a $\Delta\ ABC$ such that BC = 7 cm, $\angle B$ = 45° and $\angle A$ = 105°.

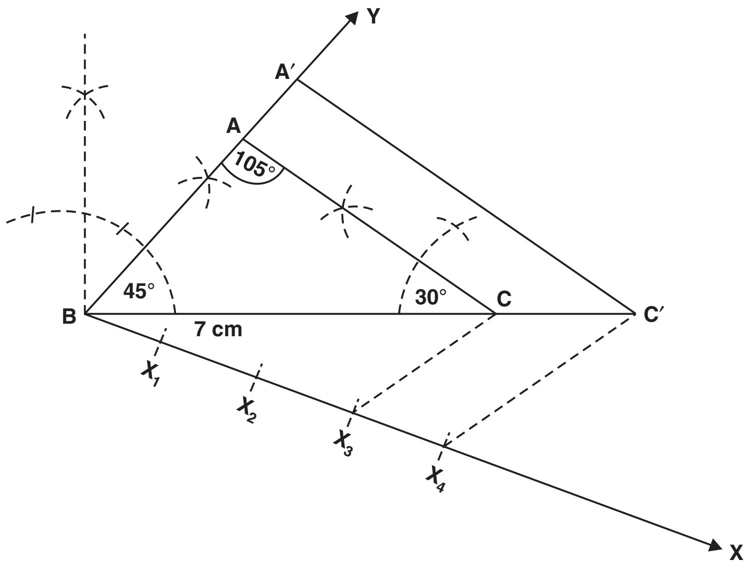
II. Draw a ray BX making an acute angle $\angle CBX$ with BC.

III. On BX, mark four points X_1, X_2, X_3 and X_4 such that $BX_1 = X_1X_2 = X_2X_3 = X_3X_4$.

IV. Join X_3 to C.

V. Draw $X_4C' \parallel X_3C$ such that C' lies on BC (extended).

VI. Draw a line through C' parallel to CA intersecting the extended line segment BA at A'.



Thus, $\Delta A' BC'$ is the required triangle.

Justification:

By construction, we have:

$$C'A' \parallel CA$$

$\therefore$ $\Delta ABC \sim \Delta A'BC'$ [AA similarity]

$$\Rightarrow \quad \frac{A'B}{AB} = \frac{A'C'}{AC} = \frac{BC'}{BC} \qquad ...(1)$$

Also, by construction,

$$X_4 C' \parallel X_3 C$$

$\therefore$ $\Delta BX_4C' \sim \Delta BX_3C$

$$\Rightarrow \quad \frac{BC'}{BC} = \frac{BX_4}{BX_3}$$

But $$\frac{BX_4}{BX_3} = \frac{4}{3}$$

$$\Rightarrow \quad \frac{BC'}{BC} = \frac{4}{3} \qquad ...(2)$$

From (1) and (2), we have:

$$\frac{A'B}{AB} = \frac{A'C'}{AC} = \frac{BC'}{BC} = \frac{4}{3}.$$

Q. 7. *Draw a right triangle in which the sides (other than hypotenuse) are of lengths 4 cm and 3 cm. Then construct another triangle whose sides are $\frac{5}{3}$ times the corresponding sides of the given triangle.*

Sol. Steps of construction:

I. Construct the right triangle ABC such that $\angle B = 90°$, $BC = 4$ cm and $BA = 3$ cm.

II. Draw a ray BX such that an acute angle $\angle CBX$ is formed.

III. Mark 5 points X_1, X_2, X_3, X_4 and X_5 on BX such that

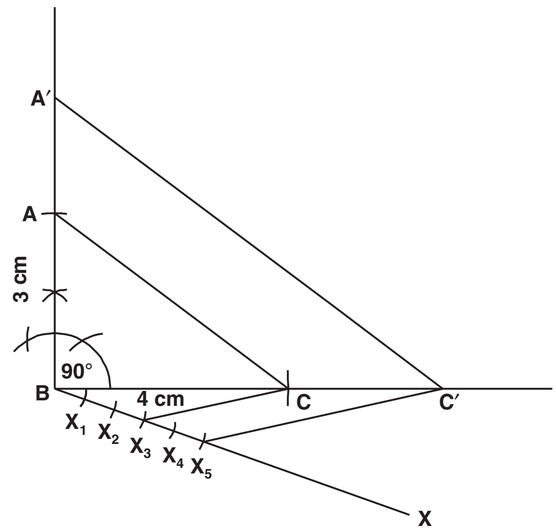
$BX_1 = X_1X_2 = X_2X_3 = X_3X_4 = X_4X_5$.

IV. Join X_3 to C.

V. Draw a line through X_5 parallel to $X_3\,C$, intersecting the extended line segment BC at C'.

VI. Draw another line through C' parallel to CA intersecting the extended line segment BA at A'.

Thus, $\Delta\ A'\ BC'$ is the required triangle.



Justification:

By construction, we have:

$$C'A' \parallel CA$$

$\therefore \quad \Delta\ ABC \sim \Delta\ A'\ BC'$ [By AA similartiy]

$$\Rightarrow \quad \frac{A'B}{AB} = \frac{A'C'}{AC} = \frac{BC'}{BC} \qquad ...(1)$$

Also, $X_5C' \parallel X_3C$ [By construction]

$\therefore \quad \Delta\ BX_5\ C' \sim \Delta\ BX_3\ C$

$$\Rightarrow \quad \frac{BC'}{BC} = \frac{BX_5}{BX_3}$$

But $$\frac{BX_5}{BX_3} = \frac{5}{3} \qquad ...(2)$$

From (1) and (2) we get

$$\frac{A'B}{AB} = \frac{A'C'}{AC} = \frac{BC'}{BC} = \frac{5}{3}.$$

TANGENTS TO A CIRCLE

☞ **Remember:**

I. *If a point lies inside a circle, then there cannot be a tangent to the circle through this point.*

II. *If a point lies on the circle, then there is only one tangent to the circle at this point and it is perpendicular to the radius through that point.*

III. *If the point lies outside the circle, there will be two tangents to the circle from this point.*

NOTE:

(*i*) *For drawing a tangent at a point of a circle, simply draw the radius through this point and draw a line perpendicular to this radius through this point.*

(*ii*) *The two tangents to a circle from an external point are equal.*

Construction of tangents to a circle from a point outside it.

Steps of construction:

I. Let the centre of the circle be *O* and *P* be a point outside the circle.

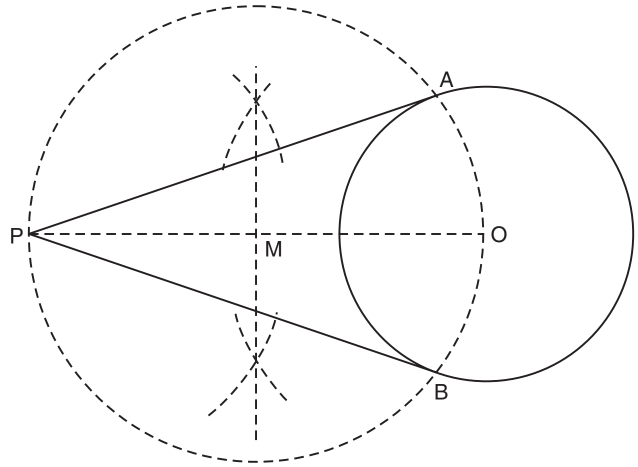
II. Join *O* and *P*.

III. Bisect *OP* and let *M* be the mid point of *OP*.

IV. Taking *M* as centre and *MP* or *MO* as radius, draw a circle intersecting the given circle at the points *A* and *B*.

V. Join *PA* and *PB*.

Thus, *PA* and *PB* are the required two tangents.



NOTE:

In case, the centre of the circle is not known, then to locate its centre, we take any two non-parallel chords and then find the point of intersection of their perpendicular bisectors.

NCERT TEXTBOOK QUESTIONS SOLVED

EXERCISE 11.2

Q. 1. *In each of the following, give also the justification of the construction:*

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.

Sol. Steps of construction:

I. With O as centre and radius 6 cm, draw a circle.

II. Take a point P at 10 cm away from the centre.

III. Join *O* and *P*.

IV. Bisect *OP* at *M*.

V. Taking *M* as centre and *MP* or *MO* as radius, draw a circle.

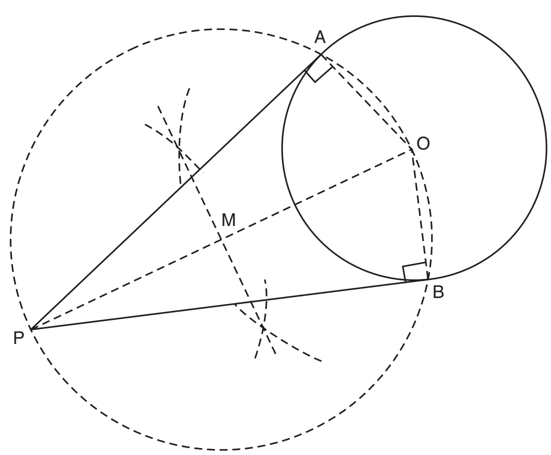
VI. Let the new circle intersects the given circle at *A* and *B*.

VII. Join *PA* and *PB*.

Thus, *PA* and *PB* are the required two tangents.

By measurement, we have:

$PA = PB =$ **9.6 cm.**



Justification:

Join OA and OB

Since PO is a diameter.

$\therefore \quad \angle OAP = 90° = \angle OBP$ [Angles in a semicircle]

Also, OA and OB are radii of the same circle.

$\Rightarrow$ PA and PB are tangents to the circle.

Q. 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.*

Sol. **Steps of construction:**

I. Join PO and bisect it such that the mid point of PO is represented by M.

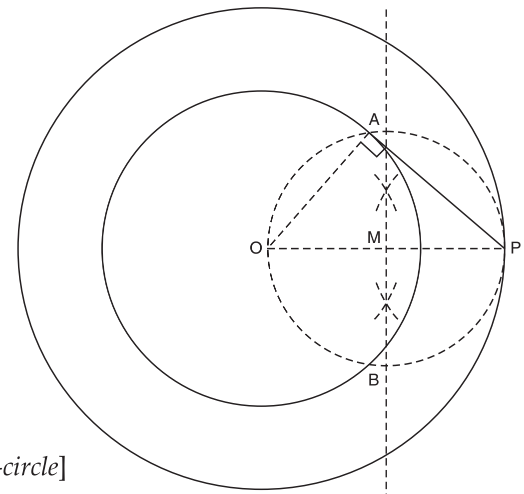
II. Taking M as centre and OM or MP as radius, draw a circle such that this circle intersects the circle (of radius 4 cm) at A and B.

III. Join A and P.

Thus, PA is the required tangent.

By measurement, we have:

$$PA = 4.5 \text{ cm}$$



Justification:

Join OA such that

$$\angle PAO = 90° \quad [\textit{Angle in a semi-circle}]$$

$\Rightarrow \quad PA \perp OA$

$\because$ OA is a radius of the inner circle.

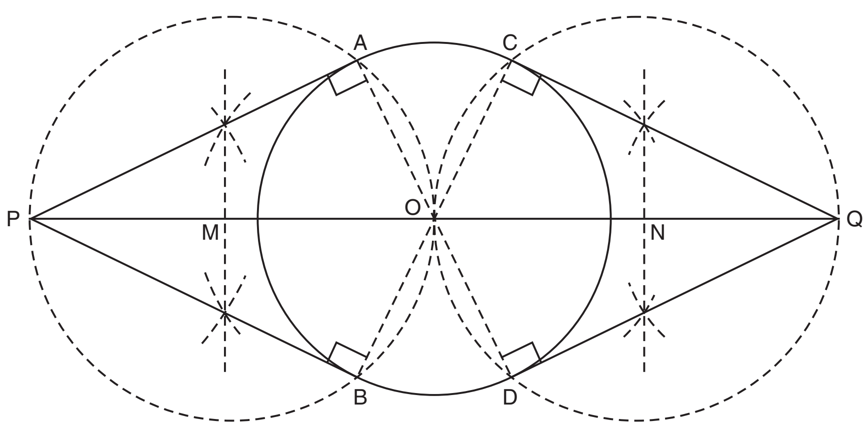
$\therefore$ PA has to be a tangent to the inner circle.

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

Sol. **Steps of construction:**

I. Join P and O.

II. Bisect PO such that M be its mid-point.



III. Taking M as centre and MO as radius, draw a circle. Let it intersect the given circle at A and B.

IV. Join PA and PB.

Thus, **PA and PB** are the two required tangents from P.

V. Now, join O and Q.

VI. Bisect OQ such that N is its mid point.

VII. Taking N as centre and NO as radius, draw a circle. Let it intersect the given circle at C and D.

VIII. Join QC and QD.

Thus, **QC and QD** are the required tangents to the given circle.

Justification:

Join OA such that $\angle OAP = 90°$ [*Angle in a semi-circle*]

$\Rightarrow$ $PA \perp OA \Rightarrow PA$ is a tangent.

Similarly, $PB \perp OA \Rightarrow PB$ is a tangent

Now, join OC such that $\angle QCO = 90°$ [*Angle in a semi-circle*]

$\Rightarrow$ $QC \perp OC \Rightarrow QC$ is a tangent.

Similarly, $QD \perp OC \Rightarrow QD$ is a tangent.

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

Sol. Steps of construction:

I. With centre O and radius = 5 cm, draw a circle.

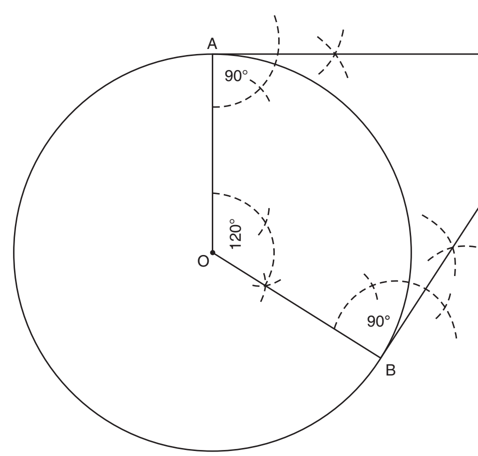
II. Draw an angle $\angle AOB = 120°$.

III. Draw a perpendicular on OA at A.

IV. Draw another perpendicular on OB at B.

V. Let the two perpendiculars meet at C.

CA and CB are the two required tangents to the given circle which are inclined to each other at 60°.



Justification:

In a quadrilateral $OACB$, using angle sum property, we have:

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

$\Rightarrow \quad 300 + \angle ACB = 360°$

$\Rightarrow \quad \angle ACB = 360° - 300° = 60°$.

Q. 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.* [CBSE 2012]

Sol. Steps of construction:

I. Bisect the line segment *AB*. Let its mid point be *M*.

II. With centre as *M* and *MA* (or *MB*) as radius, draw a circle such that it intersects the circle with centre *A* at the points *P* and *Q*.

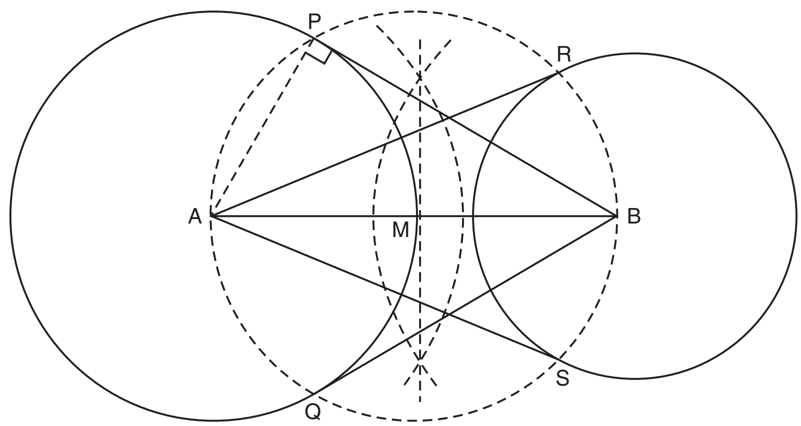
III. Join *BP* and *BQ*.

Thus, *BP* and *BQ* are the required two tangents from *B* to the circle with centre *A*.

IV. Let the circle with centre *M*, intersects the circle with centre *B* at *R* and *S*.

V. Join *RA* and *SA*.

Thus, *RA* and *SA* are the required two tangents from *A* to the circle with centre *B*.



Justification:

Let us join *A* and *P*.

$\because \quad \angle APB = 90°$ [Angle in a semi circle]

$\therefore \quad BP \perp AP$

But *AP* is radius of the circle with centre *A*.

$\Rightarrow$ *BP* has to be a tangent to the circle with centre *A*.

Similarly, *BQ* has to be tangent to the circle with centre *A*.

Also, *AR* and *AS* have to be tangent to the circle with centre *B*.

Q. 6. *Let ABC be a right triangle in which AB = 6 cm, BC = 8 cm and ∠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.* [CBSE 2012]

Sol. Steps of construction:

I. Join *AO* (*O* is the centre of the circle passing through *B*, *C* and *D*.)

II. Bisect *AO*. Let *M* be the mid point of *AO*.

III. Taking *M* as centre and *MA* as radius, draw a circle intersecting the given circle at *B* and *E*.

IV. Join *AB* and *AE*. Thus, *AB* and *AE* are the required two tangents to the given circle from *A*.

Justification

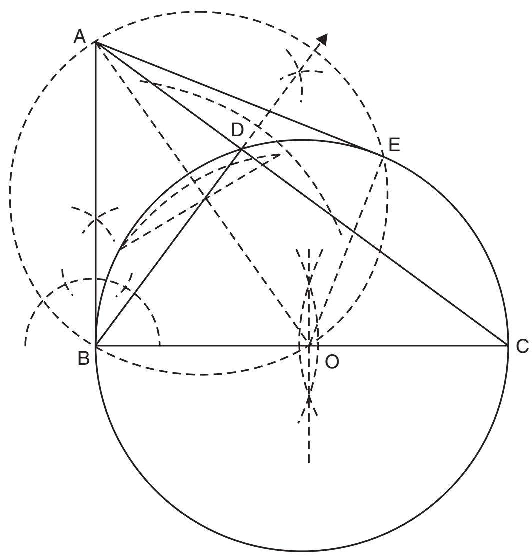
Join OE, then $\angle AEO = 90°$ [Angle being in a semi circle]

$\therefore$ $AE \perp OE$.

But OE is a radius of the given circle.

$\Rightarrow$ AE has to be a tangent to the circle.

Similarly, AB is also a tangent to the given circle.



Q. 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.* [CBSE 2012]

Sol. Steps of construction:

I. Draw the given circle using a bangle.

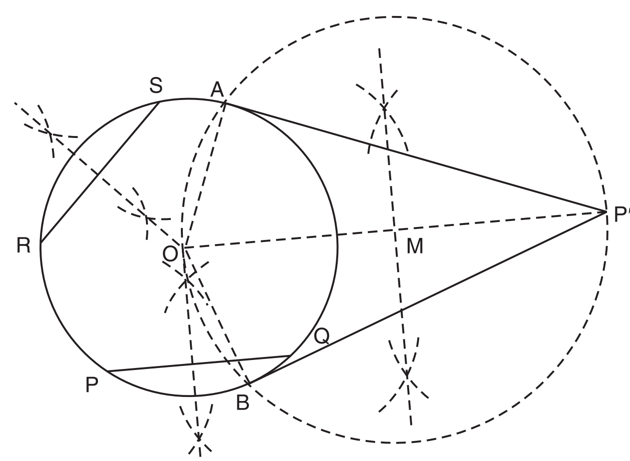
II. Take two non parallel chords PQ and RS of this circle.

III. Draw the perpendicular bisectors of PQ and RS such that they intersect at O. Therefore, O is the centre of the given circle.

IV. Take a point P' outside this circle.

V. Join OP' and bisect it. Let M be the mid point of OP'.

VI. Taking M as centre and OM as radius, draw a circle. Let it intersect the given circle at A and B.



VII. Join $P'A$ and $P'B$. Thus, $P'A$ and $P'B$ are the required two tangents.

Justification:

Join OA and OB.

Since $\angle OAP = 90°$ [Angle in a semi-circle]

$\therefore$ $PA \perp OA$

Also OA is a radius.

$\therefore$ PA has to be a tangent to the given circle.

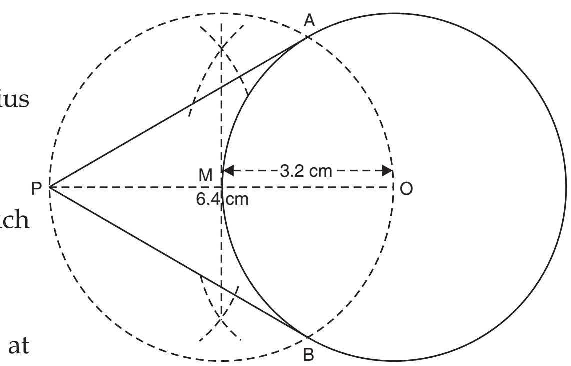
Similarly, PB is also a tangent to the given circle.

MORE QUESTIONS SOLVED

I. SHORT ANSWER TYPE QUESTIONS

Q. 1. *Draw a circle of diameter 6.4 cm. Then draw two tangents to the circle from a point P at a distance 6.4 cm from the centre of the circle.*

Sol. Steps of construction:



I. Draw a circle with centre O and radius $= \frac{6.4}{2}$ cm or 3.2 cm.

II. Mark a point P outside the circle such that OP = 6.4 cm.

III. Join OP.

IV. Bisect OP such that its mid point is at M.

V. With centre M and radius OM, draw a circle intersecting the given circle at A and B.

VI. Join PA and PB. Thus, PA and PB are the two tangents to the given circle.

Q. 2. *Draw a circle of radius 3.4 cm. Draw two tangents to it inclined at an angle of 60° to each other:* *[NCERT Exemplar]*

Sol. Steps of construction:

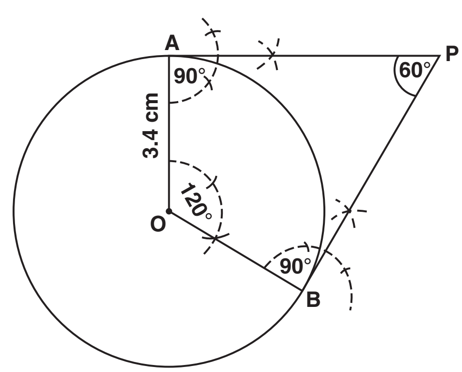
I. Draw a circle with centre O and radius as 3.4 cm.

II. Draw two radii OA and OB such that $\angle AOB$ = 120°.

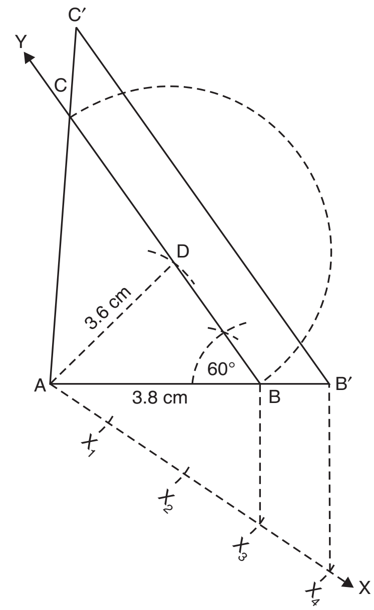
III. Draw perpendiculars at A and B such that these perpendiculars meet at P.

Obviously, $\angle APB$ = 60°.
[Using Angle sum property of a quadrilateral]

IV. Thus, PA and PB are the required tangents to the given circle.



Q. 3. *Draw ΔABC in which AB = 3.8 cm, $\angle B$ = 60° and median AD = 3.6 cm. Draw another triangle $AB'C'$ similar to the first such that $AB' = \left(\dfrac{4}{3}\right)AB$.*



Sol. Steps of construction:

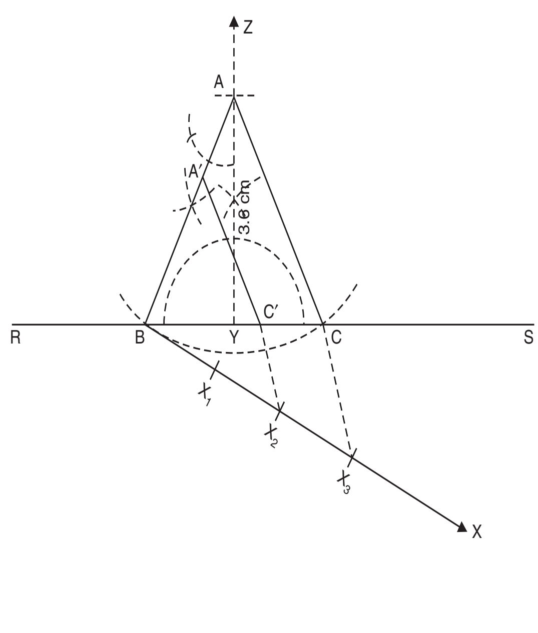
I. Draw AB = 3.8 cm.
II. Construct $\angle ABY$ = 60°.
III. With centre A and radius as 3.6 cm mark a ray to intersect BY at D.
IV. With centre D and radius BD, mark an arc to intersect BY at C.
V. Join CA. Thus, ABC is a triangle.
VI. Draw a ray AX, such that $\angle BAX$ is an acute angle.
VII. Mark 4 points X_1, X_2, X_3 and X_4 such that $AX_1 = X_1X_2 = X_2X_3 = X_3X_4$.
VIII. Join X_3B.
IX. Through X_4 draw $X_4B' \parallel X_3B$
X. Through B' draw $B'C' \parallel BC$ where C' lies on AC (produced).

Thus, $\Delta C'AB$ is the required triangle.

Q. 4. *Draw an equiliateral triangle of height 3.6 cm. Draw another triangle similar to it such that its side is $\dfrac{2}{3}$ of the side of the first.*

Sol. Steps at construction:

I. Draw a line segment RS.
II. Mark a point Y on it.
III. Through Y, draw $YZ \perp RS$
IV. Mark a point A on YZ such that YA = 3.6 cm
V. At A draw $\angle YAB$ = 30° such that the point B is on RS.
VI. With centre A and radius = AB, mark a point C on RS.
VII. Join AC.
VIII. Draw a ray BX such that $\angle CBX$ is an acute angle.
IX. Mark three points X_1, X_2, X_3 such that $AX_1 = X_1X_2 = X_2X_3$.
X. Join X_3 and C.
XI. Through X_2 draw $X_2C' \parallel X_3C$.
XII. Through C' draw $C'A' \parallel CA$.



Thus, $\Delta A'BC'$ is the required triangle.

Q. 5. *Draw an isosceles ΔABC, in which $AB = AC = 5.6$ cm and $\angle ABC = 60°$. Draw another $\Delta AB'C'$ similar to ΔABC such that $AB' = \left(\frac{2}{3}\right) AB$.*

Sol. Steps of Construction:

I. Draw a ray BD.

II. Through B, draw another ray BE such that $\angle DBE = 60°$.

III. Cut off $BA = 5.6$ cm.

IV. With A as centre and radius 6 cm, mark an arc intersecting BD at C.

V. Join A and C to get ΔABC.

VI. Draw a ray BX such that $\angle CBX$ is an acute angle.

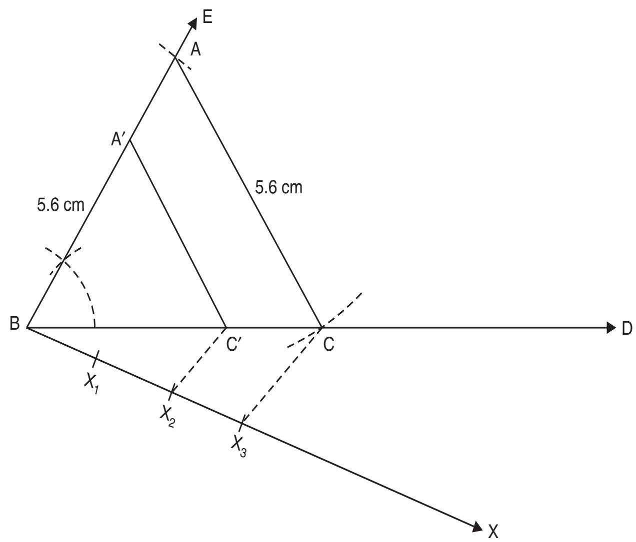
VII. Mark three point X_1, X_2 and X_3 such that $BX_1 = X_1X_2 = X_2X_3$.

VIII. Join X_3 and C.

IX. Through X_2 draw $X_2C' \parallel X_3C$

X. Through C', draw $C'A' \parallel CA$

Thus, $\Delta A'BC'$ is the required triangle.



Q. 6. *Construct an isosceles triangle whose base is 9 cm and altitude is 5 cm. Then construct another triangle whose sides are $\frac{3}{4}$ of the corresponding sides of the first isosceles triangle.*

(CBSE 2009 C)

Sol. Steps of construction:

I. Construct a ΔABC such that $AB = AC$, $BC = 9$ cm and altitude $AD = 5$ cm.

II. Through B, draw a ray BX such that $\angle CBX$ is an acute angle.

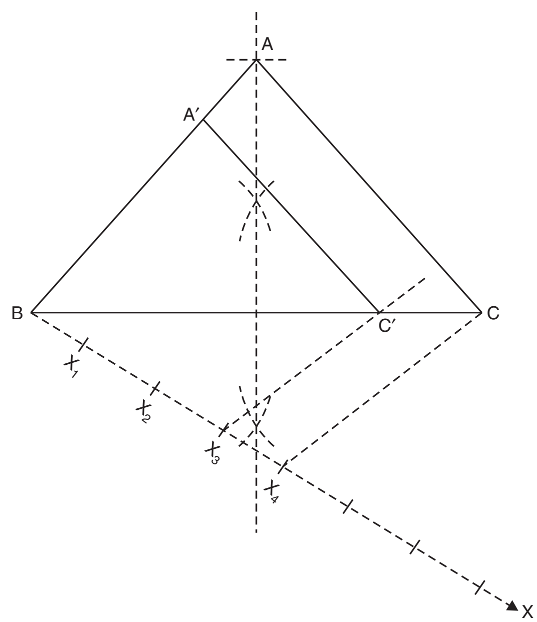
III. Mark 4 equal points X_1, X_2, X_3 and X_4 on BX. such that $BX_1 = X_1X_2 = X_2X_3 = X_3X_4$

IV. Join X_4 and C.

V. Through X_3, draw $X_3C' \parallel X_4C$, intersecting BC in C'.

VI. Through C', draw $C'A' \parallel CA$, intersecting AB in A'.

Thus, $\Delta A'BC'$ is the required triangle.

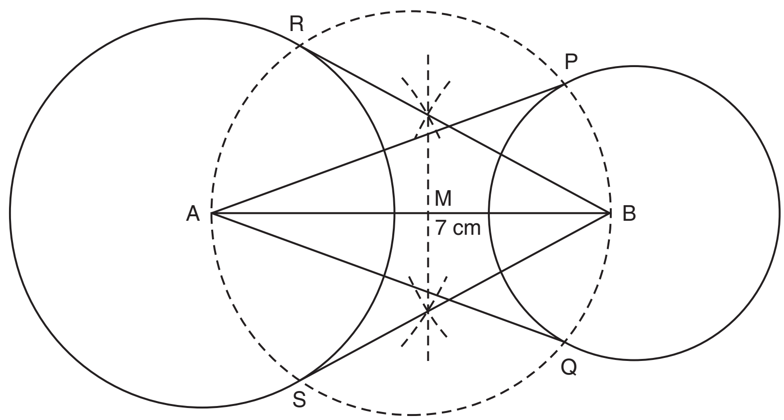


Q. 7. *Draw a line segment AB of length 7 cm. Taking A as centre draw a circle of radius 3 cm and taking B as centre, draw another circle of radius 2.5 cm. Construct tangents to each circle from the centre of the other circle.* *[CBSE 2009 C.]*

Sol. Steps of construction:

I. Draw a line segment AB = 7 cm

II. With centre A and radius 3 cm, draw a circle.



III. With centre B and radius 2.5 cm, draw another circle.

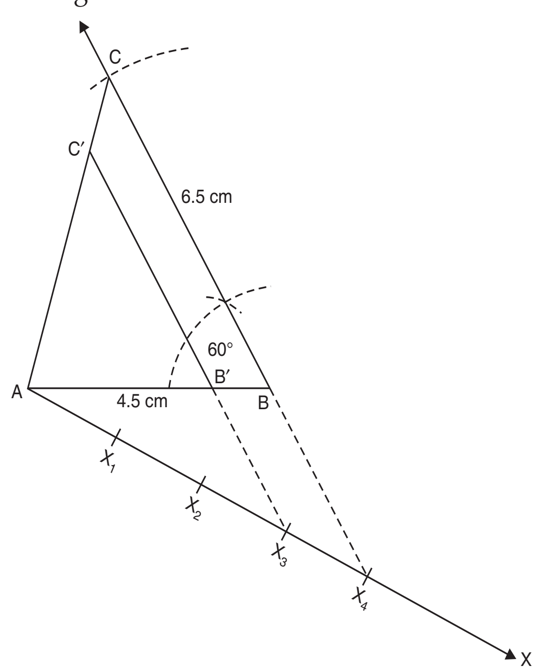
IV. Bisect AB and let M be the mid point of AB.

V. With centre M and radius AM, draw a circle intersecting the two circles in P,Q and R,S.

VI. Join AP, AQ, BR and BS.

Thus, AP, AQ, BR and BS are required tangents.

Q. 8. *Construct a ΔABC in which BC = 6.5 cm, AB = 4.5 cm and $\angle ABC$ = 60°. Construct a triangle similar to this triangle whose sides are $\frac{3}{4}$ of the corresponding sides of the ΔABC.* (CBSE 2009)



Sol. Steps of construction:

I. Construct the ΔABC such that AB = 4.5 cm, $\angle B$ = 60° and BC = 6.5 cm.

II. Construct an acute angle $\angle BAX$.

III. Mark 4 points X_1, X_2, X_3 and X_4 on AX such that $AX_1 = X_1X_2 = X_2X_3 = X_3X_4$.

IV. Join X_4 and B.

V. Draw $X_3 B' \parallel BC$, meeting AC at C'.

Thus, $\Delta C'AB'$ is the required Δ.

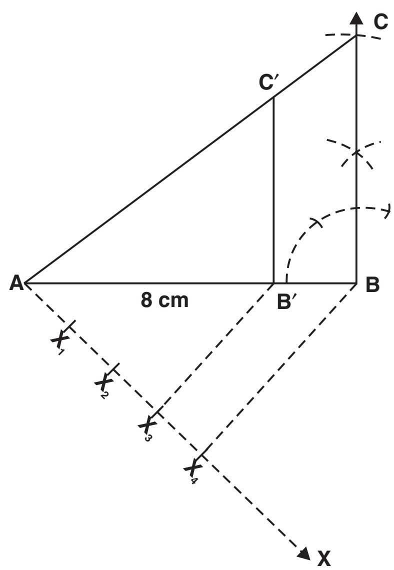
Q. 9. *Draw a right triangle in which sides (other than hypotenuse) are of lenghts 8 cm and 6 cm. Then construct another triangle whose sides are $\frac{3}{4}$ times the corresponding sides of the first triangle.* (AI CBSE 2009)

Sol. Steps of construction:

I. Draw a ΔABC such that $AB = 8$ cm, $\angle B = 90°$ and $BC = 6$ cm.

II. Construct an acute angle $\angle BAX$.

III. Mark 4 points X_1, X_2, X_3 and X_4 on AX such that $AX_1 = X_1X_2, = X_2X_3 = X_3X_4$.



IV. Join X_4 and B.

V. Draw $X_3B' \parallel X_4B$.

VI. Draw $B'C' \parallel BC$.

Thus, $\Delta AB'C'$ is the required rt Δ.

Q. 10. *Construct a ΔABC in which $BC = 5$ cm, $CA = 6$ cm and $AB = 7$ cm. Construct a $\Delta A'BC'$ similar to ΔABC, each of whose sides are $\frac{7}{5}$ times the corresponding sides of ΔABC.*

Sol. Steps of construction:

I. Construct ΔABC such that:

$BC = 5$ cm, $CA = 6$ cm and $AB = 7$ cm.

II. Draw a ray BX such that $\angle CBX$ is an acute angle.

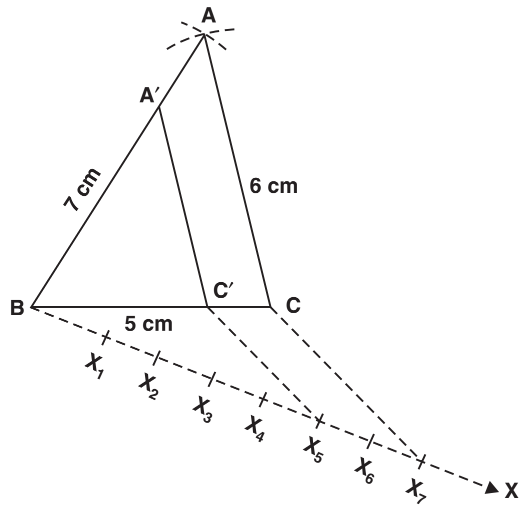
III. Mark 7 points X_1, X_2, ... X_7 such that:

$BX_1 = X_1X_2, = X_2X_3 = X_3X_4 = X_4X_5 = X_5X_6 = X_6X_7$

IV. Join X_7 and C.

V. Draw a line through X_5 parallel to $X_7\,C$ to meet BC extended at C'.

VI. Through C', draw a line parallel to CA to meet BA extended at A'.



Thus, $\Delta A'BC'$ is the required triangle.

Q. 11. *Construct a triangle with sides 4 cm, 5 cm and 7 cm. Then construct a triangle similar to it whose sides are $\frac{2}{3}$ of the corresponding sides of the given triangle.* (AI CBSE 2008 C)

Sol. Steps of construction:

I. Construct the ΔABC such that BC = 7 cm, CA = 5 cm and BA = 4 cm.

II. Draw a ray BX such that $\angle CBX$ is an acute angle.

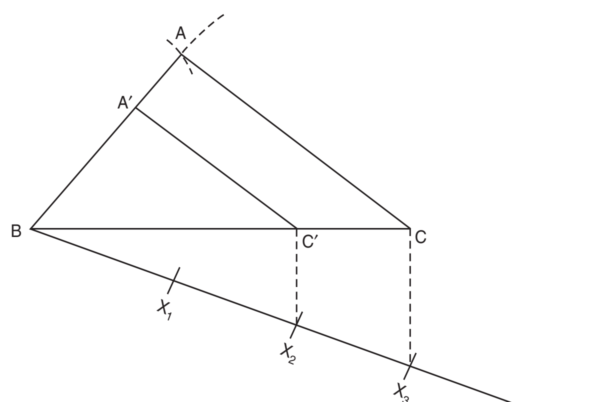
III. Mark three points X_1, X_2 and X_3 on BX such that:

$$BX_1 = X_1 X_2 = X_2 X_3$$

IV. Join X_3 and C.

V. Draw $X_2C' \parallel X_3C$.

VI. Draw $C'A' \parallel CA$



Thus, $\Delta A'BC'$ is the required triangle.

Q. 12. *Construct a ΔABC in which AB = 6.5 cm, $\angle B$ = 60° and BC = 5.5 cm. Also construct a triangle $AB'C'$ similar to ΔABC whose each side is $\frac{3}{2}$ times the corresponding side of the ΔABC.*

(CBSE 2008)

Sol. Steps of construction:

I. Construct a ΔABC such that AB = 6.5 cm, $\angle B$ = 60° and BC = 5.5 cm.

II. Draw a ray AX making an acute angle $\angle BAX$.

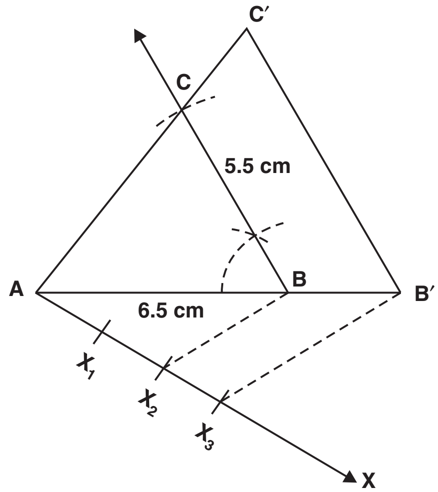
III. Mark three points X_1, X_2, X_3 on the ray AX such that $AX_1 = X_1 X_2 = X_2 X_3$

IV. Join X_2 and B.

V. Draw $X_3B' \parallel X_2B$ such that B' is a point on extended AB.

VI. Join $B'C' \parallel BC$ such that C' is a point on AC (extended).

Thus, $\Delta C'AB'$ is the required triangle.



Q. 13. *Draw a ΔABC with side $BC = 6$ cm, $AB = 5$ cm and $\angle ABC = 60°$. Construct $\Delta AB'C'$ similar to ΔABC such that sides of $\Delta AB'C'$ are $\frac{3}{4}$ of the corresponding sides of ΔABC.* (AI CBSE 2008)

Sol. Steps of construction:

I. Construct the given ΔABC.

II. Draw a ray AX such that $\angle BAC$ *is an acute angle.*

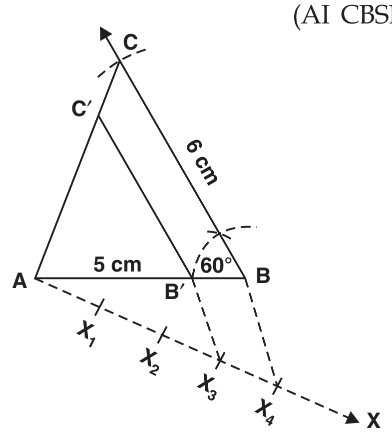
III. Mark 4 points X_1, X_2, X_3 and X_4 on $\overrightarrow{AX}$ such that $AX_1 = X_1X_2 = X_2X_3 = X_3X_4$.

IV. Join X_4B.

V. Draw $X_3B' \parallel X_4B$

VI. Through B' draw $B'C' \parallel BC$.

Thus, $\Delta B'AC'$ is the required triangle.



Q. 14. *Draw a circle of radius 3 cm. From a point P, 6 cm away from its centre, construct a pair of tangents to the circle. Measure the lengths of the tangents.* (AI CBSE F 2009)

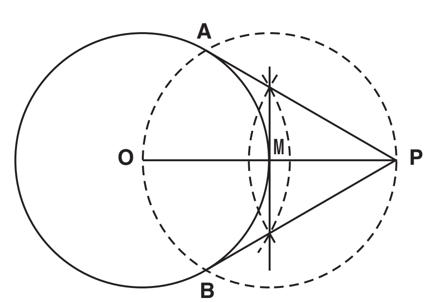
Sol. Steps of construction:

I. Draw the given circle such that its centre is at O and radius = 3 cm.

II. Mark a point P such that $OP = 6$ cm.

III. Bisect OP. Let M be the mid point of OP.

IV. Taking M as centre and OM as radius draw a circle intersecting the given circle at A and B.



V. Join PA and PB.

Thus, PA and PB are the required tangents to the given circle.

Q. 15. *Construct a triangle whose perimeter is 13.5 cm and the ratio of the three sides is 2 : 3 : 4.* (CBSE 2012)

Sol. Steps of construction:

I. Draw a line PQ = 13.5 cm

II. At P, draw a ray PR making a convenient acute angle $\angle QPR$ with PQ.

III. On PR mark (2 + 3 + 4), 9 points at equal distances.

IV. Join Q and the mark 9.

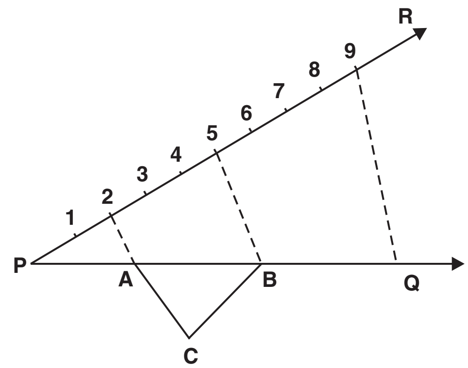
V. Through the points 2 and 5 draw lines 2-A and 5-B parallel to 9-Q. Let these lines meet PQ at A and B respectively.

VI. With A as centre and radius = AP, draw an arc.

VII. With B as centre and radius = BQ, draw another arc which intersects the arc of step VI at C.

VIII. Join CA and CB.

ABC is the required triangle.



TEST YOUR SKILLS

1. Draw a line AB = 12 cm and divide it in the ratio 3 : 5. Measure the two parts. (CBSE 2007)

2. Draw a rt. ΔABC, in which $\angle B = 90°$, BC = 5 cm, AB = 4 cm. Then construct another $\Delta A'BC'$ whose sides are $\frac{5}{3}$ times the corresponding sides of ΔABC. (AI CBSE 2008)

3. Construct a triangle similar to a given ΔABC such that each of its sides is $\frac{2}{3}$rd of the corresponding side of the ΔABC. It is given that AB = 4 cm, BC = 5 cm and AC = 6 cm. Also write the steps of construction. (CBSE 2012)

4. Construct a triangle similar to a given triangle ABC with its sides $\frac{4}{5}$th of the corresponding sides of ΔABC. Also, write the steps of construction. (AI CBSE 2006)

5. Draw a circle of radius 3 cm. Take a point at a distance of 5 cm from the centre of the circle. Measure the length of each tangent. (CBSE 2006 C)

6. Divide a line segment of 7 cm internally in the ratio 2 : 3. (AI CBSE 2006 C)

7. Draw any triangle ABC. Construct another triangle $AB'C'$ similar to the triangle ABC with each side equal to $\frac{4}{5}$th of the corresponding side of triangle ABC. (CBSE 2004)

8. Divide a line segment of length 6 cm internally in the ratio 3 : 2. (AI CBSE 2004)

9. Divide a line segment of length AB = 6 cm into 2 : 3 internally. (AI CBSE 2004)

10. Draw a circle of radius 3.5 cm, from a point P outside the circle at a distance of 6 cm from the centre of circle, draw two tangents to the circle. (AI CBSE 2005)

11. Construct a triangle similar to a given ΔABC with sides equal to $\frac{5}{3}$ of the corresponding sides of ΔABC. (AI CBSE 2005)

12. Construct a ΔPQS such that PQ = 4.5 cm, PS = 4 cm and SQ = 5.4 cm. Construct another triangle $P'QS'$ similar to ΔPQS with side $S'Q$ = 7.2 cm. (CBSE 2005)

13. Construct a ΔABC in which AB = 6 cm, $\angle B = 60°$ and AC = 7 cm. Construct a Δ similar to the ΔABC whose sides are $\frac{4}{7}$ of the corresponding sides. (AI CBSE 2005, CBSE 2012)

14. Draw a right triangle in which the sides (other than hypotenuse) are of lengths 4 cm and 3 cm. Then construct another triangle whose sides are $\frac{3}{5}$ times the corresponding sides of the given triangle. [CBSE 2012]

15. Draw a right triangle ABC in which BC = 12 cm, AB = 5 cm and $\angle B = 90°$. Construct a right Δ similar to it and of scale factor $\frac{2}{3}$. (NCERT Exemplar)

16. Draw a right triangle in which the sides (other than hypotenuse) are of lengths 4 cm and 3 cm. Then construct a triangle similar to it and of scale factor $\frac{5}{3}$.

17. Draw a triangle ABC with side BC = 7 cm, $\angle B = 45°$, $\angle A = 105°$. Then, construct a Δ whose sides are $\frac{4}{3}$ times the corresponding sides of ΔABC. (CBSE 2011)

18. Construct a rhombus $ABCD$ in which AB = 4 cm and $\angle ABC = 60°$. Divide it into two triangles ABC and ADC. Construct the triangle $AB'C'$ similar to ΔABC with the scale factor $\frac{2}{3}$. Draw a line segment $C'D'$ parallel to CD, where D' lies on AD. Is $AB'\,C'\,D'$ a rhombus? Give reasons. (CBSE 2011, 2012)

19. Draw a circle of radius 1.5 cm. Take a point P outside it. Without using the centre, draw two tangents to the circle from the point P. (CBSE 2011, 2012)

20. Draw a right triangle ABC in which AB = 6 cm, BC = 8 cm and $\angle B = 90°$. Draw BD perpendicular from B on AC and draw a circle passing through the points B, C and D. Construct tangents from A to this circle. [CBSE (Delhi) 2014]

21. Construct a triangle with sides are 5 cm, 5.5 cm and 6.5 cm. Now construct another triangle, whose sides are $\frac{3}{5}$ times the corresponding sides of the given triangle. (AI CBSE 2014)

22. Construct a triangle ABC, in which AB = 5 cm, BC = 6cm and AC = 7cm. Then construct another triangle whose sides are $\frac{3}{5}$ times the corresponding sides of ΔABC.

[AI CBSE (Foreign) 2014]