CBSE Class 10 Mathematics

Important Questions

Chapter 11

Constructions

1 Marks Questions

1. The length of tangent from a point A at a distance of 5 cm from the centre of the circle is 4 cm. What will be the radius of circle?

(a) 1 cm

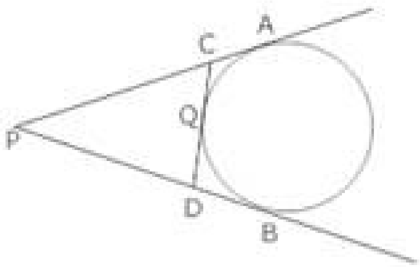
(b) 2 cm

(c) 3 cm

(d) none of these

Ans. c) 3 cm

2. In the figure given below, PA and PB are tangents to the circle drawn from an external point P. CD is a third tangent touching the circle at Q. If PB = 12 cm and CQ = 3 cm, what is the length of PC?



(a) 9 cm

(b) 10 cm

(c) 1 cm

(d) 13 cm

Ans. (a) 9 cm

3. The tangent of a circle makes angle with radius at point of contact

(a) 60°

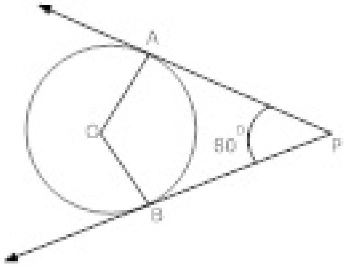
(b) 30°

(c) 90°

(d) none of these

Ans. (c) 90°

4. If tangent PA and PB from a point P to a circle with centre O are inclined to each other at an angle of 80°, then what is the value of $\angle POA$?



(a) 30°

(b) 50°

(c) 70°

(d) 90°

Ans. (b) 50°

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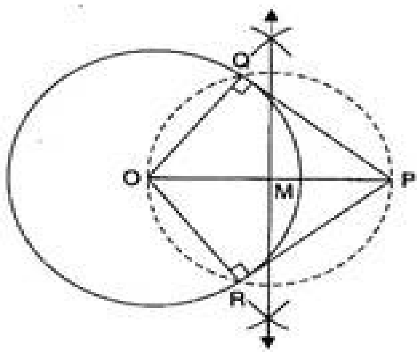
2 Marks Questions

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

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.

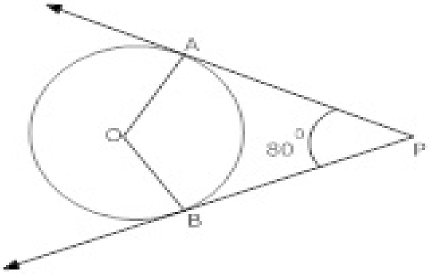
$\therefore \angle OQP = 90^\circ = \angle ORP$

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. In figure, PA and PB are tangents from P to the circle with centre O. R is a point on the circle,prove that PC + CR = PD + DR.



Ans. Since length of tangents from an external point to a circle are equal in length

$\therefore PA = PB$

$CA = CR$ ...(i)

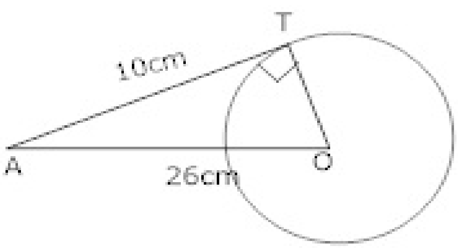
And DB = DR

Now PA = PB

$\Rightarrow$ PC + CA = PD + DB

$\Rightarrow$ PC + CR = PD + DR [By (i)]

3. The length of tangents from a point A at distance of 26 cm from the centre of the circle is 10cm, what will be the radius of the circle?



Ans. Since tangents to a circle is perpendicular to radius through the point of contact

$\therefore \angle OTA = 90^\circ$

In right $\Delta OTA = 90^\circ$, we have

$OA^2 = OT^2 + AT^2$

$\Rightarrow (26)^2 = OT^2 + (10)^2$

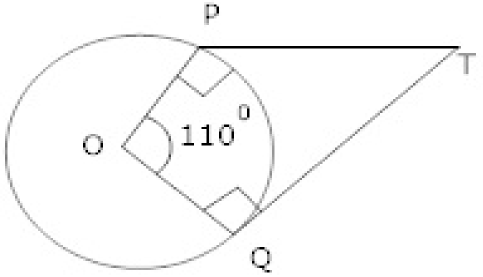
$\Rightarrow OT^2 = 676 - 100$

$\Rightarrow OT^2 = 576$

$\Rightarrow OT = 24$

Hence, radius of circle is 24 cm

4. In the given figure, if TP and TQ are the two tangents to a circle with centre O so that $\angle POQ = 110^\circ$, then find $\angle PTO$.



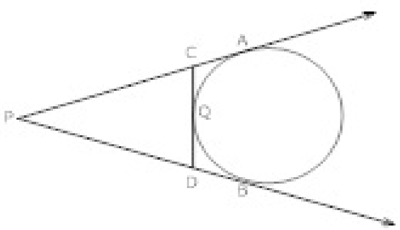
Ans. Since $\angle POQ + \angle PTO = 180^\circ$

$[\because \angle OPT = 90^\circ, \angle OQT = 90^\circ]$

$\Rightarrow 110^\circ + \angle PTQ = 180^\circ$

$\Rightarrow \angle PTQ = 180^\circ - 110^\circ = 70^\circ$

5. In the figure, given below PA and PB are tangents to the circle drawn from an external point P. CD is thethird tangent touching the circle at Q. If PB = 10 cm and CQ = 2 cm, what is the length of PC?



Ans. PA=PB=10 cm

CQ = CA = 2 cm

PC = PA – CA = 10 – 2 = 8 cm

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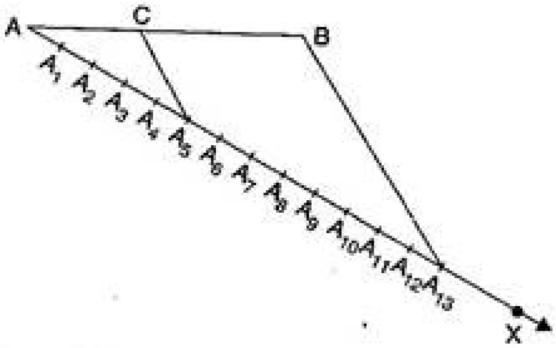
3 Marks Questions

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

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



Ans. Given: A line segment of length 7.6 cm.

To construct: To divide it in the ration 5 : 8 and to measure the two parts.

Steps of construction:

(a) From any ray AX, making an acute angle with AB.

(b) Locate 13 (=5 + 8) points A_1, A_2, A_3, A_4, A_5, A_6, A_7, A_8, A_9, A_{10}, A_{11}, A_{12} and A_{13} on AX such that $AA_1 = A_1A_2 = A_2A_3 = A_3A_4 = A_4A_5 = A_5A_6 = A_6A_7 = A_7A_8 = A_8A_9 = A_9A_{10} = A_{10}A_{11} = A_{11}A_{12} = A_{12}A_{13}$.

(c) Join BA_{13}.

(d) Through the point A_5, draw a line parallel to $A_{13}B$ intersecting AB at the point C.

Then, AC : CB = 5 : 8

On measurement, AC = 3.1 cm, CB = 4.5 cm

Justification:

$\because$ $A_5C \parallel A_{13}B$ [By construction]

$\therefore$ $\frac{AA_5}{A_5A_{13}} = \frac{AC}{CB}$ [By Basic Proportionality Theorem]

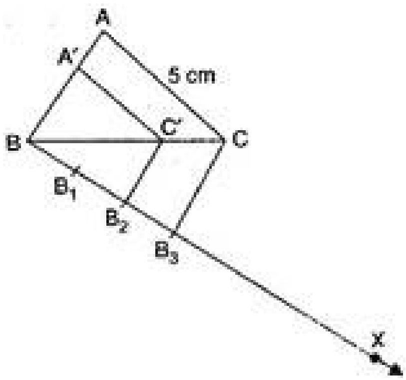
But $\frac{AA_5}{A_5A_{13}} = \frac{5}{8}$ [By construction]

Therefore, $\frac{AC}{CB} = \frac{5}{8}$

$\Rightarrow$ AC : CB = 5 : 8

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

Ans. To construct: To 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.



Steps of construction:

(a) Draw a triangle ABC of sides 4 cm, 5 cm and 6 cm.

(b) From any ray BX, making an acute angle with BC on the side opposite to the vertex A.

(c) Locate 3 points B_1, B_2 and B_3 on BX such that $BB_1 = B_1B_2 = B_2B_3$.

(d) Join B_3C and draw a line through the point B_2, draw a line parallel to B_3C intersecting BC at the point C'.

(e) Draw a line through C' parallel to the line CA to intersect BA at A'.

Then, A'BC' is the required triangle.

Justification:

$\because$ $B_3C \parallel B_2C'$ [By construction]

$\therefore \dfrac{BB_2}{B_2B_3} = \dfrac{BC'}{C'C}$ [By Basic Proportionality Theorem]

But $\dfrac{BB_2}{B_2B_3} = \dfrac{2}{1}$ [By construction]

Therefore, $\dfrac{BC'}{C'C} = \dfrac{2}{1}$

$\Rightarrow \dfrac{C'C}{BC'} = \dfrac{1}{2}$

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

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

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

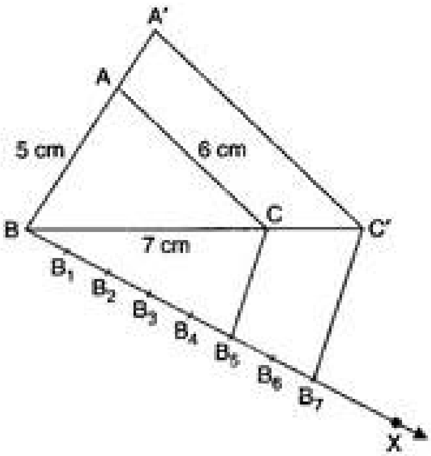
$\Rightarrow \dfrac{BC'}{BC} = \dfrac{2}{3}$ ....(i)

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

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

$\therefore \frac{AB'}{AB} = \frac{A'C'}{AC} = \frac{BC'}{BC} = \frac{2}{3}$ [From eq. (i)]

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



Ans. To construct: To construct a triangle of sides 5 cm, 6 cm and 7 cm and then a triangle similar to it whose sides are $\frac{7}{5}$ of the corresponding sides of the first triangle.

Steps of construction:

(a) Draw a triangle ABC of sides 5 cm, 6 cm and 7 cm.

(b) From any ray BX, making an acute angle with BC on the side opposite to the vertex A.

(c) Locate 7 points B_1, B_2, B_3, B_4, B_5, $B_6$and B_7 on BX such that $BB_1 = B_1B_2 = B_2B_3 = B_3B_4 = B_4B_5 = B_5B_6 = B_6B_7$.

(d) Join B_5C and draw a line through the point B_7, draw a line parallel to B_5C intersecting BC at the point C'.

(e) Draw a line through C' parallel to the line CA to intersect BA at A'.

Then, A'BC' is the required triangle.

Justification:

$\because$ C'A' || CA [By construction]

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

$\therefore \frac{A'B}{AB} = \frac{A'C'}{AC} = \frac{BC'}{BC}$ [By Basic Proportionality Theorem]

$\because$ $B_7C' \parallel B_5C$ [By construction]

$\therefore$ $\triangle BB_7C' \sim \triangle BB_5C$ [AA similarity]

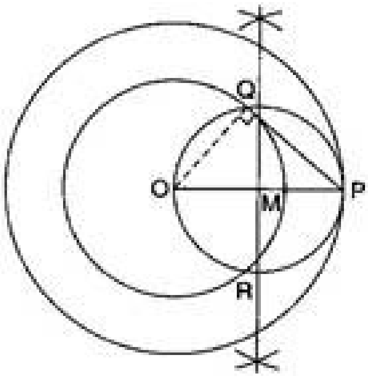
But $\frac{BB_5}{BB_7} = \frac{5}{7}$ [By construction]

Therefore, $\frac{BC}{BC'} = \frac{5}{7}$

$\Rightarrow \frac{BC'}{BC} = \frac{7}{5}$

$\therefore \frac{A'B}{AB} = \frac{A'C'}{AC} = \frac{BC'}{BC} = \frac{7}{5}$

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

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

= $\sqrt{36 - 16}$

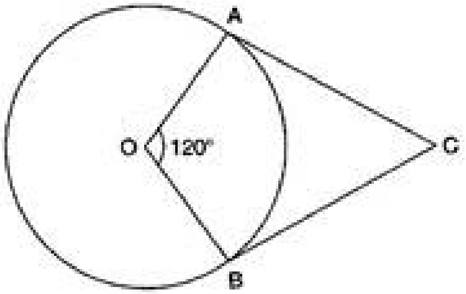
= $\sqrt{20}$ = 4.47 cm

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.

5. 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° and OA is a radius. [By construction]

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

$\because$ $\angle$OBC = 90° 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°

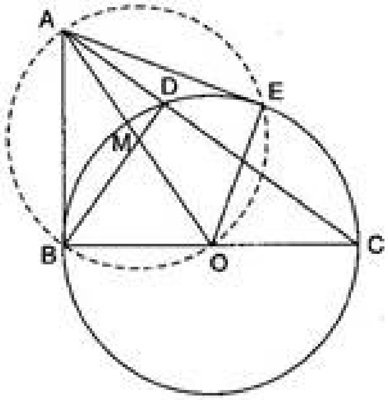
[Angle sum property of a quadrilateral]

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

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

$\Rightarrow \angle ACB = 60^\circ$

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.

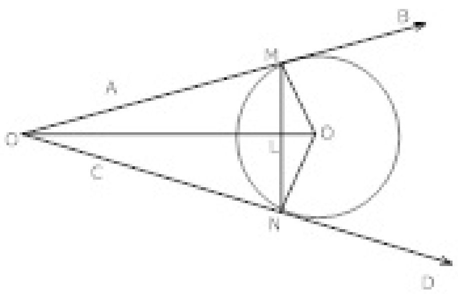
Then, $\angle$ AEO is an angle in the semicircle.

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

$\Rightarrow AE \perp OE$

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. Prove that the tangents drawn at the ends of a chord of a circle make equal angles with chord.



Ans. Let NM be chord of circle with centre C.

Let tangents at M.N meet at the point O.

Since OM is a tangent

$\therefore OM \perp CM$ i.e. $\angle OMC = 90^\circ$

$\because ON$ is a tangent

$\therefore ON \perp CN$ i.e. $\angle ONC = 90^\circ$

Again in ΔCMN, $CM = CN = r$

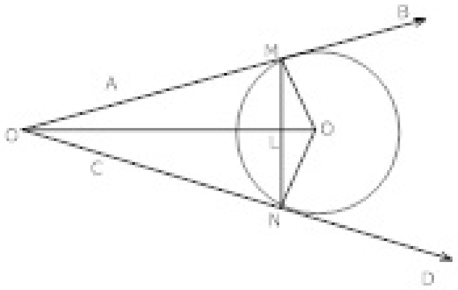
$\therefore \angle CMN = \angle CNM$

$\therefore \angle OMC - \angle CMN = \angle ONC - \angle CNM$

$\Rightarrow \angle OML = \angle ONL$

Thus, tangents make equal angle with the chord

8. In the given figure, if AB = AC, prove that BE = EC.



Ans. Since tangents from an exterior point A to a circle are equal in length

$\therefore AD = AF$............(i)

Similarly, tangents from an exterior point B to a circle are equal in length

$\therefore BD = BE$............(2)

Similarly, for C

CE = CF ....(3)

Now AB = AC

$\therefore AB - AD = AC - AD$

$\Rightarrow AB - AD = AC - AF$.........[By (i)]

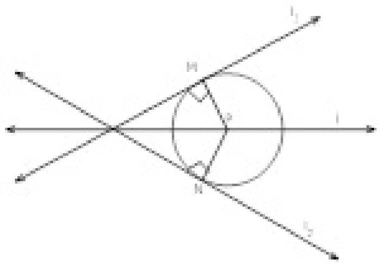
$\Rightarrow BD = CF$

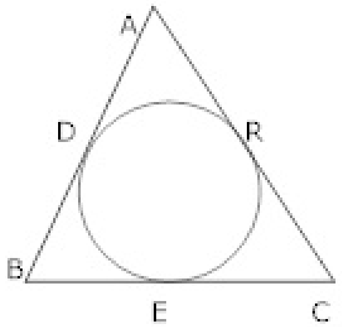
$\Rightarrow BE = CF$.........[By (ii)]

$\Rightarrow BE = CE$ [$\because BD = BE, CE = CF$] [By (iii)]

9. Find the locus of centre of circle with two intersecting lines.

Ans.





Let l_1, l_2 be two intersection lines.

Let a circle with centre P touch the two lines l_1 and l_2 at M and N respectively.

PM = PN [Radii of same circle]

∴ P is equidistance from the lines l_1 and l_2

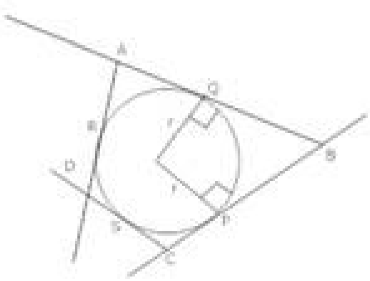
Similarly, centre of any other circle which touch the two intersecting lines l_1, l_2 will be equidistant from l_1 and l_2

∴ P lies on l a bisector of the angle between l_1 and l_2

[∵ The locus of points equidistant from two intersecting lines is the pair of bisectors of the angle between the lines]

Hence, locus of centre of circles which touch two intersecting lines is the pair of bisectors of the angles between the two lines.

10. In the given figure, a circle is inscribed in a quadrilateral ABCD in which $\angle B = 90°$. If AD = 23 cm, AB = 29 cm and DS = 5 cm, find the radius of the circle.



Ans. In the given figure, $OP \perp BC$ and OQ^ BA

Also, OP = OQ =r

$\therefore OPBQ$ is a square

∴ BP = BQ =r

But DR = DS = 5 cm ...(i)

$$\therefore AR = AD - DR$$
$$= 23 - 5 = 18\ cm$$
$$AQ = AR = 18\ cm$$
$$BQ = AB - AQ$$
$$= 20 - 18 = 11\ cm$$
$$r = 11\ cm$$

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Important Questions

Chapter 11

Constructions

4 Marks Questions

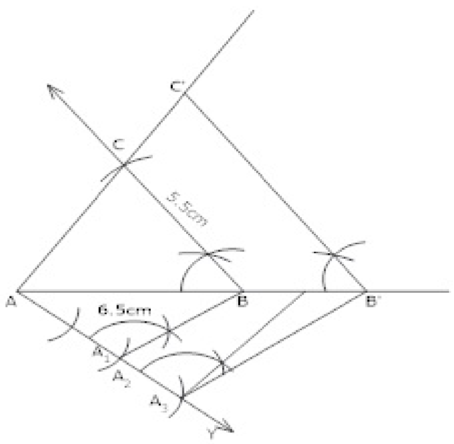
1. Construct a ΔABC in which $AB = 6.5\,cm, \angle B = 60^\circ$ and $BC = 5.5\,cm$. Also construct a triangle ABC similar to ΔABC whose each side is $\frac{3}{2}$ times the corresponding side of the ΔABC.

Ans. Steps of construction:

1. Draw a line segment AB = 6.5cm.
2. At B construct $\angle ABX = 60^\circ$.
3. With B as centre and radius BC = 5.5cm draw an arc intersecting BX at C.
4. Join AC.

Triangle so obtained is the required triangle.

5. Construct an acute angle ÐBAY at A on opposite side of vertex C of ΔABC.
6. Locate 3 points A_1, A_2, A_3 on AY such that $AA_1 = A_1A_2 = A_2A_3$.
7. Join A_2 to B and draw the line through A_3 parallel to A_2B intersecting the extended line segment AB at B'.
8. Draw a line through B' parallel to BC intersecting the extended line seg.AC at C'.
9. Δ AB'C' so obtained is the required triangle

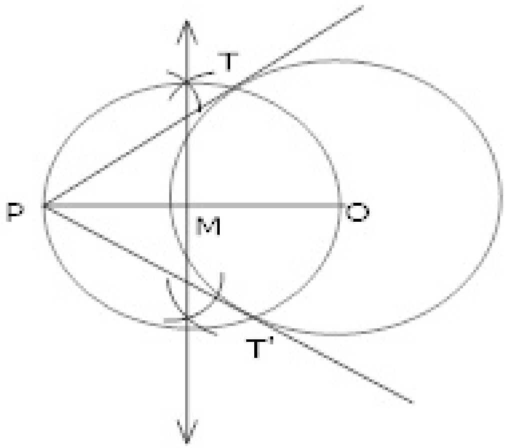


2. Draw a circle of radius 4 cm from a point P, 7 cm from the centre of the circle, draw a pair of tangents to the circle measure the length of each tangent segment.

Ans. Steps of construction:

1. Take a point O in the plane of a paper and draw a circle of the radius 4 cm.
2. Make a point P at a distance of 7 cm from the centre O and Join OP.
3. Bisect the line segment OP. Let M be the mid-point of OP.
4. Taking M as a centre and OM as radius draw a circle to intersect the given circle at the points T and T'.
5. Join PT and PT', then PT and PT' are required tangents.

PT = PT' = 5.75 cm



3. Draw a right triangle in which the sides containing the right angle are 5cm and 4cm.Construct a similar triangle whose sides are $\frac{5}{3}$ times the sides of the above triangle.

Ans. Steps of construction:

1. Draw a line segment BC = 5 cm.

2. At B construct $\angle CBX = 90°$.

3. With B as centre and radius = 4 cm draw an arc intersecting the ray BX at A.

4. Join AC to obtain the required ΔABC.

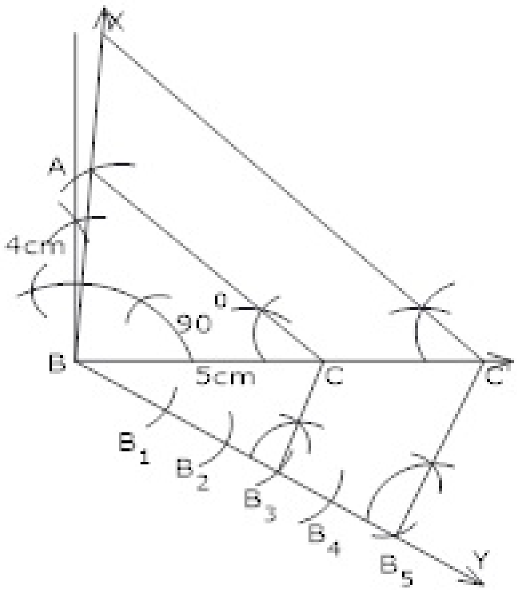
5. Draw any ray BY making an acute angle with BC on the opposite side to the vertex A.

6. Locate 5 points B_1, B_2, B_3, B_4 and B_5 on BY so that $BB_1 = B_1B_2 = B_2B_3 = B_3B_4 = B_4B_5$.

7. Join B_3 to C and draw a line through B_5 parallel to B_3C intersecting the extended line segment BC at C'.

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

Thus, DA'BC' is the required right triangle.



4. Construct a circle whose radius is equal to 4 cm. Let P be a point whose distance from its centre is 6 cm. Construct two tangents to it from P.

Ans. Steps of construction:

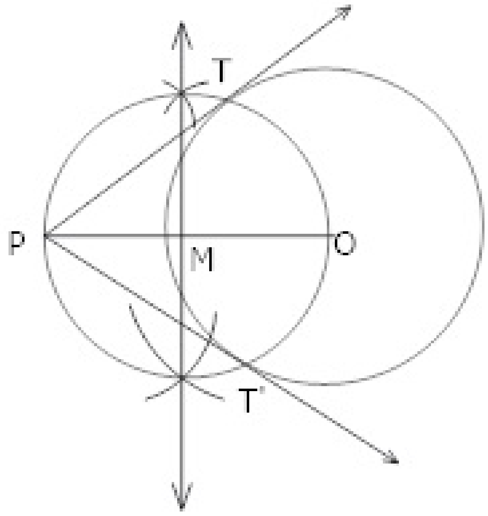
1. Take a point O in the plane of the paper and draw a circle of radius 4cm.

2. Make a point P at a distance of 6cm from the centre O and join OP.

3. Bisect the line segment OP. Let the point of bisection be M.

4. Taking M as centre and OM as radius, draw a circle to intersect the given circle at the point T and T'.

5. Join PT and PT' to get the required tangents.



5. Draw a triangle ABC with sides BC = 6.3 cm, AB = 5.2 cm and $\angle ABC = 60°$. Then construct a triangle whose sides are $\frac{4}{3}$ times the corresponding sides of ΔABC.

Ans. Steps of construction:

1. Draw a line segment BC = 6.3 cm.

2. At B make $\angle CBX = 60°$.

3. With B as centre and radius equal to 5.2 cm, draw an arc intersecting BX at A.

4. Join AC, then DABC is the required triangle.

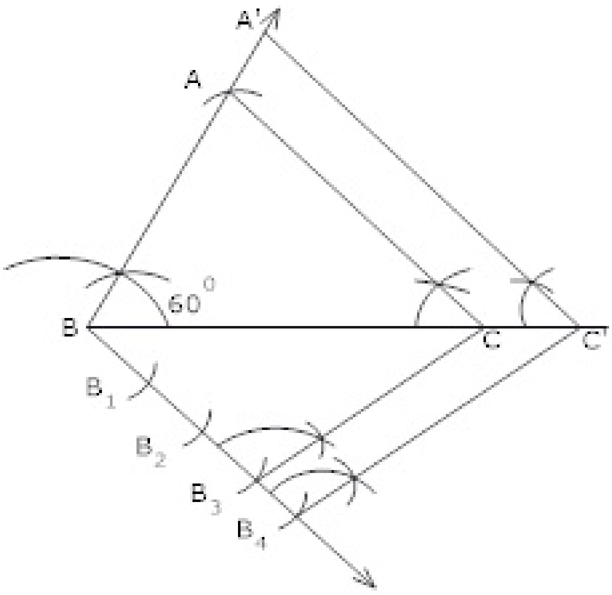
5. Draw any ray by making an acute angle with BC on the opposite side to the vertex A.

6. Locate the points B_1, B_2, B_3 *and* B_4 on BY so that $BB_1 = B_1B_2 = B_2B_3 = B_3B_4$.

7. Join B_3 to C and draw a line through B_4 parallel to B_3C intersecting the extended line segment BC at C'.

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

Thus, DA'BC' is the required triangle.



6. Draw a pair of tangents to a circle of radius 5 cm which are inclined to each other at $60°$.

Ans. Steps of construction:

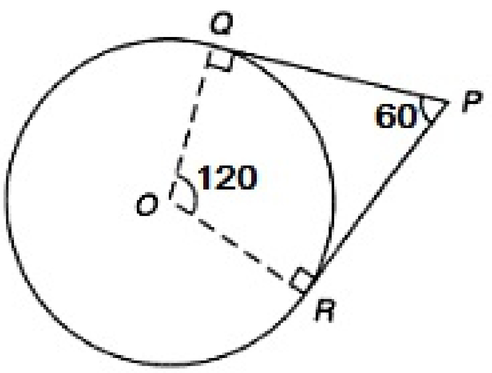
1. Draw a circle with center O and radius 5cm.

2. Draw any diameter AOC.

3. Construct $\angle BOC = 60°$ meeting the circle at B.

4. At A and B draw perpendiculars to OA and OB intersecting at P.

5. PA and PB are required tangents and $\angle APB = 60°$.



7. Draw the tangents at the extremities of a diameter AB of a circle of radius 2cm. Are

these tangents parallel? Given reasons.

Ans. Steps of construction:

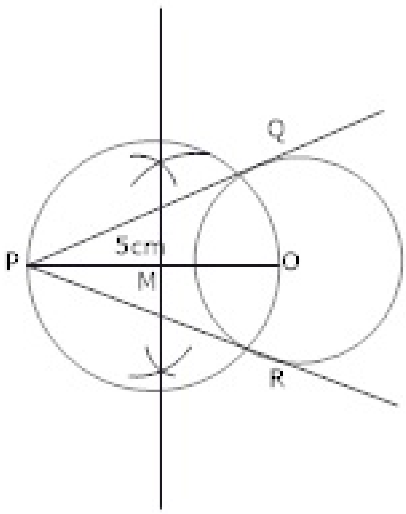
1. Draw a circle of radius 2 cm.

2. Draw any diameter AOB.

3. Draw $AT \perp AB$ and $BM \perp AB$.

4. AT and BM are tangents extremities of the diameter AB.

5. $\because \angle 1 = 90^\circ, \angle 2 = 90^\circ, \therefore \angle 1 = \angle 2$, they are alternate angles. $\therefore AT \parallel BM$



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8. Construct a ΔABC in which AB = 4 cm, BC = 5 cm and AC = 6 cm. Now construct a triangle similar to ΔABC such that each of its sides is two-third of the corresponding sides of ΔABC . Also prove your assertion.

Ans. Steps of construction:

1. Draw ΔABC with sides BC = 5 cm, AB = 4 cm and AC = 6 cm.

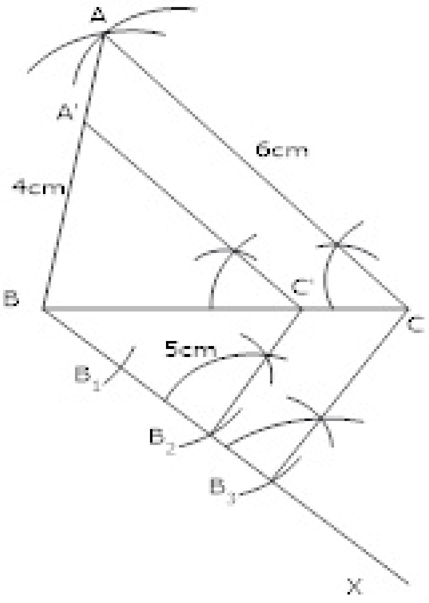
2. Below BC make acute $\angle CBX$.

3. Along BX mark off three points B_1, B_2 and B_3 such that $BB_1 = B_1B_2 = B_2B_3$.

4. Join B_3C.

5. Draw $B_2C' \parallel B_3C$ also $C'A' \parallel CA$

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



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

Ans. Steps of construction:

1. Construct a ΔABC is which AB = 6.5cm, $\angle B = 60°$ and BC = 5.5cm.

2. Draw a ray AX making any acute angle with AB on the opposite side of the vertex C.

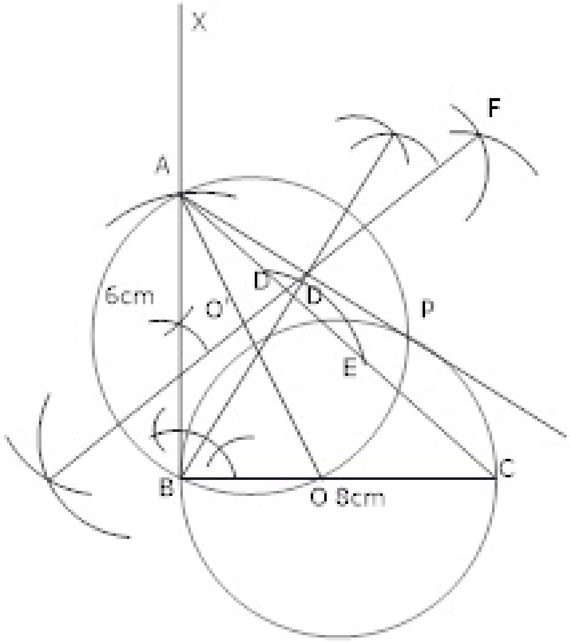
3. Cut three equal parts from AX say $AX_1 = X_1X_2 = X_2X_3$.

4. Join X_2 to B.

5. From X_3 draw $X_3B' \parallel X_2B$ at B'.

6. At B' draw $B'C' \parallel BC$ intersecting AY at C'.

7. $\Delta AB'C'$ is required triangle similar to ΔABC.



10. Draw a pair of tangents to a circle of radius 5cm which are inclined to each other at $60°$ **.**

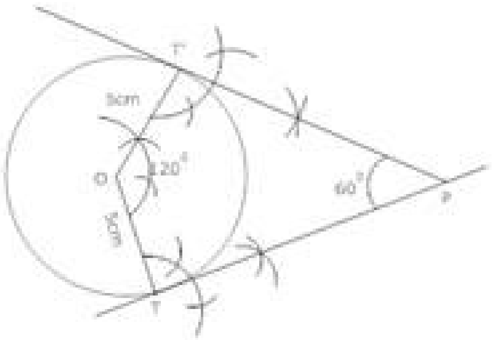
Ans. Steps of construction:

1. Draw a circle with centre O and radius 5cm.

2. Draw any radius OT.

3. Construct $\angle TOT' = 180° - 60° = 120°$.

4. Draw $TP \perp OT$ and $TP \perp OT$. Then PT' and PT are the two required tangents such that $\angle TPT' = 60°$. Here, $PT = PT'$



11. Draw a circle of radius 4 cm with centre O. Draw a diameter POQ. Through P or Q

draw tangent to the circle.

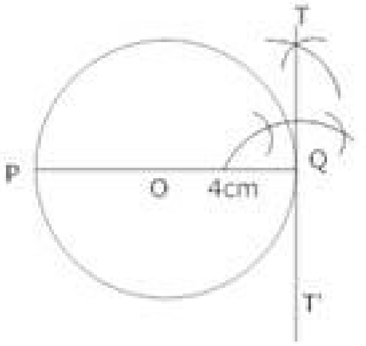
Ans. Steps of construction:

1. Draw a circle of radius 4 cm.

2. Draw diameter POQ.

3. Construct $\angle PQT = 90^\circ$.

4. Produce PQ to T', then TQT' is the required tangent at the point Q.



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

Ans. Steps of construction:

1. Draw a line segment AB = 5cm.

2. With A as centre and radius 6cm draw an arc.

3. Again B as centre and radius 7cm draw another arc cutting the previous arc at C. Join AC and BC,thenDABC is required triangle.

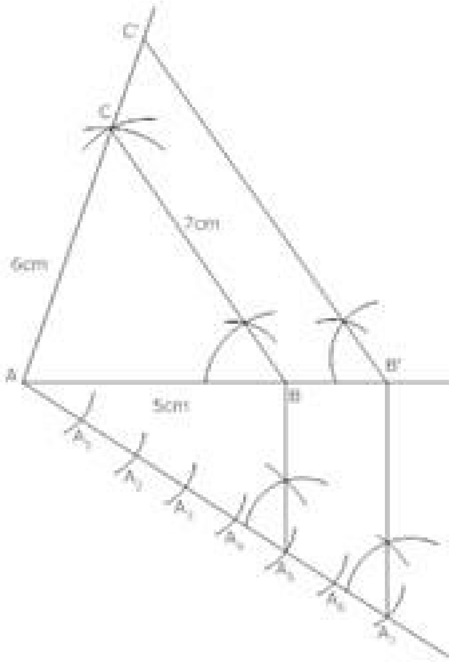
4. Draw any ray AX making acute angle.

5. Locate 7 points $A_1, A_2, A_3, A_4, A_5, A_6$ *and* A_7 on AX so that $AA_1 = A_1A_2 = A_2A_3 = A_3A_4 = A_4A_5 = A_5A_6 = A_6A_7$.

6. Join A_5 to B and draw a line through A_7 parallel to A_5B intersecting the extended line

segment AB at B'.

7. Draw $B'C' \parallel BC$, then $\Delta AB'C'$ is the required triangle



13. 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 and D is drawn construct the tangents from A to this circle.

Ans. Steps of construction:

1. Draw ΔABC with BC = 8 cm, AB = 6 cm and $\angle B = 90°$.

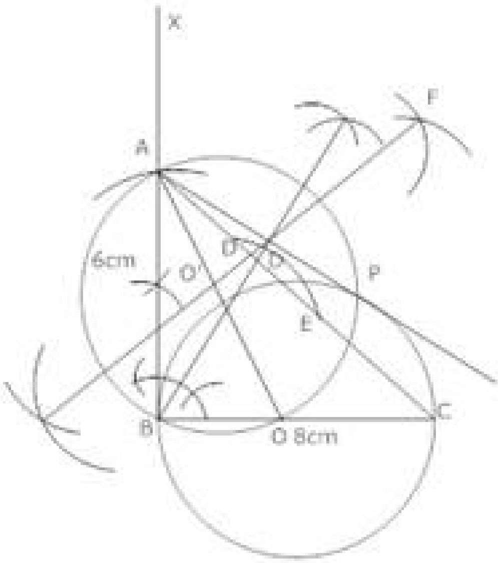
2. Draw perpendicular BD from B to AC.

3. Let O be the mid-point of BC. Draw a circle with centre O and radius OB = OC. This circle will pass through the point D.

4. Join AO and bisect AO.

5. Draw a circle with centre O' and $O'A$ as radius cuts the previous circle at B and P.

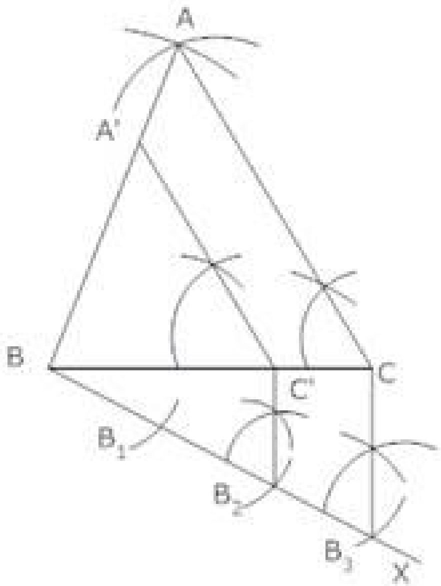
6. Join AP, AP and AB are required tangents drawn from A to the circle passing through B,C and D.



14. 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

Ans. Steps of construction:

1. Draw ΔABC with AB = 4 cm, BC = 6 cm and AC = 5 cm.
2. Draw any ray BX making an acute angle with BC on the side opposite to the vertex A.
3. Locate 3 points B_1, B_2 and B_3 on BX so that $BB_1 = B_1B_2 = B_2B_3$.
4. Join B_3C and draw $B_2C' \parallel B_3C$.
5. Draw a line through C' such that $C'A' \parallel CA$ Then, $\Delta A'BC'$ is the required triangle.



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

Ans. Steps of construction:

1. Draw line segment AB = 8 cm.

2. Draw perpendicular bisector of AB which intersects AB at D.

3. Cut DC = 4 cm. Join AC and BC. Thus, ΔABC is the required triangle.

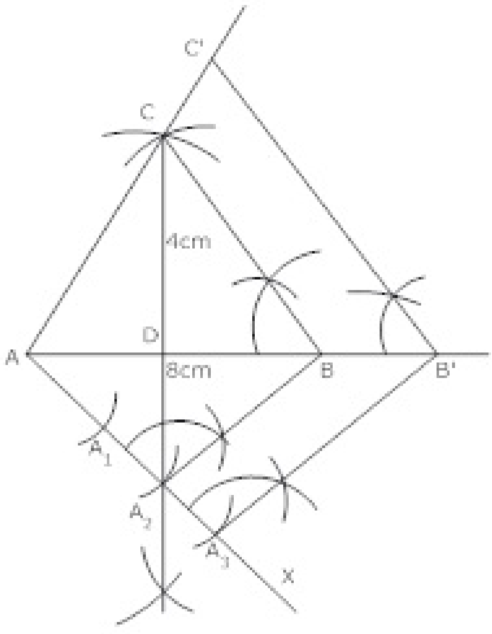
4. Draw acute angle $\angle BAX$.

5. Locate 3 points A_1, A_2 and A_3 on AX so that $AA_1 = A_1A_2 = A_2A_3$.

6. Join A_2B and draw $A_3B' \parallel A_2B$.

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

8. $\Delta AB'C'$ isthe required triangle



16. Draw a ΔABC with side BC = 7cm, $\angle B = 45°$ and $\angle A = 105°$, then construct a triangle whose sides are $\frac{4}{3}$ times the corresponding sides of ΔABC.

Ans. Steps of construction:

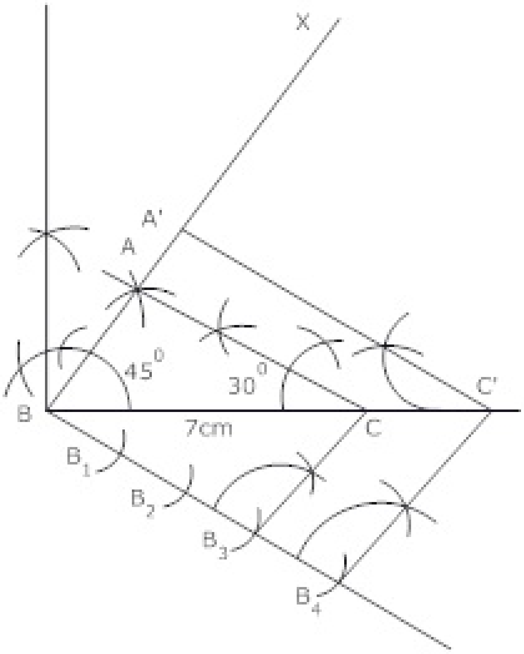
1. Draw ΔABC in which BC = 7cm, $\angle B = 45°$ and $\angle C = 30°$.

2. Locate 4 points B_1, B_2, B_3 and B_4 on BZ such that $BB_1 = B_1B_2 = B_2B_3 = B_3B_4$.

3. Join B_3C and draw $B_4C' \| B_3C$.

4. Now Draw $C'A' \| CA$

5. $\Delta BC'A'$ is the required triangle.



17. Construct a circle whose radius is equal to 4 cm. Let P be a point whose distance from its centre is 6 cm. Construct two tangents to it from P.

Ans. Steps of construction:

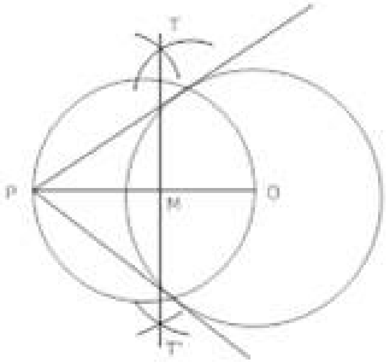
1. Draw a circle with centre O and radius 4 cm.

2. Mark point P at a distance of 6 cm from the centre O and join OP.

3. Bisect the line segment OP. Let the point of bisection be M.

4. Take M as centre and OM as radius draw a circle to intersect the given circle at the points T and T'.

5. Join PT and PT' to get the required tangents.



18. 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 to the other circle.

Ans. Steps of construction:

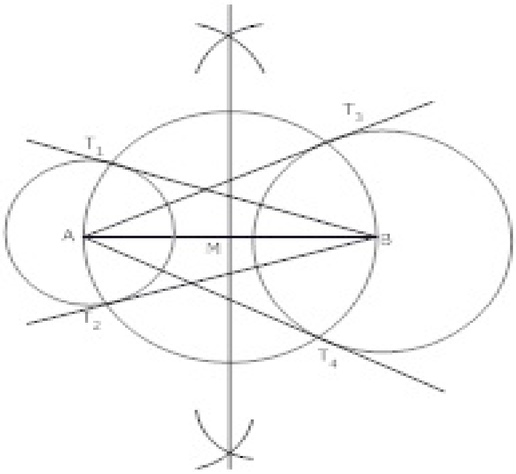
1. Draw a line segment AB = 8 cm.

2. Taking A as centre and radius = 4 cm draw a circle.

3. Taking B as centre and radius = 3 cm draw another circle.

4. Bisect the line segment AB, let the point of bisection be M.

5. Taking M as centre and MA as radius, draw a circle intersecting the given circles at the point T_1, T_2, T_3 and T_4.



19. 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.

Ans. Steps of construction:

1. Draw ΔABC in which AB = 4 cm, BC = 6 cm and AC = 5 cm.

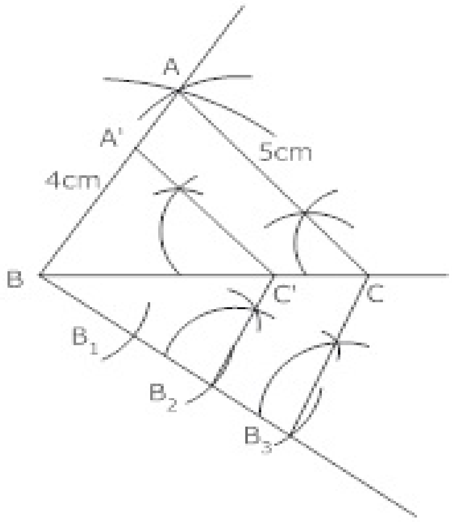
2. Draw acute $\angle CBX$.

3. Locate 3 points B_1, B_2 and B_3 on BX so that $BB_1 = B_1B_2 = B_2B_3$.

4. Join B_3C and draw $B_2C' \parallel B_3C$.

5. Now Draw $C'A' \parallel CA$

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



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

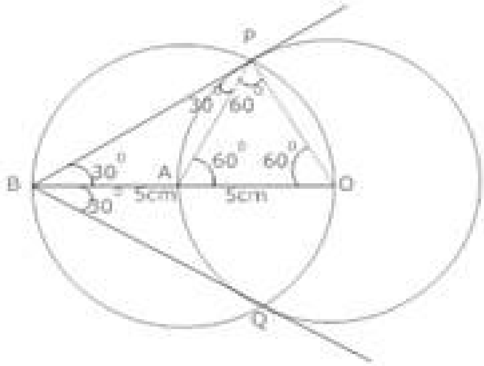
Ans. Steps of construction:

1. Draw a circle with centre O and radius OA = 5 cm.

2. Extend OA to B such that OA = AB = 5 cm

3. With A as centre draw a circle of radius OA = AB = 5 cm. Suppose it intersect the circle drawn in step 1 at the points P and Q.

4. Join BP and BQ. Then BP and BQ are the required tangents.



Justification: In ΔOAP,

$OA = OP = 5\,cm\,(r)$

Also, AP = 5 cm

ΔOAP is an equilateral triangle

$\Rightarrow \angle PAO = 60°$

$\Rightarrow \angle BAP = 120°$

In ΔBAP,

AB = AP and $\angle BAP = 120°$

$\therefore \angle ABP = \angle APB = 30°$

Similarly, $\angle ABQ = \angle AQB = 30°$

$\Rightarrow \angle PBQ = 60°$

21. From a point P two tangents are drawn to a circle with centre O. If OP = diameter of the circle, show that ΔAPB is equilateral

Ans. Join OP.

Suppose OP meets the circle at Q. Join AQ.

We have

i.e., OP = diameter

∴ OQ + PQ = diameter

PQ = Diameter – radius [∵ $OQ = r$]

∴ PQ = radius

Thus, OQ = PQ = radius

Thus, OP is the hypotenuse of right triangle

OAP and Q is the mid-point of OP

∴ OA = AQ = OQ

[∵ mid-point of hypotenuse of a right triangle is equidistant from the vertices]

$\Rightarrow \Delta OAQ$ is equilateral

$\Rightarrow \angle AOQ = 60°$

So, $\angle APO = 30°$

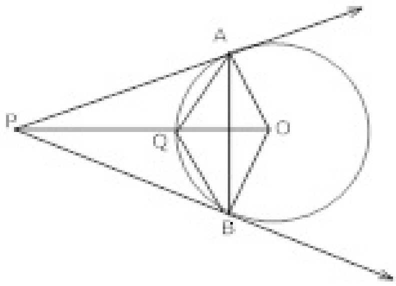
$\therefore \angle APB = 2\angle APO = 60°$

Also $PA = PB \Rightarrow \angle PAB = \angle PBA$

But $\angle APB = 60°$

$\angle APB = 60° \therefore \angle PAB = \angle PBA = 60°$

Hence, $\triangle APB$ is equilateral.



22. 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.

Ans. To construct: To construct an isosceles triangle whose base is 8 cm and altitude 4 cm and then a triangle similar to it whose sides are $1\frac{1}{2}\left(\text{or } \frac{3}{2}\right)$ of the corresponding sides of the first triangle.

Steps of construction:

(a) Draw BC = 8 cm

(b) Draw perpendicular bisector of BC. Let it meets BC at D.

(c) Mark a point A on the perpendicular bisector such that AD = 4 cm.

(d) Join AB and AC. Thus $\triangle$ABC is the required isosceles triangle.

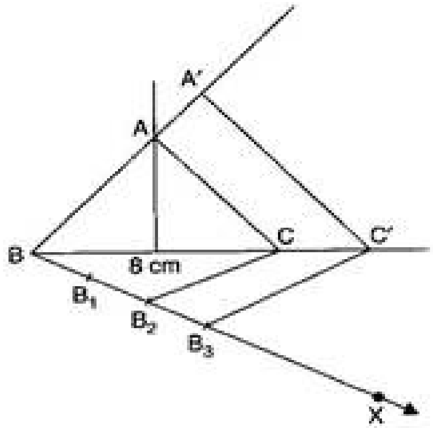
(e) From any ray BX, making an acute angle with BC on the side opposite to the vertex A.

(f) Locate 3 points B_1, $B_2$and B_3 on BX such that $BB_1 = B_1B_2 = B_2B_3$.

(g) Join B_2C and draw a line through the point B_3, draw a line parallel to B_2C intersecting BC at the point C'.

(h) Draw a line through C' parallel to the line CA to intersect BA at A'.

Then, A'BC' is the required triangle.



Justification:

∵ C'A' || CA [By construction]

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

∴ $\frac{A'B}{AB} = \frac{A'C'}{AC} = \frac{BC'}{BC}$ [By Basic Proportionality Theorem]

∵ $B_3C' \parallel B_2C$ [By construction]

∴ $\Delta BB_3C' \sim \Delta BB_2C$ [AA similarity]

But $\frac{BB_3}{BB_2} = \frac{3}{2}$ [By construction]

Therefore,

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

∴ $\frac{A'B}{AB} = \frac{A'C'}{AC} = \frac{BC'}{BC} = \frac{3}{2}$

23. Draw a triangle ABC with side BC = 6 cm, AB = 5 cm and $\angle ABC = 60^\circ$. Then construct a triangle whose sides are $\frac{3}{4}$ of the corresponding sides of triangle ABC.

Ans. To construct: To construct a triangle ABC with side BC = 6 cm, AB = 5 cm and $\angle ABC = 60^\circ$ and then a triangle similar to it whose sides are $\frac{3}{4}$ of the corresponding sides of the first triangle ABC.

Steps of construction:

(a) Draw a triangle ABC with side BC = 6 cm, AB = 5 cm and $\angle ABC = 60^\circ$.

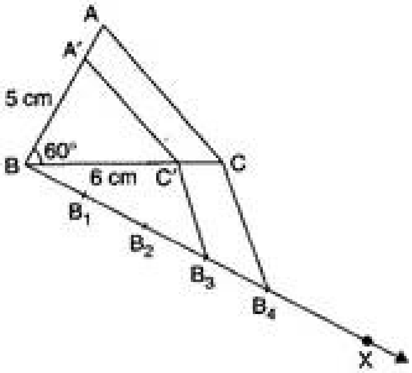
(b) From any ray BX, making an acute angle with BC on the side opposite to the vertex A.

(c) Locate 4 points B_1, B_2, B_3 and B_4 on BX such that $BB_1 = B_1B_2 = B_2B_3 = B_3B_4$.

(d) Join B_4C and draw a line through the point B_3, draw a line parallel to B_4C intersecting BC at the point C'.

(e) Draw a line through C' parallel to the line CA to intersect BA at A'.

Then, A'BC' is the required triangle.



Justification:

$\because$ $B_4C \parallel B_3C'$ [By construction]

$\therefore$ $\frac{BB_3}{BB_4} = \frac{BC'}{BC}$ [By Basic Proportionality Theorem]

But $\frac{BB_3}{BB_4} = \frac{3}{4}$ [By construction]

Therefore, $\frac{BC'}{BC} = \frac{3}{4}$ ....(i)

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

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

$\therefore$ $\frac{AB'}{AB} = \frac{A'C'}{AC} = \frac{BC'}{BC} = \frac{3}{4}$ [From eq. (i)]

24. Draw a triangle ABC with side BC = 7 cm, $\angle$B = 45°, $\angle$A = 105°. Then construct a

triangle whose sides are $\frac{4}{3}$ times the corresponding sides of $\triangle$ABC.

Ans. To construct: To construct a triangle ABC with side BC = 7 cm, $\angle$B = 45° and $\angle$C = 105° and then a triangle similar to it whose sides are $\frac{4}{3}$ of the corresponding sides of the first triangle ABC.

Steps of construction:

(a) Draw a triangle ABC with side BC = 7 cm, $\angle$B = 45° and $\angle$C = 105°.

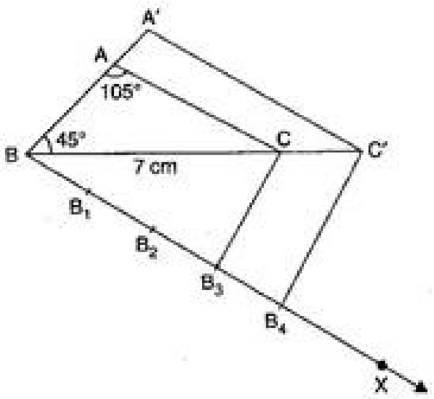
(b) From any ray BX, making an acute angle with BC on the side opposite to the vertex A.

(c) Locate 4 points B_1, B_2, B_3 and B_4 on BX such that $BB_1 = B_1B_2 = B_2B_3 = B_3B_4$.

(d) Join B_3C and draw a line through the point B_4, draw a line parallel to B_3C intersecting BC at the point C'.

(e) Draw a line through C' parallel to the line CA to intersect BA at A'.

Then, A'BC' is the required triangle.



Justification:

$\because$ $B_4C' \parallel B_3C$ [By construction]

$\therefore$ $\triangle BB_4C' \sim \triangle BB_3C$ [AA similarity]

$\therefore$ $\frac{BB_4}{BB_3} = \frac{BC'}{BC}$ [By Basic Proportionality Theorem]

But $\frac{BB_4}{BB_3} = \frac{4}{3}$ [By construction]

Therefore, $\frac{BC'}{BC} = \frac{4}{3}$ ....(i)

$\because$ CA || C'A' [By construction]

$\therefore$ ΔBC'A' ~ ΔBCA [AA similarity]

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

25. 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

Ans. To construct: To construct a right triangle in which sides (other than hypotenuse) are of lengths 4 cm and 3 cm and then a triangle similar to it whose sides are $\frac{5}{3}$ of the corresponding sides of the first triangle ABC.

Steps of construction:

(a) Draw a right triangle in which sides (other than hypotenuse) are of lengths 4 cm and 3 cm.

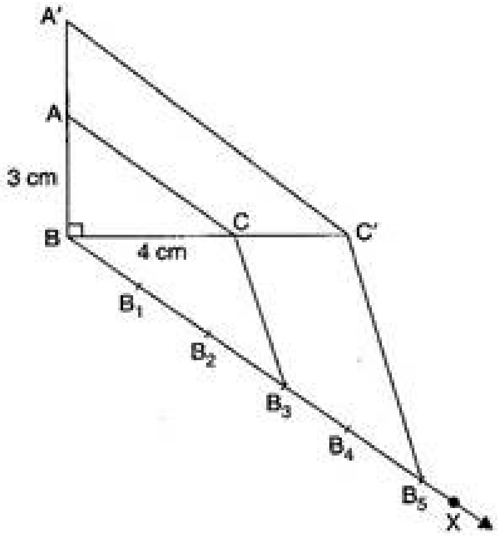
(b) From any ray BX, making an acute angle with BC on the side opposite to the vertex A.

(c) Locate 5 points B_1, B_2, B_3, $B_4$and B_5 on BX such that $BB_1 = B_1B_2 = B_2B_3 = B_3B_4 = B_4B_5$.

(d) Join B_3C and draw a line through the point B_5, draw a line parallel to B_3C intersecting BC at the point C'.

(e) Draw a line through C' parallel to the line CA to intersect BA at A'.

Then, A'BC' is the required triangle.



Justification:

∵ $B_5C' \parallel B_3C$ [By construction]

∴ $\triangle BB_5C' \sim \triangle BB_3C$ [AA similarity]

∴ $\frac{BB_5}{BB_3} = \frac{BC'}{BC}$ [By Basic Proportionality Theorem]

But $\frac{BB_5}{BB_3} = \frac{5}{3}$ [By construction]

Therefore, $\frac{BC'}{BC} = \frac{5}{3}$ ....(i)

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

∴ $\triangle BC'A' \sim \triangle BCA$ [AA similarity]

∴ $\frac{A'B}{AB} = \frac{A'C'}{AC} = \frac{BC'}{BC} = \frac{5}{3}$ [From eq. (i)]

26. 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.

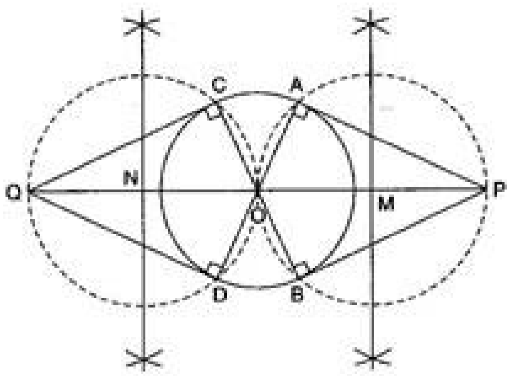
Then PA and PB are the required two tangents.

(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 ∠QCO is an angle in the semicircle and therefore ∠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.

27. 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.

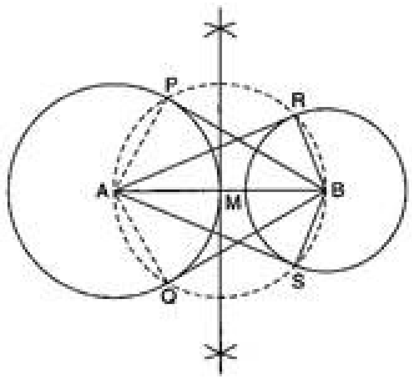
(b) Taking M as centre and MA as radius, draw a circle. Let it intersects the given circle at the points P and Q.

(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.

28. 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.

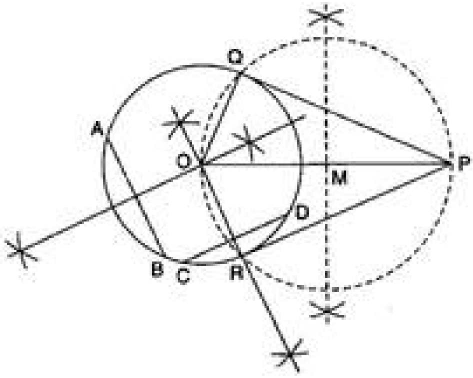
(d) Take a point P outside the circle.

(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.