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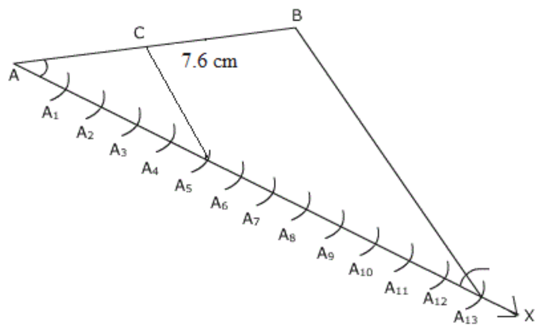
**Class: 10**
**Subject: Mathematics**
**Topic: Construction**
**No. of Questions: 20**

Q1. Draw a line segment of length 7.6 cm and divide it in the ratio 5 : 8 . Measure the two parts.

Sol.




**Step of construction:**

1. Draw any ray AX, making an acute angle with AB.
2. Locate 13 (= 8 + 5 ) points $A_1$, $A_2$ , $A_3$ ……. $A_{13}$ on AX so that $AA_1 = A_1A_2$ …. $A_{12}A_{13}$.
3. Join $BA_{13}$
4. Through the point $A_5$(m = 5), draw a line parallel to $BA_{13}$ (by making an angle equal to < $AA_{13}$ B at $A_5$ intersecting AB at C. Then
   AC : CB = 5 : 8)

Let us see how this method gives us the required division.

Since $A_5C$ is parallel to $A_{13}$ B therefore $\frac{AA_5}{A_5A_{13}} = \frac{AC}{CB}$. (BY the Basic proportionality theorem)

By construction, $\frac{AA_5}{A_5\,A_{13}} = \frac{5}{8}$. There fore $\frac{AC}{CB} = \frac{5}{8}$

This shows C divides AB in the ratio 5 : 8.

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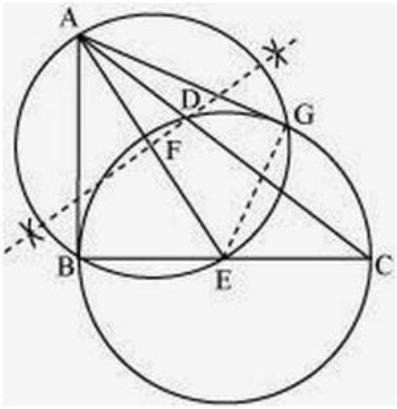
Q2. Let ABC be a right triangle in which AB = 6cm, BC = 8 cm and ∠B = 90°. BD is the perpendicular from B on AC. The circle through B, C, D is drawn. Construction the tangents from A to this circle.

Sol.




**Step of construction:**

1. Draw BC = 8 cm
2. Make ∠CBX = 90 degree
3. Cut off AB = 6 cm along AX
4. Join AC. ABC is required triangle
5. Draw BD perpendicular to AC from B
6. Draw perpendicular bisector of BC and CD let meet BC at E
7. Taking E as a centre and CE as a radius draw circle passing through B,D, C
8. Join AE and bisect it. Let F be the mid-point of AE.
9. Taking F as centre and FE as its radius, draw a circle which will intersecting the circle at point B and G. Join AG.
10. AB and AG are the required tangents.

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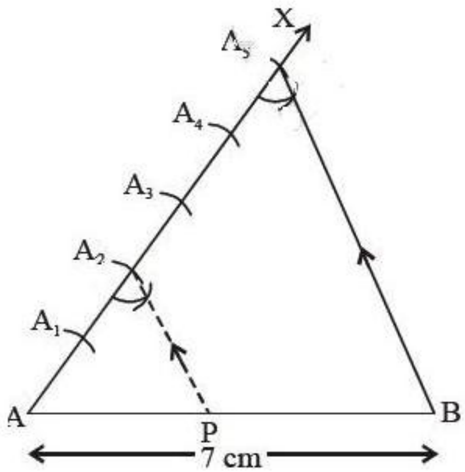
Q3. Draw a line segment of length 7 cm and divide it in the ratio 2 : 3

Sol.

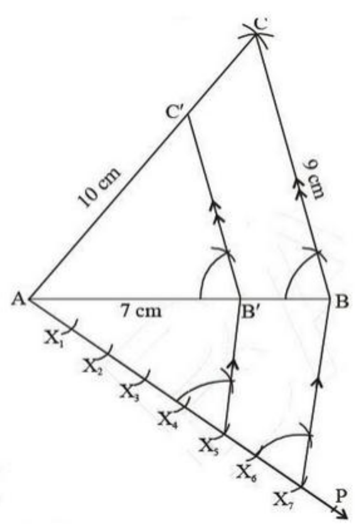



**Steps of construction:**

1. Draw AB = 7 cm
2. Draw ray AX making a suitable acute angle with AB.
3. Cut 2+3 = 5 equal segments $AA_1$, $A_1A_2$ , $A_2A_3$ , $A_3A_4$ and $A_4A_5$ on AX.
4. Join $A_5$ with B.
5. Through $A_2$, Draw $A_2$ P parallel to $A_5B$ by making corresponding angles $AA_2P$ and $AA_5B$ equal
6. The line through $A_2$ and parallel to $A_5B$ will meet the given line segment at point P.
   Then P is the required point which divides AB in the ratio 2 : 3 i.e. AP : PB = 2: 3

Q4. Construct a triangle similar to a given triangle with sides 7 cm, 9 cm and 10 cm and whose sides are 5/7 th of the corresponding sides of the given triangle.

Sol.

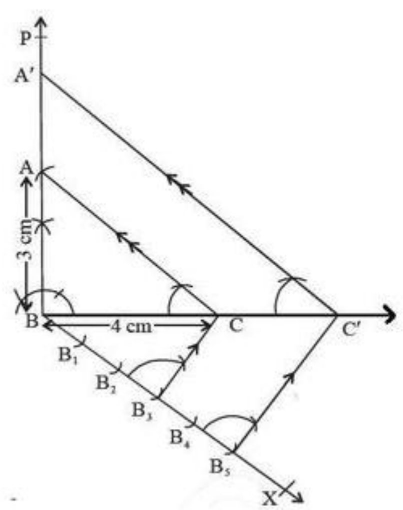


**Steps of construction:**

1. With the given measurements construction the triangle ABC in which AB = 7 cm, BC = 9 cm and AC =10 cm
2. Draw a ray AP, making any suitable angle with AB and on opposite side of vertex C
3. Starting from A, cut off seven equal line segment $AX_1$, $X_1X_2$, $X_2X_3$ , $X_3 X_4$, $X_4X_5$, $X_5X_6$ and $X_6X_7$ on AP.
4. Join $BX_1$ and draw a line $X_5B'$ parallel to $X_7B$ which meets AB at B'.
5. Through B' draw B'C' ∥ BC which meets AC at point C'.
   The DAB'C' so obtained, is similar to the given DABC and each side of DAB'C' is 5 /7 times the corresponding side of tri. ABC.

Q5. 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 5/3 times the corresponding sides of the given triangle.

Sol.



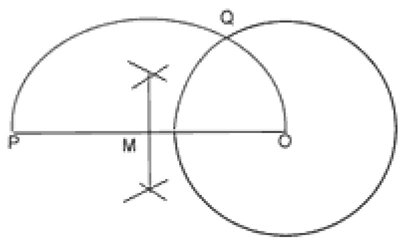

Sol. **Steps of construction:**

1. Draw BC = 4 cm
2. At B, draw a ray BP making angle 90° with BC i.e. ∠PBC = 90°
3. From BP, cut BA = 3 cm
4. Join A and C to get the given DABC
5. Through vertex B, draw ray BX making any suitable angle with BC.
6. On BX cut 5 equal line segment $BB_1 = B_1B_2 = B_2B_3 = B_3B_4 = B_4B_5$.
7. Join $B_3$ to C.
8. Through $B_5$, draw a line parallel to $B_3C$ to meet BC produced at point C'.

9. Through C', draw a line parallel to side CA to meet BA produced to A'. DA'BC' is the required triangle

Q6. To construct a tangent to circle from a point P outside the circle using its center O.

Sol.

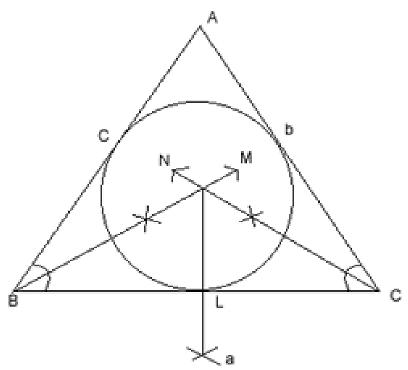



**Procedure:**

1. OP is joined and is bisected at M.
2. Taking M as center and MO as radius a semicircle is drawn which intersect the given circle at Q.
3. PQ is the required tangent P to the circle

Q7. To construct incircle of a triangle ABC whose sides are BC = a, CA = b and AB = c.

Sol.




**Procedure :**

1. Triangle ABC in which BC = a, CA = b and AB = c is constructed.
2. BM and CN is constructed angle bisectors of $\angle B$ and $\angle C$ which intersect at I.
3. IL ⊥ BC is drawn
4. Taking I as center and IL as radius, circle is drawn. This is the required incircle.

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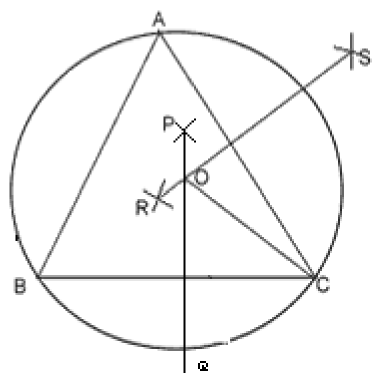
Q8. To construct a circumscribe of a triangle ABC where a = BC , b = CA and c = AB.

Sol.

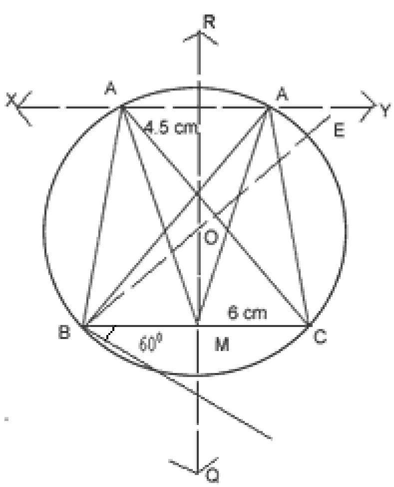



**Procedure:**

1. Triangle ABC is constructed with BC = a, CA = b and AB = c.
2. Perpendicular bisector PQ of BC and RS of CA is constructed. They intersect at O.
3. Taking O as centre and OC as a radius circle is drawn which passes through A, B and C.

Q9. Construct a triangle ABC in which BC = 6 cm, $\angle A = 60°$ and the altitude through A is 4.5 cm. Measure the length of median through A. Write the steps of construction.

Sol.



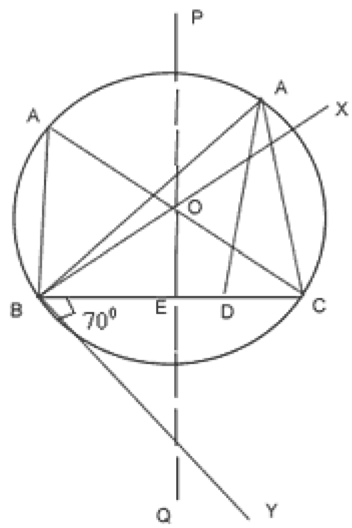

**Procedure:**

1. $BC = 6$ cm is drawn and $\angle CBP = 60°$ is made downwards with BC of any length.
2. $\angle PBE = 90°$ is drawn
3. Perpendicular bisector RQ of BC is drawn which cut BC at M. and intersect BE at O.
4. Taking O as centre and OB as radius, a circle is drawn.

5. Ml = 4.5 cm is cut from RQ.
6. A line XY, parallel to BC is drawn through L to intersect the circle at A and A'.
   AB, AC, A'B and A'C are joined
   ABC and A'BC are the required triangle
   Medium AM = A'M = 5.5 cm (app.)

Q10. Construct a triangle ABC in which BC = 5 cm, ∠A = 70° and median AD through A is of length 3.5 cm. Also, determine the length of the altitude drawn from A on the side BC (Write the steps of construction also).

Sol.

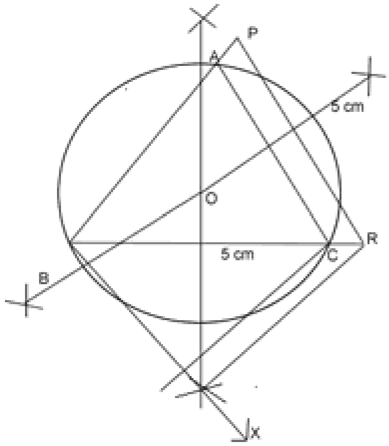



**Procedure:**

1. BC = 5 cm is drawn and is construct downwards.
2. BX is drawn perpendicular to BY.
3. Q is drawn perpendicular bisector if BC intersecting BX at O and Cutting BC at E.
4. Taking O as a centre and OB as radius, a circle is drawn.
5. Taking E as centre and radius equal to 3.5 cm, arc is drawn to cut the circle at A.
6. AC and AB are joined.
7. AD is drawn perpendicular to BC from A to cut BC at D.
8. By measuring we find that AD = 3 cm.

Q11. Construction a $\Delta ABC \sim$ to a equilateral $\Delta PQR$ with side 5 cm such that each its sides is 6/7th of the corresponding side of $\Delta PQR$ . Also draw the circumcircle of $\Delta ABC$.

Sol.

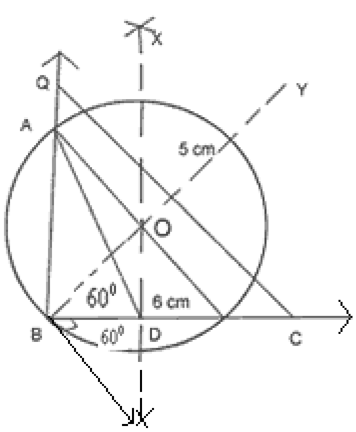



**Procedure:**

1. A ray QX is draw making any angle with QR and opposite to P.
2. Starting from Q seven equal line segments $QQ_1$, $Q_1Q_2$, $Q_2Q_3$, $Q_3Q_4$, $Q_4Q_5$, $Q_5Q_6$, $Q_6Q_7$ are cut of from QX.
3. $RQ_7$ is joined and a line $CQ_6$ is drawn parallel to $RQ_4$ to intersect QR at C.
4. Line CA is drawn parallel to PR.
   ABC is the required triangle.

Q12. Construct a triangle ABC in which BC = 6 cm, $\angle A = 60°$ and median $AD = 5$ cm. Also construct another triangle BPQ similar to triangle BCA such that the sides $BP = 3/2$ BC.

Sol.



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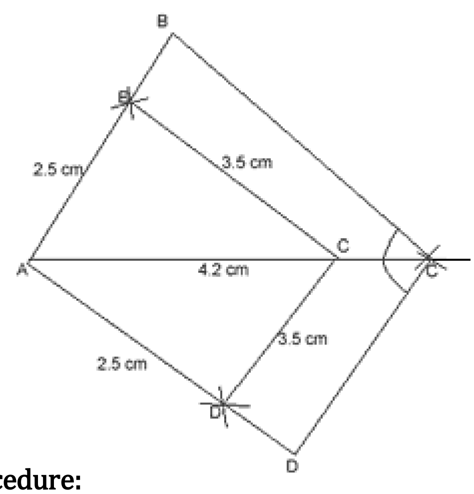
**Procedure:**

1. A line segment BC of length 6 cm is drawn.
2. At B, ∠CBX = 60° is drawn on downwards.
3. At B, BY ⊥ BX is drawn
4. Perpendicular bisector of BC is drawn which intersect BY at O and BC at D.
5. Taking O as a center and OB as a radius a circle passing through B and C is drawn.
6. Taking D as a center and radius 5 cm an arc is drawn to intersect the circle at A.
7. AB and AC are joined. The required triangle is ABC.
8. Taking C as centre and CD as radius an arc is drawn to intersect BC produced P such that BP = 3/2 BC.
9. Through P, PQ is drawn parallel to CA meeting BA produced at Q.
10. BPQ is the required triangle similar to triangle BCA.

Q13. Construct a quadrilateral in which AB = 2.5 cm, BC = 3.5 cm , AC = 4.2 cm, CD = 3.5 cm and AD = 2.5 cm. Construct another quadrilateral AB'C'D' with diagonal AC' = 6.3 cm such that it is similar to quadrilateral ABCD.

Sol.




**Procedure:**

1. A line segment AC = 4.2 cm is drawn.
2. With A as a centre and radius 2.5 cm, two arcs, one above AC and one below AC are drawn
3. With C as centre and radius 3.5 cm, two arcs arc drawn intersecting previous arcs at B and D.
4. AB, AD, BC and CD are joined ABCD is the required quadrilateral.
5. Taking A as a centre and radius 6.3 cm an arc is drawn to intersect AC produced at C'.
6. Through C', C'B' and C'D' are drawn parallel to CB and CD respectively.
   AB'C'D' is the required similar to ABCD.

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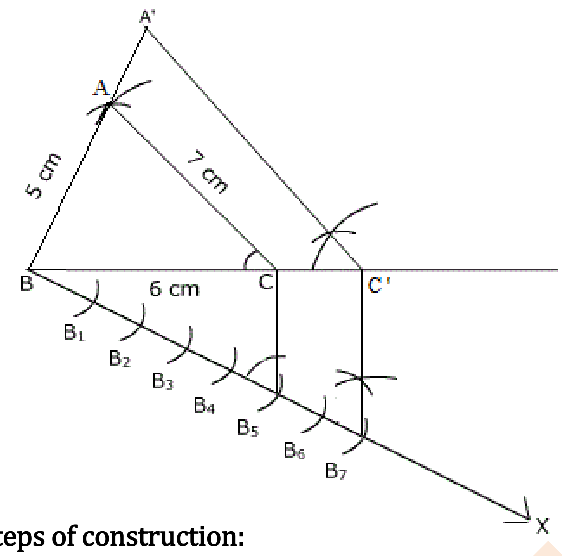
Q14. Construct a triangle with sides 5 cm, 6 cm and 7 cm and then another triangle whose sides are $\frac{7}{5}$ of the corresponding sides of the first triangle.

Sol.




**Steps of construction:**

1. Draw a line segment BC = 6 cm
2. With B as centre and with radius 5 cm, draw an arc.
3. With C as centre and with radius 7 cm, draw another arc, intersecting the previously drawn arc at A.
4. Join AB and AC. Then, ΔABC is the required triangle.
5. Below BC, mark an acute angle ∠CBX .
6. Along BX, make off seven points $B_1$, $B_2$ , $B_3$ …. $B_7$ such that $BB_1 = B_1B_2$ …. $B_6B_7$
7. Join $B_5$ to C (5 being smaller of 5 and 7 in $\frac{7}{5}$) and draw a line through $B_7$ parallel to $B_5C$. 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'. Then A'BC' is the required triangle.

For justification of construction

$\Delta ABC \sim \Delta A'BC'$

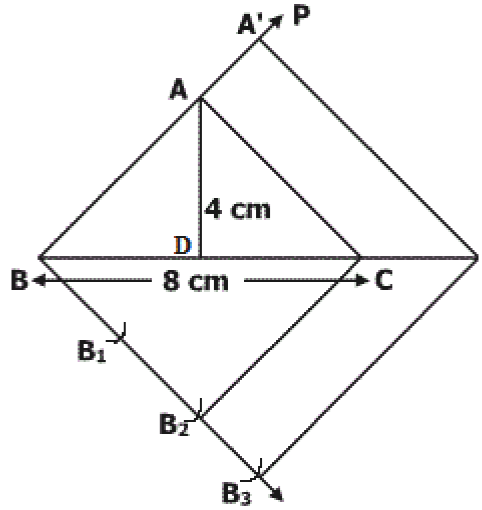
Therefore $\frac{AB}{A'B} = \frac{AC}{A'C'} = \frac{BC}{BC'}$

But $\frac{BC}{BC'} = \frac{BB_5}{BB_7} = \frac{5}{7}$

So $\frac{BC'}{BC} = \frac{7}{5}$ and thus $\frac{A'B}{AB} = \frac{A'C'}{AC} = \frac{BC'}{BC} = \frac{5}{7}$

Q15. 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.




**Given:** An isosceles triangle whose base is 8 cm and altitude 4 cm. Scale factor. $1\frac{1}{2} = \frac{3}{2}$

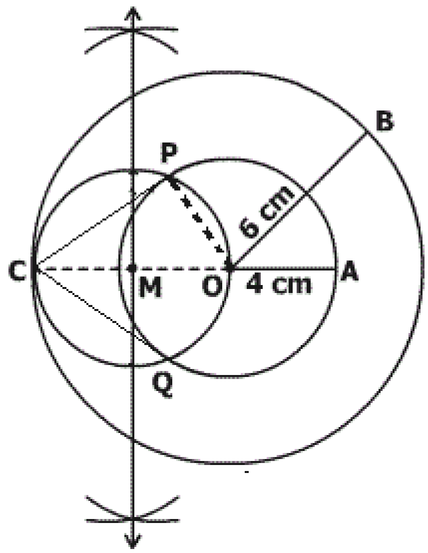
**Required:** To construct a similar triangle to above whose sides are $1\frac{1}{2}$ times the above triangle.

**Steps of construction:**

1. Draw a line segment BC = 8 cm
2. Draw a perpendicular bisect AD of BC.
3. Join AB and AC we get a isosceles ΔABC.
4. Construct an acute angle ∠CBX downwards.
5. On BX make 3 equal parts.
6. Join C to $B_2$ and draw a line through $B_3$ parallel to $B_2$ C intersecting the extended line segment BC at C'.
7. Again draw a parallel line C'A ' to AC cutting BP at A'.
8. ΔA'BC' is the required triangle.

Q16. 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:**

1. Draw a line segment of length OA = 4 cm. With O as centre and OA as radius, draw a circle.
2. With O as centre draw a concentric circle of radius 6 cm (OB).
3. Let C be any point on the circle of radius 6 cm, join OC.
4. Bisect OC such that M is the midpoint of OC.
5. With M as centre and OM as radius, draw a circle. Let it intersect the given circle of radius 4 cm at the points P and Q.
6. Join CP and CQ. Thus CP and CQ are the required two tangents.

Justification of construction:

Join OP. Here $\angle OPC$ is an angle in the semi-circle. Therefore, $\angle OPC = 90°$. Since OP is a radius of a circle, CP has to be a tangent to a circle; Similarly, CQ is also a tangent to a circle.

In ΔCOP, DP = 90°

$\Rightarrow \ CO^2 = CP^2 + OP^2$

$\therefore \ CP^2 = CO^2 - OP^2 = 6^2 - 4^2$

$\therefore$ CP $= 2\sqrt{5}$ cm

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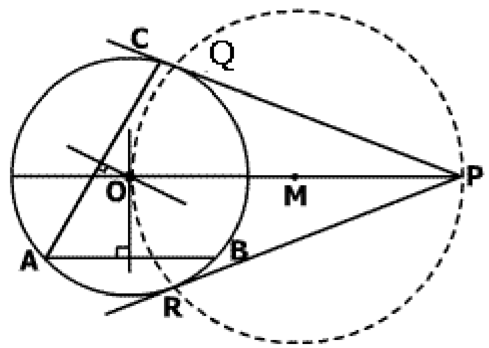
Q17. Draw a circle with the help of a bangle. Take a point outside the circle. Construct the pair of tangents from this point to the circle.

Sol.



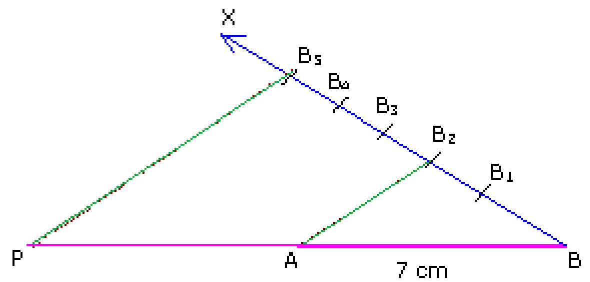

**Given:** Bangle, Point P outside the circle
**Required:** To construct the pair of tangents from P to the circle.

**Steps of construction:**

1. Draw a circle with the help of a bangle.
2. Draw two chords AB and AC. Perpendicular bisectors of AB and AC intersect each other at O, which is the centre of the circle.
3. Taking a point P, outside the circle, Join OP.
4. Let M be the midpoint of OP. Taking M as centre and OM as radius draw a circle which intersect the given circle at Q and R.
5. Join PQ and PR. Thus PQ and PR are the required tangents.

Q18. Divided a line segments of 7 cm length externally in the ratio of 3 : 5.

Sol.




**Given:** AB is a line segment of 7 cm length.
**Required:** To divided a line segment of 7 cm length externally in the ratio of 3: 5.

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**Steps of construction:**

1. Draw the line segment AB = 7 cm.
2. Draw ray BX making an acute ∠ABX.
3. Along BX, make off five points $B_1$ , $B_2$, $B_3$ , $B_4$ and $B_5$. Join $B_2$ to A.
4. The point P so obtained is the required point which divides AB externally in the ratio 3: 5

**Proof:** In Δs $ABB_2$ and $PBB_5$,

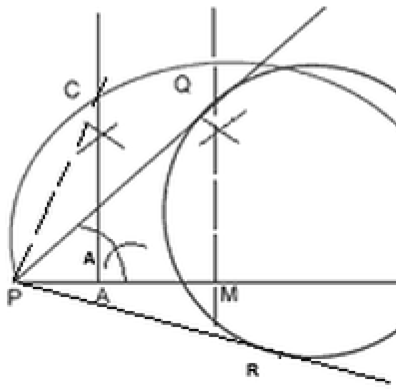
$B_5P \parallel B_2A \Rightarrow ABB_2 \sim PBB_5$,

$\therefore \frac{AB}{PB} = \frac{B_2B}{B_5B} = \frac{AB_2}{PB_5} = \frac{2}{7}$ (Property of similarty)

$\Rightarrow \frac{AP}{PB} = \frac{3}{5}$

Q19. Construction a tangent to a circle of radius 3 cm from a point out side the circle without using its centre.

Sol.

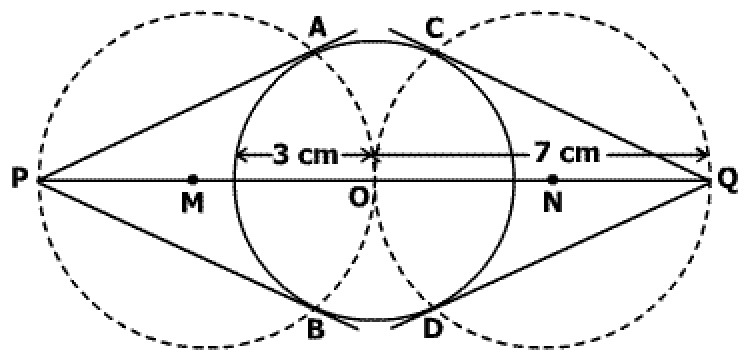



**Steps of construction:**

1. Draw a circle of radius 3 cm
2. Draw a secant PAB to the circle.
3. Draw bisector of PB let it be at M.
4. Draw a semicircle taking M as a centre and PM as a radius
5. Through A is drawn perpendicular to AB which intersecting the semicircle at C.
6. Taking P as centre and PC as radius, arcs are drawn to intersect the given circle at Q and R.
7. Join PQ and PR which is the required tangent.

Q20. 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.

Sol.




**Given**: Two points P and Q on the diameter of a circle with radius 3 cm, OP = OQ = 7 cm.
**Required:** To construct the tangents to the circle from the given points P and Q.

**Steps of construction:**

1. Draw a circle of radius 3 cm with centre O.
2. Extend its diameter both sides and cut OP = OQ = 7 cm.
3. Bisect OP and OQ. Let M and N be the mid – points of OP and OQ respectively.
4. With M as center and OM as radius, draw a circle. Let it intersect (0,3) at two points A and B. Again taking N as centre ON as radius draw a circle to intersect circle(0, 3) at two points C and D.
5. Join PA, PB, QC and QD. These are the required tangents from P and Q to circle (0,3).