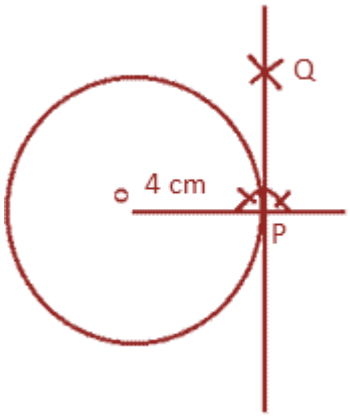
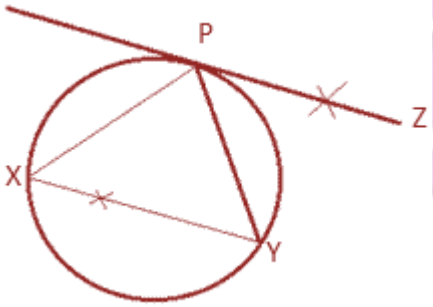
1. Draw a circle of radius 4 cm and take a point P on its circumference. Construct a tangent to the circle at P.
Solution:-



Steps for constructions:
1. Draw a circle of radius 4 cm with centre O.
2. Then join the center O to the given point P.
3. On the give point P, draw a perpendicular to OP.
4. So, PQ is the required tangent.

2. Draw a circle of radius 4.5 cm. Take a point P on its circumference. Construct a tangent to the circle at P without using the center.
Solution:-

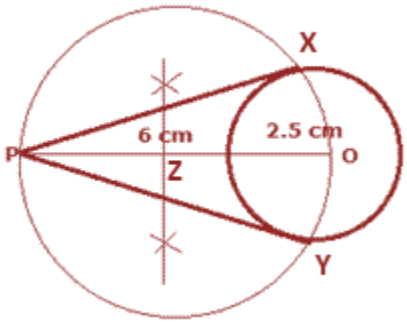


Steps for constructions:
1. Draw a circle of radius 4.5 cm.
2. Take any point P draw a chord PX.
3. Take any point Y on the circle and join PX and PY.
4. Then, at P draw ∠YPZ equal to ∠XYP.
5. Therefore, PZ is the required tangent.

3. Draw a circle with center O and radius 2.5 cm. Take a point P at distance of 6 cm

from the center. Using ruler and compasses only construct the tangent to the circle from the point.

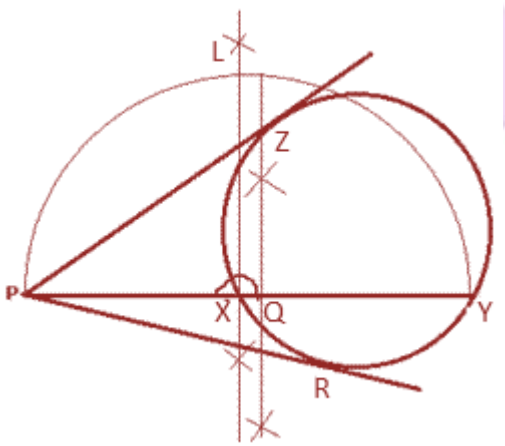
Solution:-



Steps for constructions:

1. Draw a circle of radius 2.5 cm with centre O.
2. Then join the center O to the given point P which is 6 cm away from O.
3. Now draw a perpendicular bisector of OP. let us assume Z be the mid – point OP.
4. With Z as center and radius OZ, draw a circle cutting the first circle at X and Y.
5. Now join PX and PY.
6. Therefore, PX and PY are the required tangents.

4. Draw a circle with center O and radius 3 cm. Take a point P outside the circle. Draw tangents to the circle from P without using the center and using only ruler and compasses.

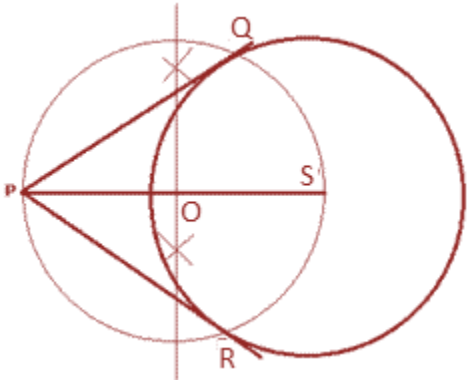


Steps for constructions:

1. Draw a circle of radius 3 cm.
2. P is the given point, then draw PXY a secant to the given circle.
3. Then, draw a perpendicular bisector of PY and let us assume Q be the mid-point of PY.
4. Now, Q as the center and QP as radius, draw a semi-circle on PY.
5. At X, draw a perpendicular to PY. Let this perpendicular meet the semi-circle at D.

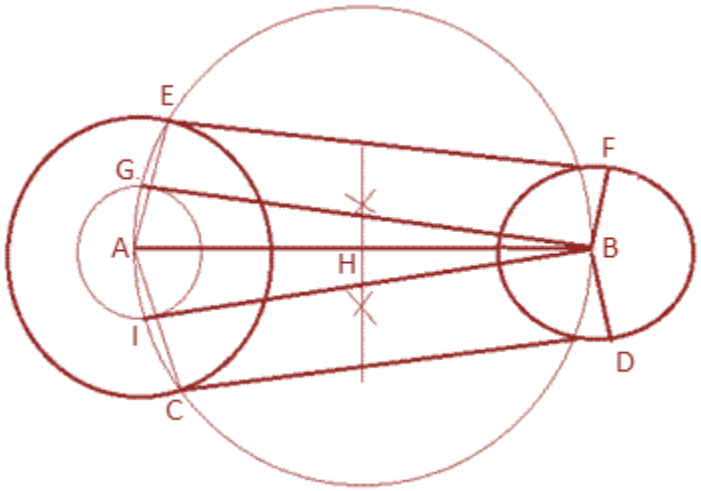
6. With P as center and PL as radius, cut off two arcs on the given circle at Z and R.
7. Then, join PZ and PR.
8. Therefore, PZ and PS are the required tangents.

5. Using ruler and compass only, draw tangents to a circle of radius 3 cm from a point 5 cm from the center. What is the length of each of them?
Solution:-



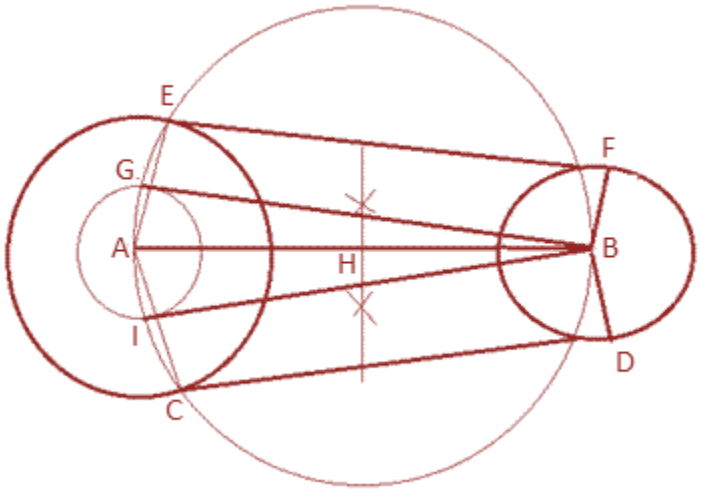
Steps for constructions:
1. Draw a circle of radius 3 cm with center O.
2. Now join the center S to the point P which is 5 cm away from S.
3. Then, draw a perpendicular bisector of SP. Let us assume O be the mid-point of SP.
4. Take O as center and radius OS, draw a circle cutting the first circle at Q and R.
5. Now join PQ and PR.
6. Therefore, PQ and PB are the required tangents.
7. Then the measure of PQ and PB are equal to 4 cm.

6. Draw two circles of radii 2.5 cm and 3.5 cm respectively so that their centers are 8 cm apart. Draw direct common tangents to the circle.
Solution:-



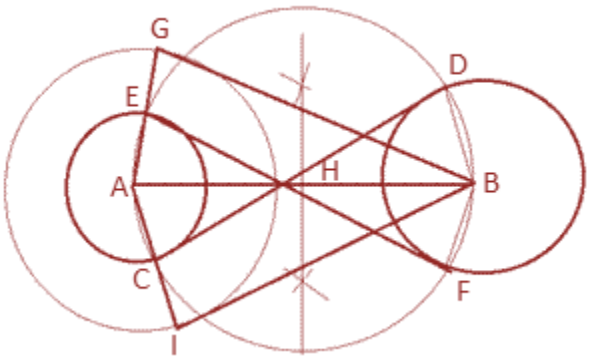
Steps for constructions:
1. First draw a line AB = 8 cm.
2. At A, draw a circle of radius 3.5 cm.
3. At B, draw a circle of radius 2.5 cm.
4. At A, draw a third circle concentric to the bigger circle and radius,
= 3.5 – 2.5 = 1 cm
5. Then draw a perpendicular bisector of AB, let H be the mid-point of AB.
6. So, take H as center and AH as radii, draw a fourth circle. Mark as G and I where the third and fourth circles intersect each other.
7. Now, join AG and AI and external line to meet the bigger circle at E and C.
8. Then join BG and BI.
9. On BG and BI, draw perpendicular to meet the smaller circle at F and D.
10. Now join EF and CD.
Therefore, EF and CD are the required tangents.

7. Draw two circles of radii 3.5 cm and 2 cm respectively so that their centers are 6 cm apart. Draw direct common tangents to the circle and show that they are equal in length.
Solution:-



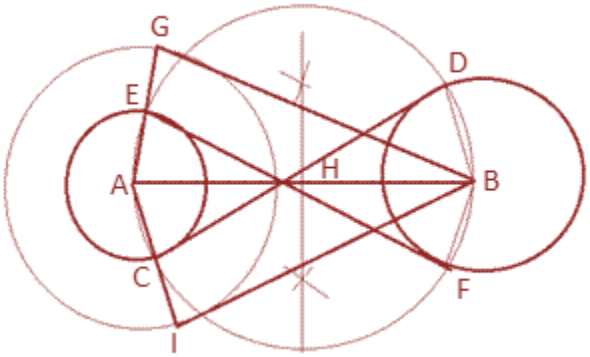
Steps for constructions:
1. First draw a line AB = 6 cm.
2. At A, draw a circle of radius 3.5 cm.
3. At B, draw a circle of radius 2 cm.
4. At A, draw a third circle concentric to the bigger circle and radius,
= 3.5 – 2 = 1.5 cm
5. Then draw a perpendicular bisector of AB, let H be the mid-point of AB.
6. So, take H as center and AH as radii, draw a fourth circle. Mark as G and I where the third and fourth circles intersect each other.
7. Now, join AG and AI and external line to meet the bigger circle at E and C.
8. Then join BG and BI.
9. On BG and BI, draw perpendicular to meet the smaller circle at F and D.
10. Now join EF and CD.
Therefore, EF and CD are the required tangents.
Now we have to prove that, both direct common tangents to the circle are equal in length.
Since, GE ∥ FB and CI ∥ BD,
So, EF = GB and CD = BI,
Now, consider the ΔABG and ΔABI,
Then, BG = BI … [tangents to a circle from same point]
Hence it is clear that, EF = CD.

8. Draw two circles of radii 3 cm and 3.5 cm, their centers being 8 cm apart. Construct a transverse common tangent and measure its length.
Solution:-



Steps for constructions:
1. First draw a line AB = 8 cm.
2. At A, draw a circle of radius 3 cm.
3. At B, draw a circle of radius 3.5 cm.
4. At A, draw a third circle concentric to the smaller circle and radius,
= 3.5 + 3 = 6.5 cm
5. Then draw a perpendicular bisector of AB, let H be the mid-point of AB.
6. So, take H as center and AH as radii, draw a fourth circle. Mark as G and I where the third and fourth circles intersect each other.
7. Now, join AG and AI to meet the smaller circle at E and C.
8. Then join BG and BI.
9. On BG and BI, draw perpendicular to meet the bigger circle at F and D.
10. Now join EF and CD.
Therefore, EF and CD are the required tangents both are equal to 8 cm.

9. Draw two circles with radii 2.5 cm and 4 cm and with their centers 7 cm apart. Draw a direct common tangent and a transverse common tangent. Calculate the length of the direct common tangent.
Solution:-



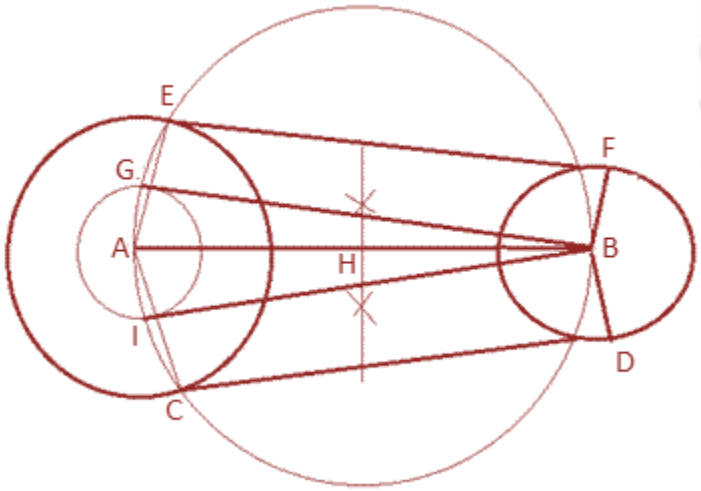
(i) Transverse common tangent

Steps for constructions:

1. First draw a line AB = 7 cm.
2. At A, draw a circle of radius 2.5 cm.
3. At B, draw a circle of radius 4 cm.
4. At A, draw a third circle concentric to the smaller circle and radius,
= 2.5 + 4 = 6.5 cm
5. Then draw a perpendicular bisector of AB, let H be the mid-point of AB.
6. So, take H as center and AH as radii, draw a fourth circle. Mark as G and I where the third and fourth circles intersect each other.
7. Now, join AG and AI to meet the smaller circle at E and C.
8. Then join BG and BI.
9. On BG and BI, draw perpendicular to meet the bigger circle at F and D.
10. Now join EF and CD.

Therefore, EF and CD are the required tangents.

(ii) Direct common tangent



Steps for constructions:

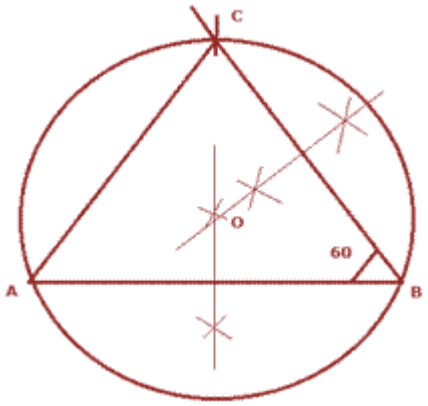
1. First draw a line AB = 7 cm.
2. At A, draw a circle of radius 4 cm.
3. At B, draw a circle of radius 2.5 cm.
4. At A, draw a third circle concentric to the bigger circle and radius,
= 4 – 2.5 = 1.5 cm
5. Then draw a perpendicular bisector of AB, let H be the mid-point of AB.
6. So, take H as center and AH as radii, draw a fourth circle. Mark as G and I where the third and fourth circles intersect each other.

7. Now, join AG and AI and external line to meet the bigger circle at E and C.
8. Then join BG and BI.
9. On BG and BI, draw perpendicular to meet the smaller circle at F and D.
10. Now join EF and CD.

Therefore, EF and CD are the required tangents both are equal to 7 cm.

10. Construct ΔABC in which AB = 5 cm, BC = 4.5 cm and ∠ABC = 60°. Construct a circle to circumcircle of ΔABC.

Solution:-



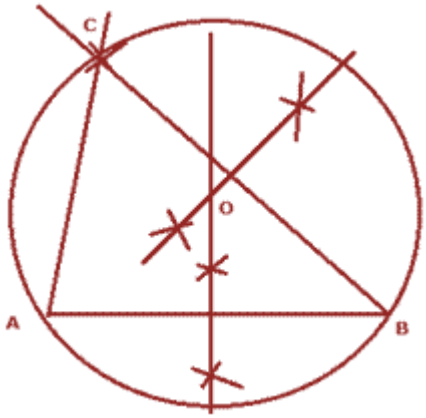
As per the dimensions given in the question, circle to circumcircle of ΔABC is constructed.

Steps for constructions:

1. First draw a line AB = 6 cm.
2. At B, draw an arc making an angle of 60° with AB.
3. Then on the arc cut BC = 4.5 cm.
4. Now join AC.
5. Then draw a perpendicular bisector of AB and BC, which meet at O.
6. Take O as center and radius equal to the distance between O and the vertex of the triangle, draw a circle to pass through all the three vertices of the triangle.
7. Therefore, above circle is the required circle with radius of 2.8 cm.

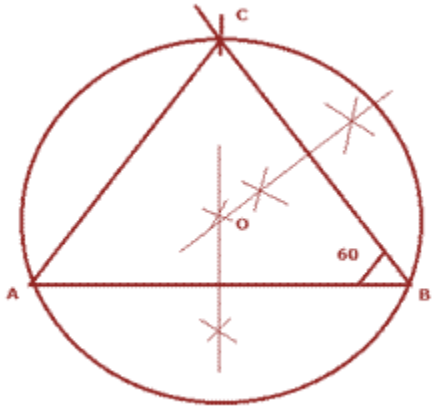
11. Using ruler and compasses only, construct a triangle ABC in which AB = 5cm, BC = 6 cm and CA = 4.5 cm. Construct a circle passing through A, B and C.

Solution:-



As per the dimensions given in the question, ΔABC is constructed.
Steps for constructions:
1. First draw a line AB = 5 cm.
2. At B, draw an arc making an angle of 6 cm.
3. Then on the arc cut AC = 4.5 cm.
4. Now join AC and BC.
5. Then draw a perpendicular bisector of AB and BC, which meet at O.
6. Take O as center and radius equal to the distance between O and the vertex of the triangle, draw a circle to pass through all the three vertices of the triangle.
7. Therefore, above circle is the required circle.

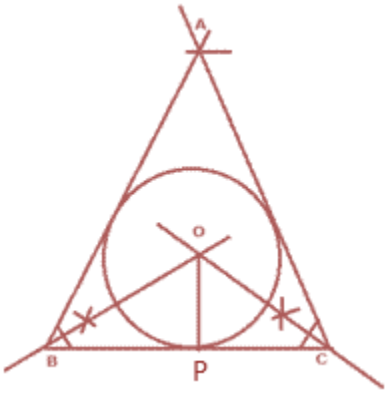
12. Using ruler and compasses only, construct and equilateral triangle with side 4.5 cm. Draw a circumcircle of this triangle and measure its radius.
Solution:-



As per the dimensions given in the question, circle to circumcircle of ΔABC is constructed.
Steps for constructions:

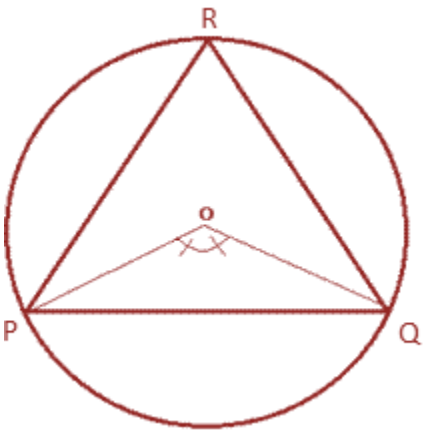
1. First draw a line AB = 4.5 cm.
2. At B, draw an arc making an angle of 60° with AB and length BC = 4.5 cm.
3. Then on the arc cut AC = 4.5 cm.
4. Now join AC.
5. Then draw a perpendicular bisector of AB and BC, which meet at O.
6. Take O as center and radius equal to the distance between O and the vertex of the triangle, draw a circle to pass through all the three vertices of the triangle.
7. Therefore, above circle is the required circle with radius of 2.6 cm.

13. Using ruler compasses only, construct ΔABC in which BC = 7.5 cm, ∠ABC = 60° and AC – AB = 1.5 cm. Inscribe a circle in the ΔABC and measure its radius.
Solution:-



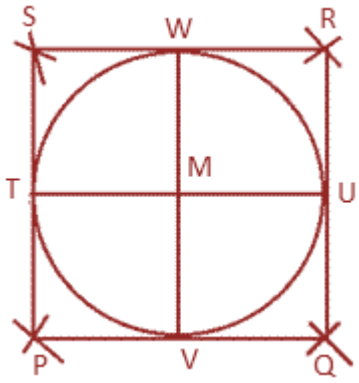
As per the dimensions given in the question, circle to circumcircle of ΔABC is constructed.
Steps for constructions:
1. First draw a line BC = 7.5 cm.
2. At B, draw an arc making an angle of 60° with BC.
3. Then on the arc cut AC = AB + 1.5 cm = 7.5 + 1.5 = 9 cm cutting the previous arc
4. Now join AC and AB.
5. Then draw an angle bisector of ∠A and ∠B, which meet at O.
6. Draw a perpendicular to BC from O and mark it as P.
6. with OP as radius draw a circle touching all three sides of the triangle.
7. Therefore, above circle is the required circle with radius of 2.3 cm.

14. Draw a circle with radius 3 cm and inscribe an equilateral triangle in it.
Solution:-



Steps for constructions:
1. First draw a circle with center O and radius = 3 cm.
2. Then draw radii OP and OB such that ∠POQ = 360/3 = 120°.
3. Now join PQ and cut off arcs PR and QR equal to PQ.
4. Join PR and QR.
Therefore, ΔABC is the required equilateral triangle.

15. Draw a circle of radius 2.5 cm and circumscribe a square about it.
Solution:-



Steps for constructions:
1. First draw a circle with center M and radius = 2.5 cm.
2. Then draw two diameters TU and VW of the circle meeting at centre M.
3. Now taking MV as radius cut two arcs from V on both sides of V and repeat same with T, U, and W.
4. Then mark new points formed as P, Q, R and S.
5. So, join PQ, QR, RS and SP.
Therefore, PQRSC is the required square circumscribing the given circle.