14. Constructions

Exercise 14.1

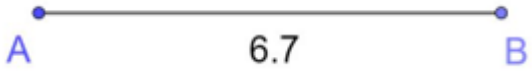
1. Question

Draw a line segment of length 6.7 cm and divide it internally in the ratio 2 : 3.

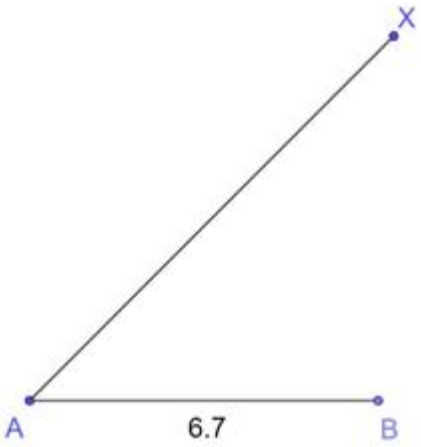
Answer

Steps of Construction:

1. Draw a line segment AB of length 6.7cm.



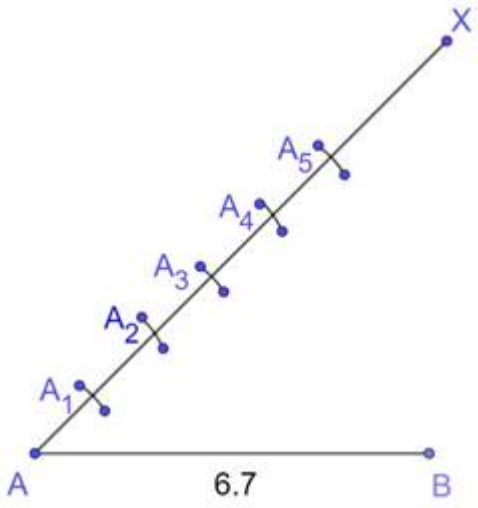
2. Draw a ray AX making an acute angle with AB.



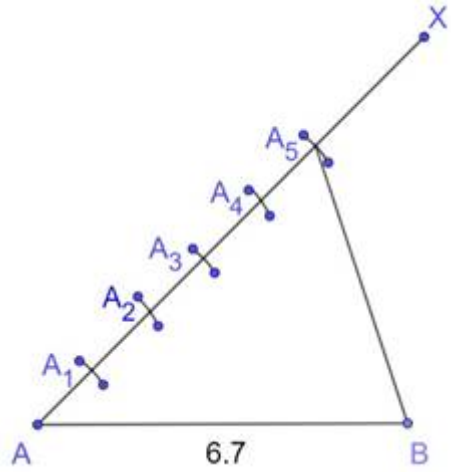
3. As we have to divide the line in ratio of 2:3, we will divide AX into five equal parts.

4. Taking A as center, cut an arc on AX. Mark the point as A_1.

5. Now, with A_1 as center and same radius cut an arc on AX. Continue till A_5.

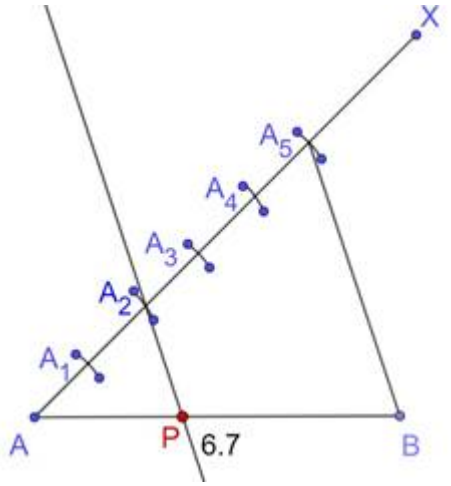


6. Join A_5 to B.



7. Now draw a line from point A_2 parallel to A_5B.

8. The point where it cuts AB is P.



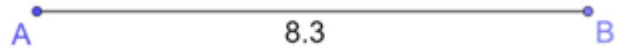
9. AP:PB=2:3

2. Question

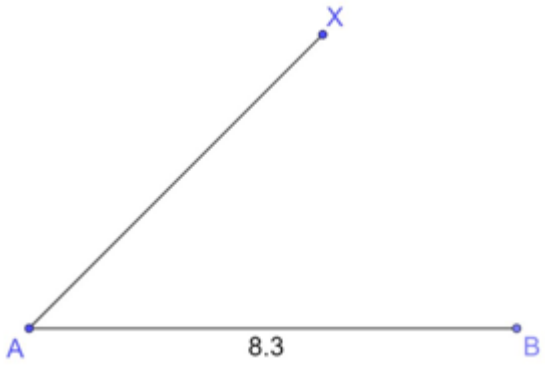
Draw a line segment AB = 8.3 cm. Locate a point C on the line segment AB such that $AC = \frac{1}{3} AB.$ Also justify it.

Answer

1. Draw a line segment AB of length 8.3cm.



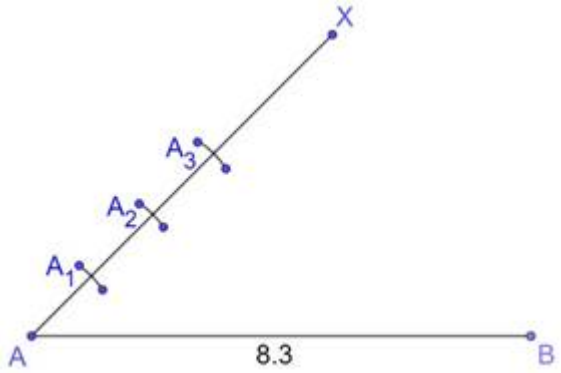
2. Draw a ray AX making an acute angle with AB.



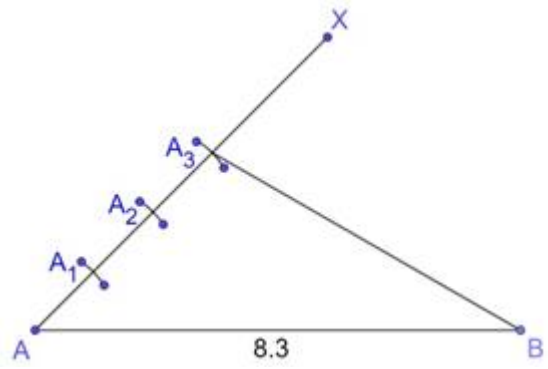
3. As we have to divide the line such that AC = AB /3, we will divide AX in three equal parts.

4. Taking A as center, cut an arc on AX. Mark the point as A_1.

5. Now, with A_1 as center and same radius cut an arc on AX. Continue till A_3.

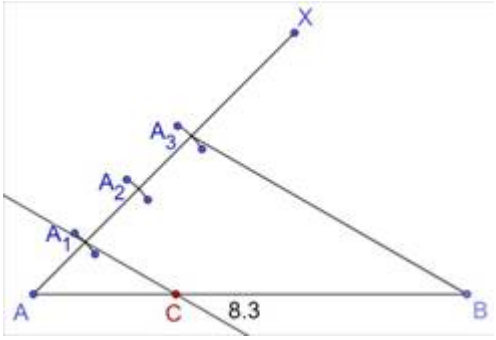


6. Join A_3 to B.



7. Now draw a line from point A_1 parallel to A_3B.

8. The point where it cuts AB is C.



9. AC:AB = 1:3

3. Question

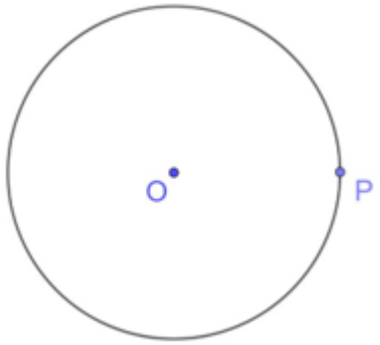
Draw a circle of radius 2.8 cm. Take a point P on it and draw a tangent to the circle at point P.

Answer

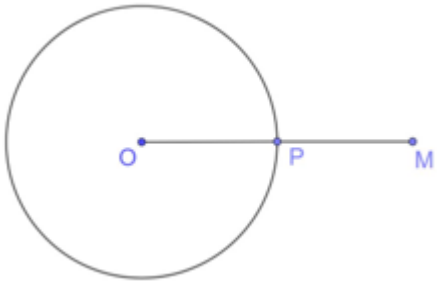
Steps of Construction:

1. Draw a circle with center O and radius 2.8cm.

2. Take a point P on the circumference of this circle.

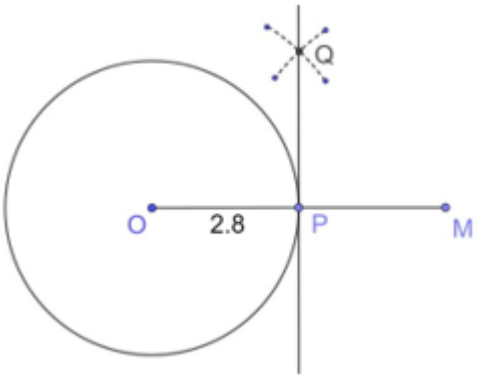


3. Join OP. Extend OP such that OP=PM.



4. Draw a perpendicular bisector of OM.

5. This perpendicular bisector is the tangent of the circle at P.



4. Question

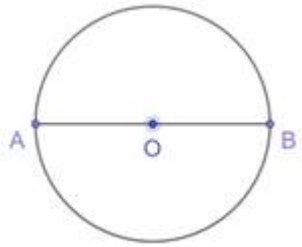
Construct tangents at the ends of the diameter of a circle of radius 3 cm. With the tangents intersect each other? Give reason for your answer.

Answer

Steps of Construction:

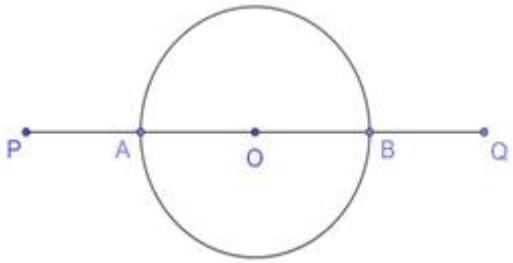
1. Draw a circle with center O and radius 3cm.

2. Draw a diameter AB of this circle.



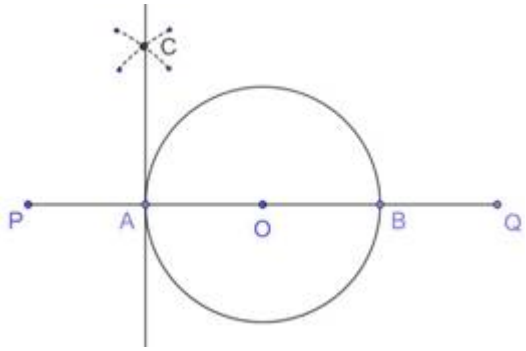
3. Extend OA such that OA=AP.

4. Extend OB such OB=BQ.



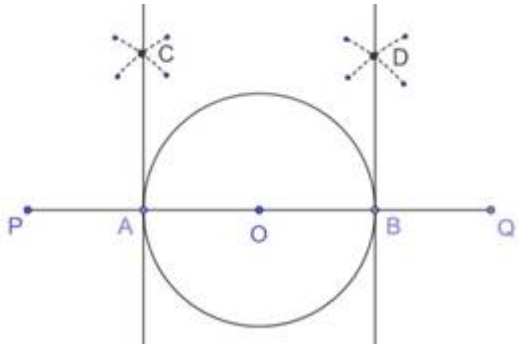
5. Draw a perpendicular bisector of OP.

6. This perpendicular bisector is the tangent at A.



7. Draw a perpendicular bisector of OQ.

8. This perpendicular bisector is the tangent at B.



No, these tangents will not intersect. They are parallel lines. Sum of internal angles is 180°. That's why they are parallel.

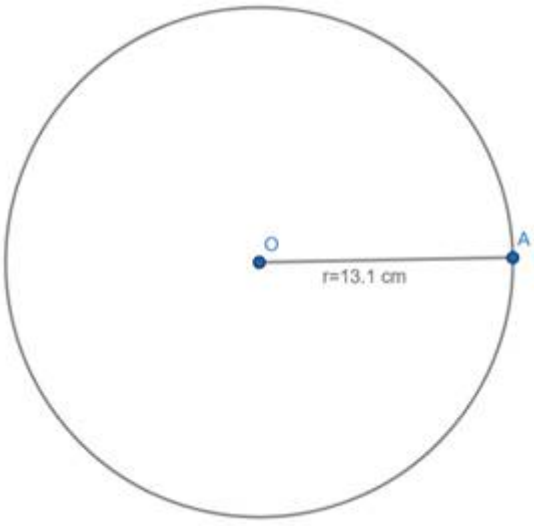
∠CAO + ∠DBO = 90° + 90° = 180°

5. Question

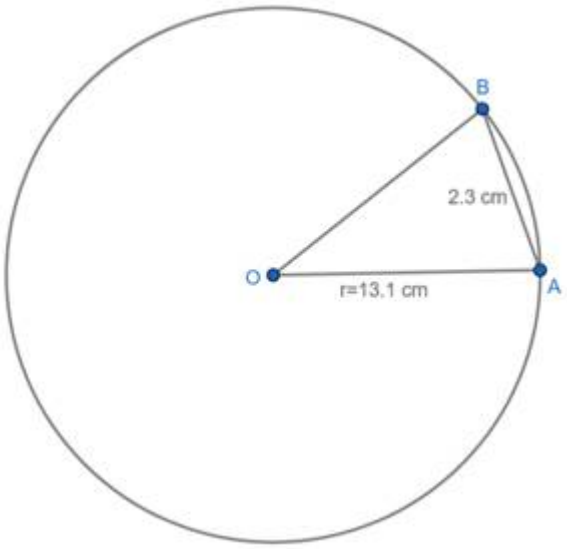
Draw a circle of radius 13.1 cm. Construct tangents to the circle at the ends of a chord of length 2.3 cm of the circle.

Answer

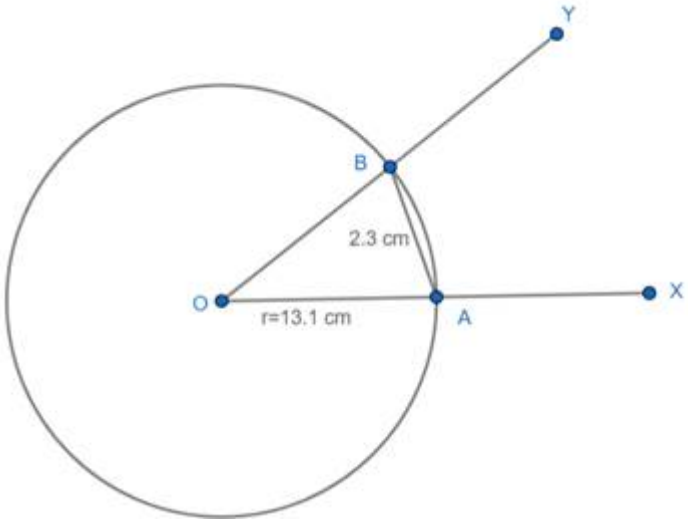
1. Draw a circle with radius 13.1 cm.



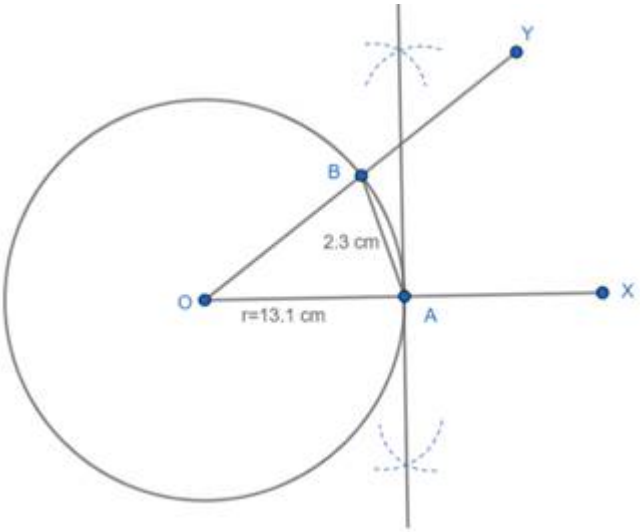
2. Draw a chord AB = 2.3 cm. Then join B to center O.



3. Extend OA such that OA=AX. Similarly extend OB to OY.

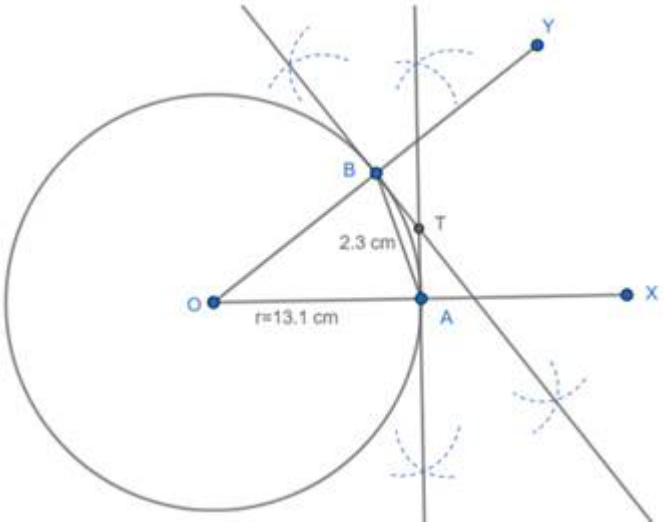


4. Draw perpendicular bisector of OX.



5. Similarly, draw perpendicular bisector of OY.

Mark the intersection of perpendiculars as T.



Here, TB and TA are required tangents.

6. Question

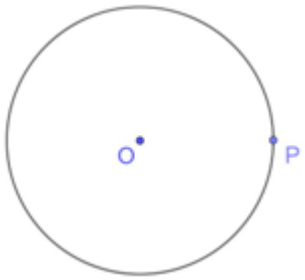
Draw a circle of radius 2.7 cm and draw a tangent to the circle.

Answer

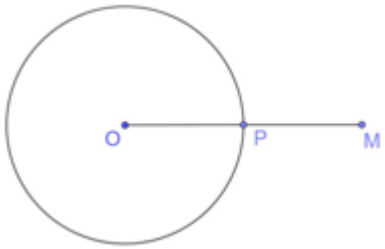
Steps of Construction:

1. Draw a circle with center O and radius 2.7cm.

2. Take a point P on the circumference of this circle.

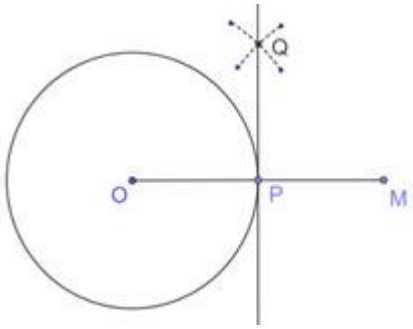


3. Join OP. Extend OP such that OP=PM.



4. Draw a perpendicular bisector of OM.

5. This perpendicular bisector is the tangent of the circle at P.



7. Question

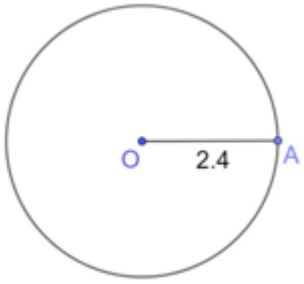
Take a point O and draw a circle of radius, 2.4 cm. Draw two radii OA and OB inclined to each other at 60°. Construct tangents at points A and B which intersect at point T. Measure angle ATB.

Answer

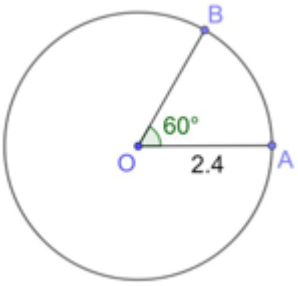
Steps of Construction:

1. Draw a circle with center O and radius 2.4cm.

2. Draw a radius OA of this circle.

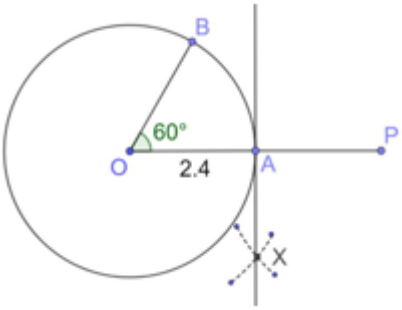


3. Draw another radius OB which is 60° to OA.



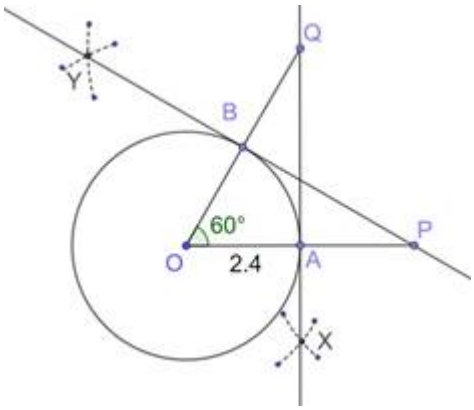
4. Extend OA such that OA=AP.

5. Draw a perpendicular bisector of OP.



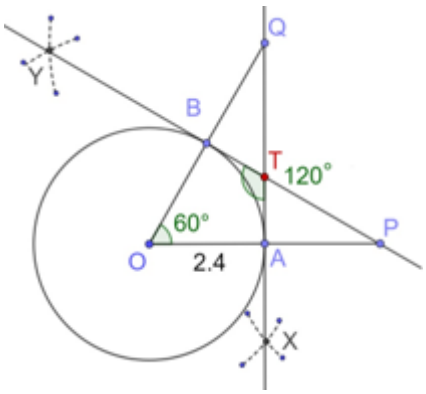
6. Extend OB such that OB=OQ.

7. Draw a perpendicular bisector of OQ.



8. The two perpendicular bisectors meet at T.

9. ∠ATB=120°.



8. Question

Draw a pair of tangents to a circle of radius 13.2 cm which are inclined to each other at an angle of 70°.

Answer

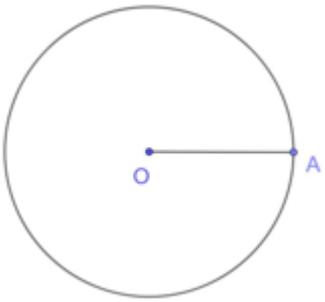
Sum of angles between the tangents and corresponding radius is 180°.

As the angle between the tangents is 70° so the angle between the radius will be (180° - 70°) =110°.

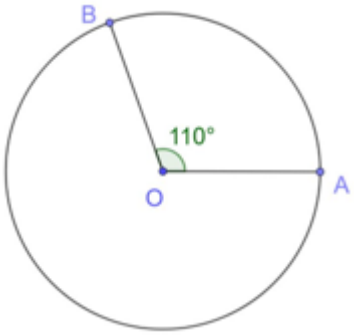
Steps of Construction:

1. Draw a circle with center O and radius 2.4cm.

2. Draw a radius OA of this circle.

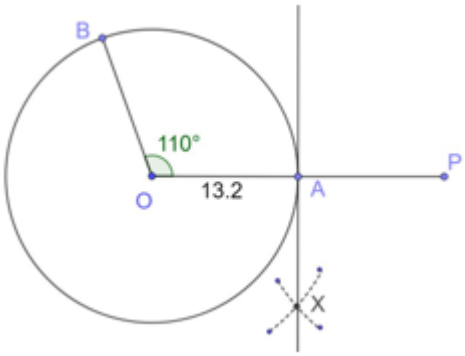


3. Draw another radius OB which is 110° to OA.



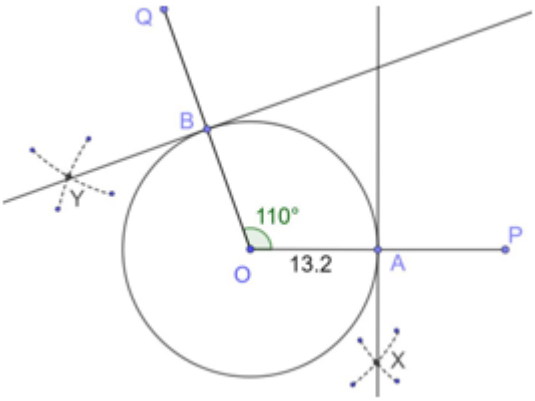
4. Extend OA such that OA=AP.

5. Draw a perpendicular bisector of OP.



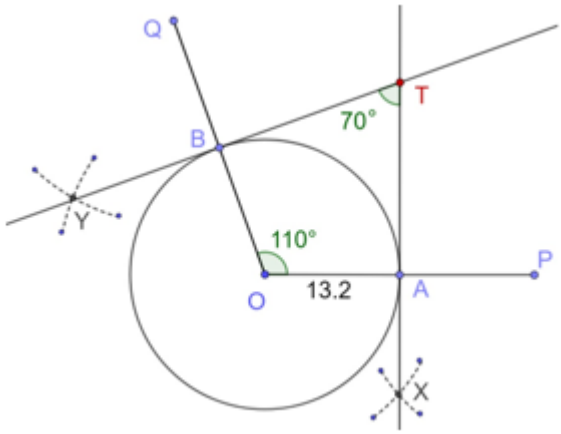
6. Extend OB such that OB=OQ.

7. Draw a perpendicular bisector of OQ.



8. The two perpendicular bisectors meet at T.

9. ∠ATB=70°.



9. Question

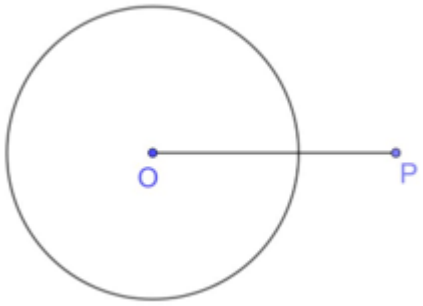
Draw a circle of radius 3 cm. Take a point P at a distance of 5 cm from the center O of the circle from the point P, draw two tangents to the circle.

Answer

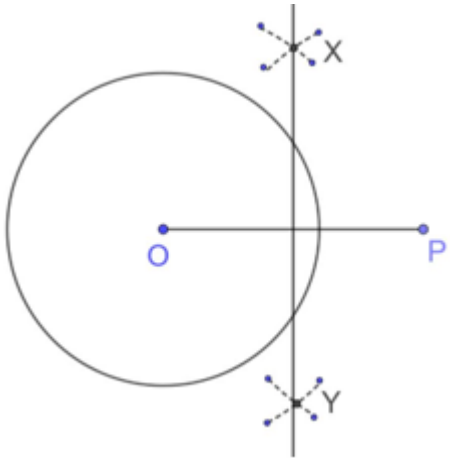
Steps of construction:

1. Draw a circle with center O and radius 3cm.

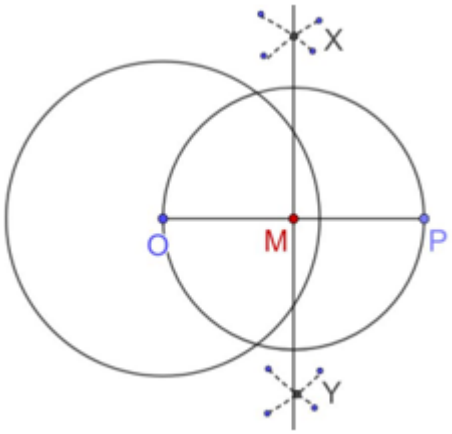
2. Draw OP=5cm.



3. Draw a perpendicular bisector of OP. It intersects with OP at M.

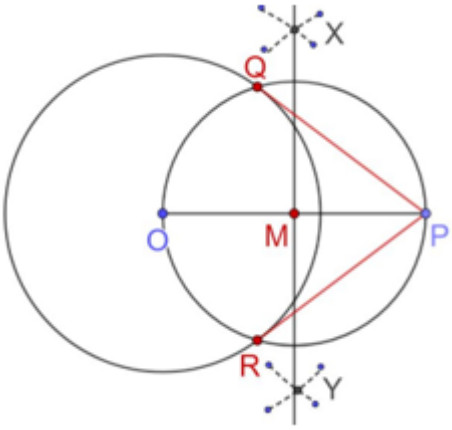


4. With M as center and MP as radius, draw a circle.



5. The circles intersect at Q and R.

6. Join PQ and PR.



7. PQ and PR are the required tangents.

10. Question

The centers of two circles of radii 3 cm and 4 cm are 8 cm apart. How many common tangents can be drawn to the two circles? Also, construct two direct common tangents to the circles.

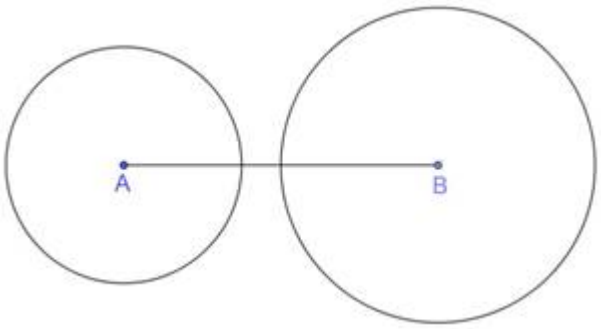
Answer

Steps of Construction:"

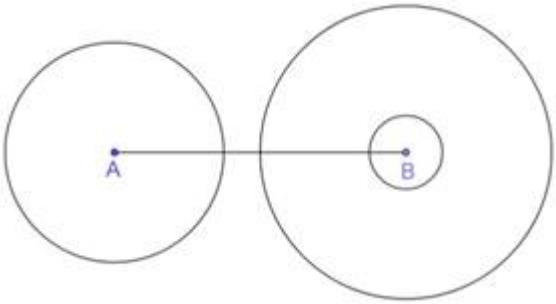
1. Draw a line segment AB of length 8cm.

2. With A as center, draw a circle of radius 3 cm.

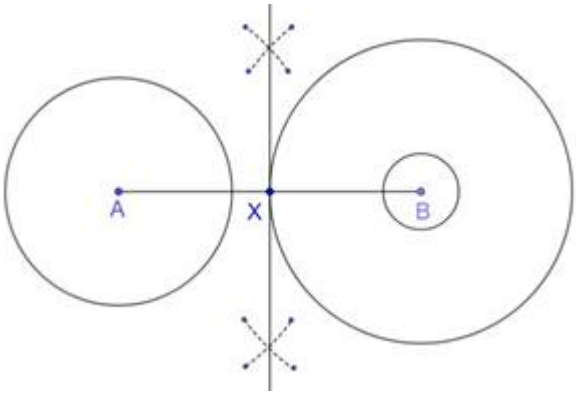
3. With B as center, draw a circle of radius 4 cm.



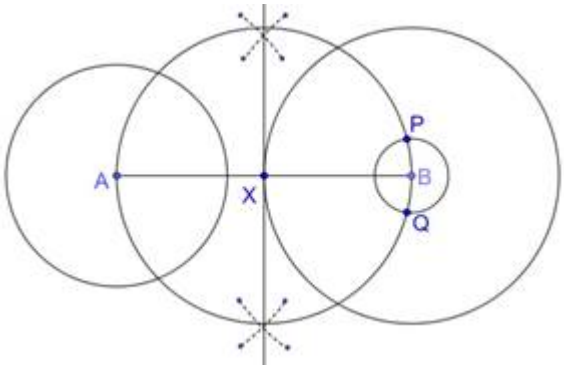
4. With B as center, draw another circle of radius (4-3) =1cm.



5. Draw a perpendicular bisector of AB. It intersects with AB at X.



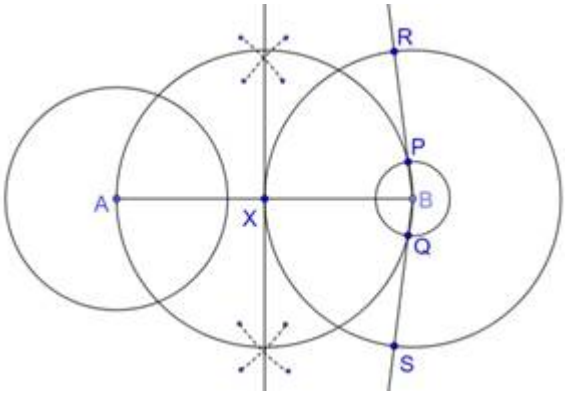
6. With X as center and AX as radius draw a circle.



7. This circle intersects with circle of radius 1cm at P and Q.

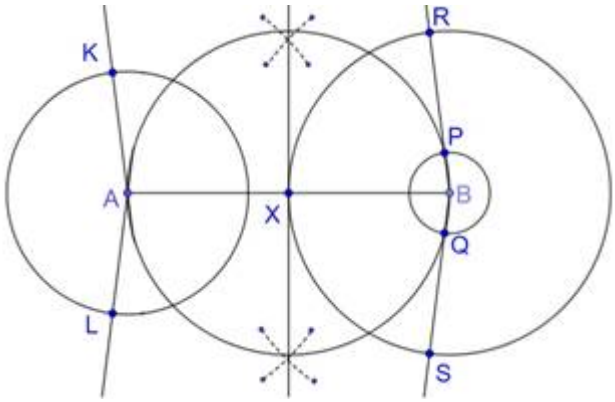
8. Join B to P. Extend BP to R, a point on the outer circle.

9. Join B to Q. Extend BQ to S, a point on the outer circle.



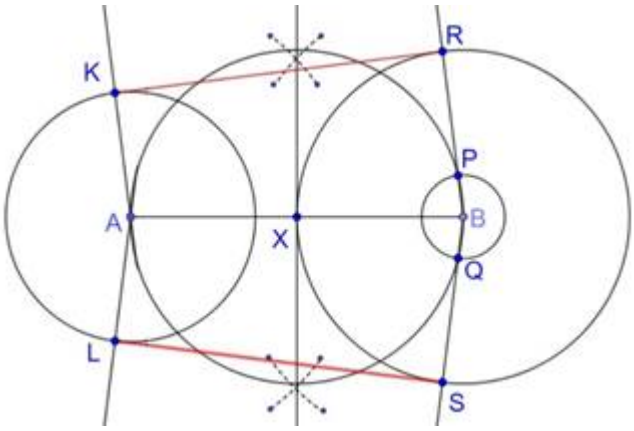
10. From A, draw a line parallel to BR and another line parallel to BS.

11. These lines intersects with the circle at K and L.



12. Join K to R and L to S.

13. KR and LS are the required direct common tangents.



11. Question

The radii of two circles are 1.7 cm and 2.8 cm, and their centers are 6 cm apart. Construct a transverse common tangent to the two circles.

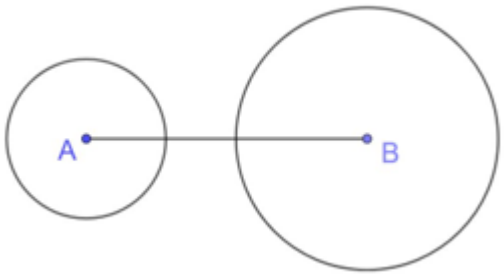
Answer

Steps of Construction:"

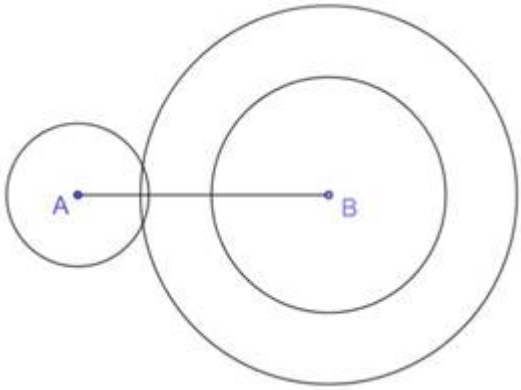
1. Draw a line segment AB of length 6cm.

2. With A as center, draw a circle of radius 1.7 cm.

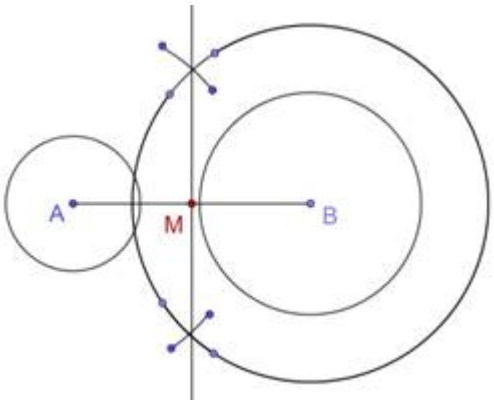
3. With B as center, draw a circle of radius 2.8 cm.



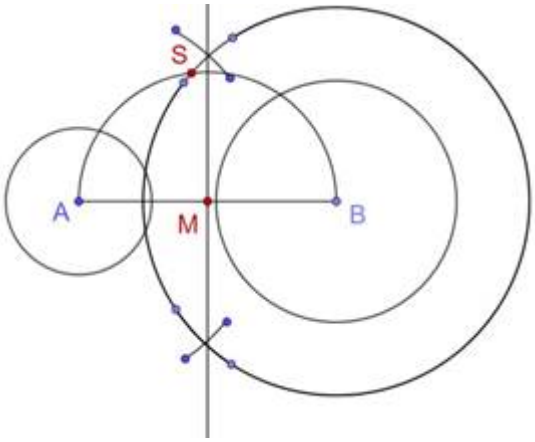
4. With B as center, draw another circle of radius (1.7+2.8) =4.5cm.



5. Draw a perpendicular bisector of AB. It intersects with AB at M.

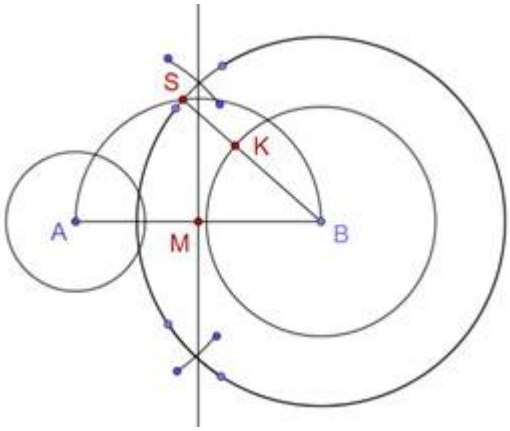


6. With M as center and AM as radius draw a semicircle.



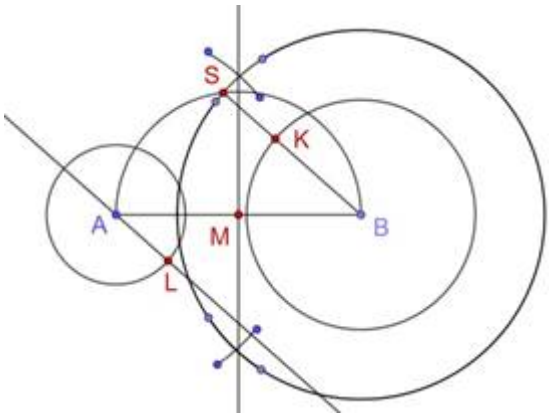
7. This circle intersects with circle of radius 5cm at S.

8. Join B to S. BS cuts the inner circle at K.



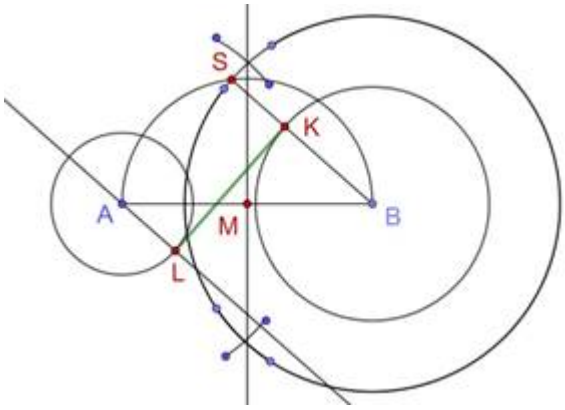
9. From A, draw a line parallel to BS.

10. This line intersects with the circle at L.



11. Join K to L.

12. KL is the required transverse common tangent.



Exercise 14.2

1. Question

Write the truth value (T/F) of each of the following statements. If possible, give reason for your answer.

(i) In an equilateral triangle, the incircle and the circumcircle can be constructed with the same centre.

(ii) The incircle of a triangle touches all sides of the triangle.

(iii) In an obtuse-angled triangle, the circumcenter lies on one of the sides of the triangle.

(iv) In an acute-angled triangle, the circumcentre lies inside the triangle.

(v) The incircle of a triangle is constructed by locating the point of intersection of perpendicular bisectors of any two sides of the triangle.

Answer

(i) True. In an equilateral triangle, circumcenter and incenter coincide and hence both the circles can be drawn using the same center.

(ii) True, because while constructing an incircle, a perpendicular is dropped on a side and length of the perpendicular is taken as the radius.

(iii) False. Only in a right-angled triangle does the circumcenter lie on the hypotenuse.

(iv) True. The perpendicular bisectors of the sides intersect inside the triangle.

(v) False. Incenter is the intersection of the angle bisectors of two of the angles.

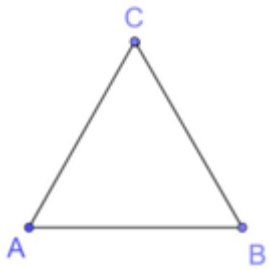
2. Question

Draw incircle of an equilateral triangle of side 4.6 cm. Do its circumcentre and incentre coincide with each other? Give reason for your answer

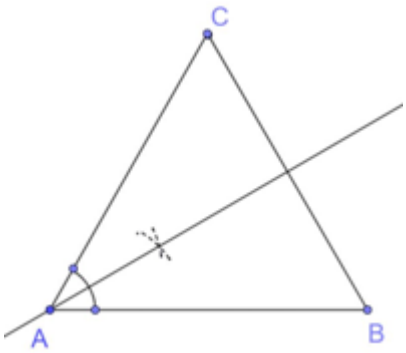
Answer

Steps of Construction:

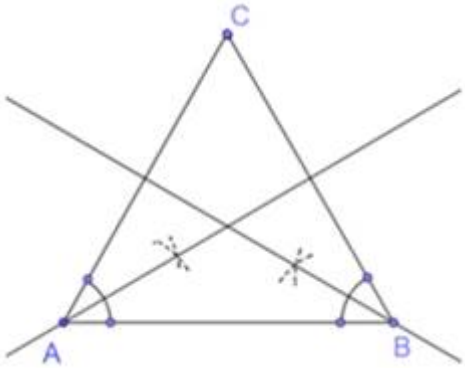
1. Draw an equilateral triangle of side 4.6cm



2. Draw angle bisector of ∠A.

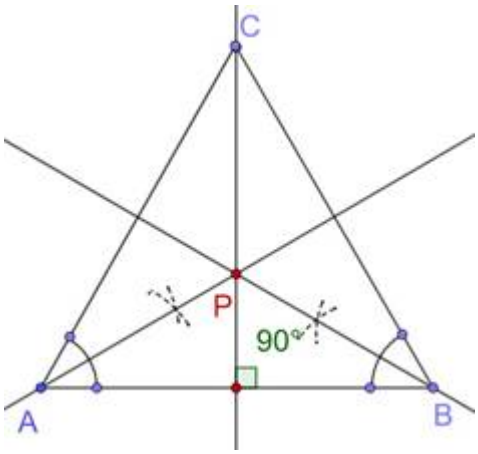


3. Draw angle bisector of ∠B.

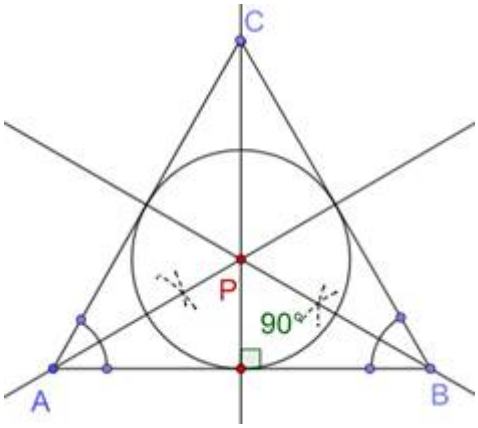


4. They intersect each other at P.

5. From P, drop a perpendicular on the line AB.



6. With P as center and length of perpendicular as the radius, draw a circle.



This circle is the incircle for the equilateral triangle.

Yes. The incenter and circumcenter of the equilateral triangle coincide with each other. This is because the perpendicular dropped from P on AP is also the perpendicular bisector of AB.

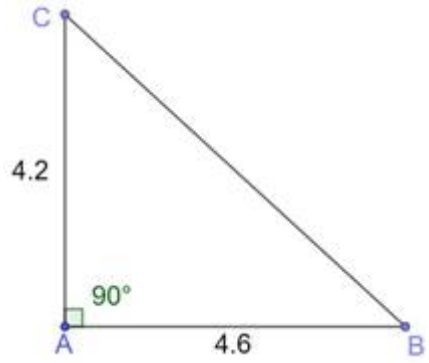
3. Question

Draw incircle of a triangle ABC where AB = 4.6 cm, AC = 4.2 cm and ∠A = 90°.

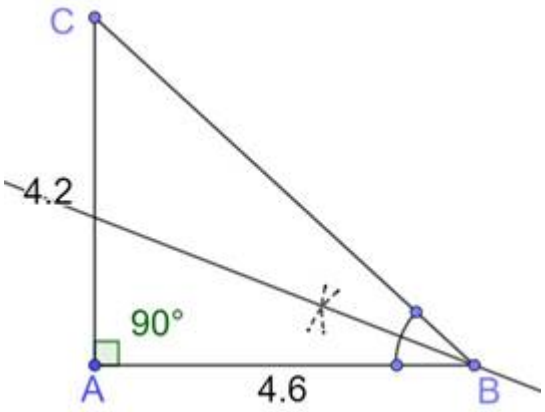
Answer

Steps of Construction:

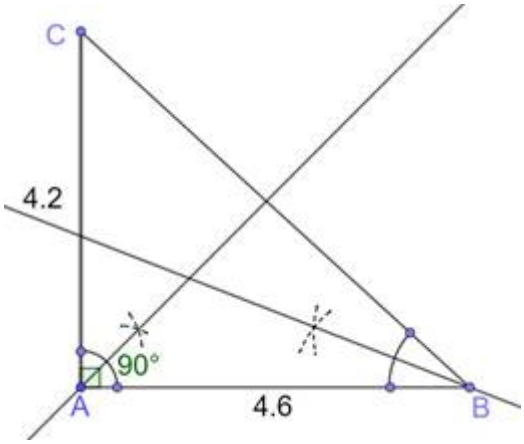
1. Draw a right-angled triangle of given dimensions.



2. Draw angle bisector of ∠B.

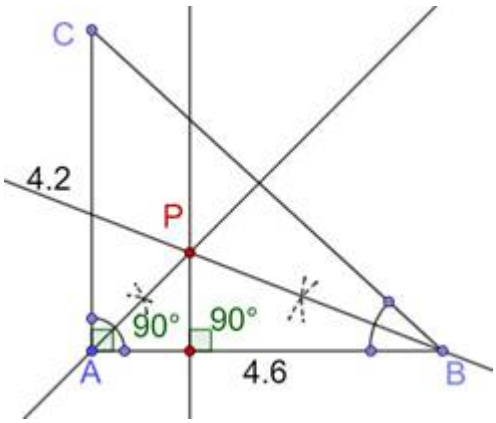


3. Draw angle bisector of ∠A.

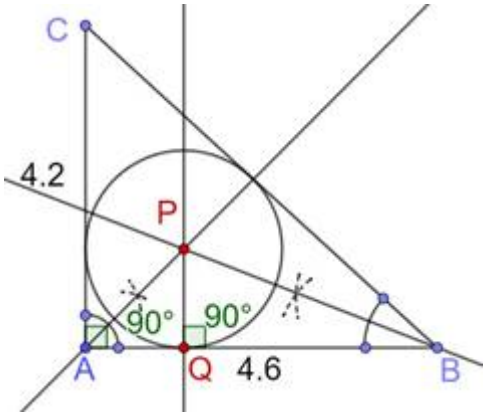


4. They intersect each other at P.

5. From P, drop a perpendicular on the line AB.



6. With P as center and length of perpendicular as the radius, draw a circle.



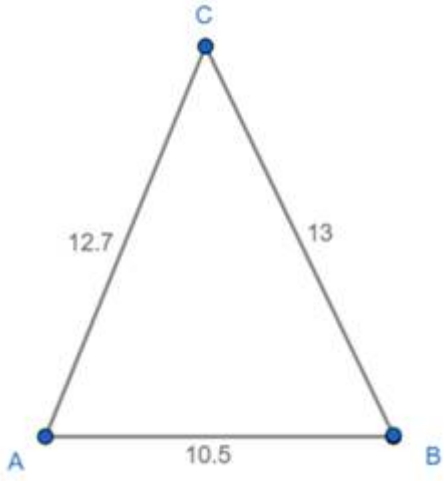
4. Question

Draw circumcircle of a triangle whose sides are 10.5 cm, 12.7 cm and 13 cm respectively. Also give reason as to why its circumcentre is located on the side of length 13 cm.

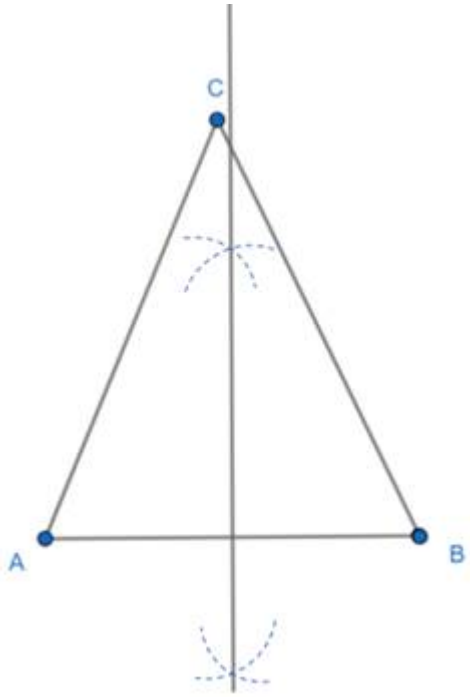
Answer

Let the triangle be ABC,

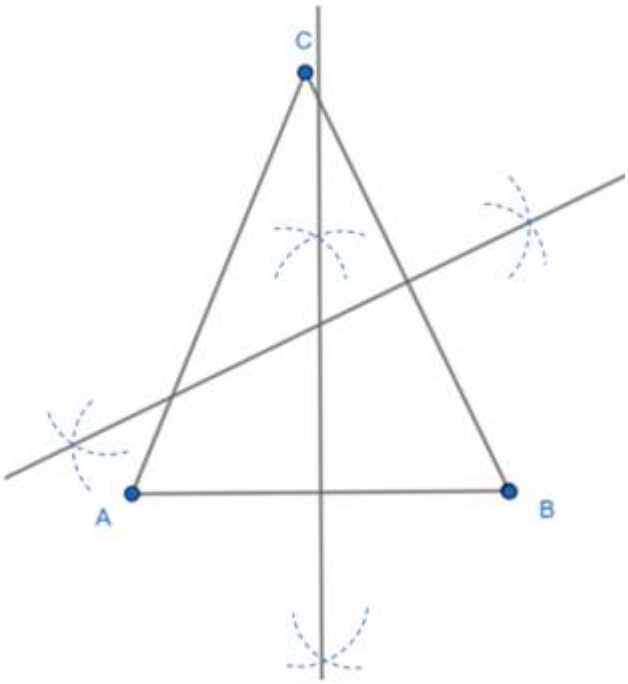
1. Draw a triangle ABC of given dimensions.



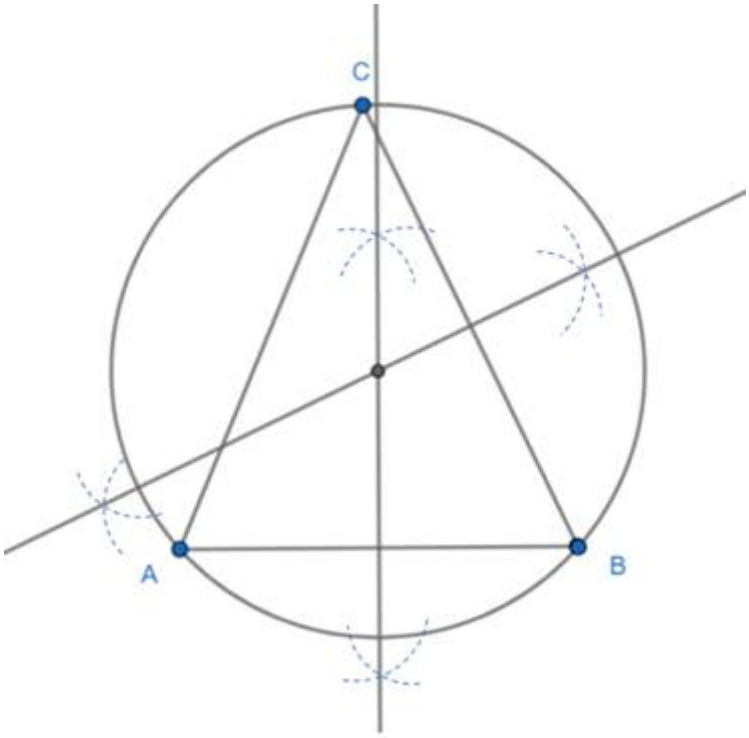
2. Now, draw perpendicular bisector of side AB.



3. Now, draw perpendicular bisector of BC.



4. Now, draw circle with the point of intersection of perpendiculars as center and passing through all vertices of the triangle.



Here we can see, the circle is touching all the vertices of the triangle. Hence it is the circumcircle.

Since the triangle is not a right angled triangle so the circumcenter is not lying on any side.

5. Question

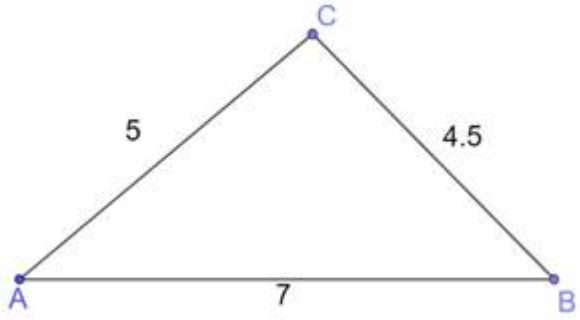
Where should the circumcentre of a triangle be located if sides of the triangle are 5 cm, 4.5 cm and 7 cm? Verify your answer by actual construction. Also, draw circumcircle to the given triangle.

Answer

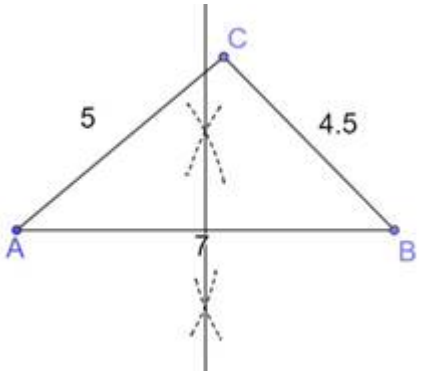
The circumcenter of this triangle should lie outside the triangle as it is an obtuse angled triangle.

Steps of construction:

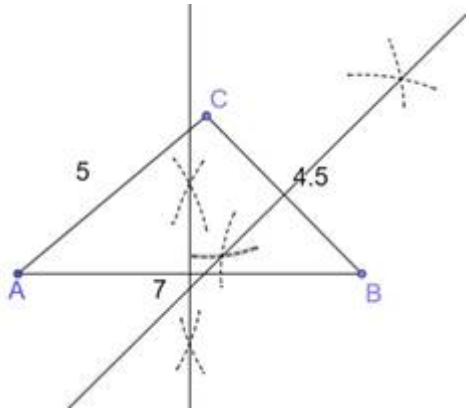
1. Construct a triangle ABC of given dimensions.



2. Draw a perpendicular bisector of AB.

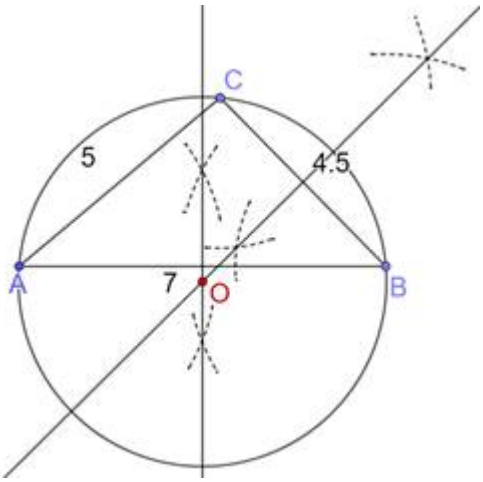


3. Draw a perpendicular bisector of BC



4. These perpendicular bisectors intersect at O.

5. With O as center and OA as radius, draw a circle.



6. This circle is the circumcircle of the given triangle.

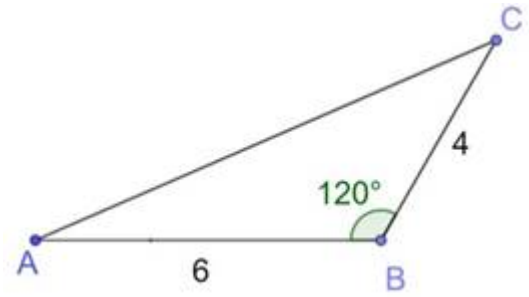
6. Question

Construct ΔABC where AB = 6 cm, BC = 4 cm and ∠B = 120°. Also draw incircle of the triangle.

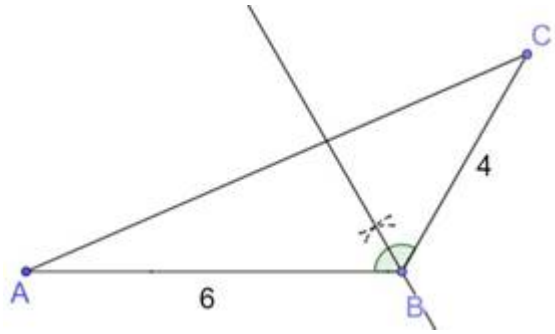
Answer

Steps of Construction:

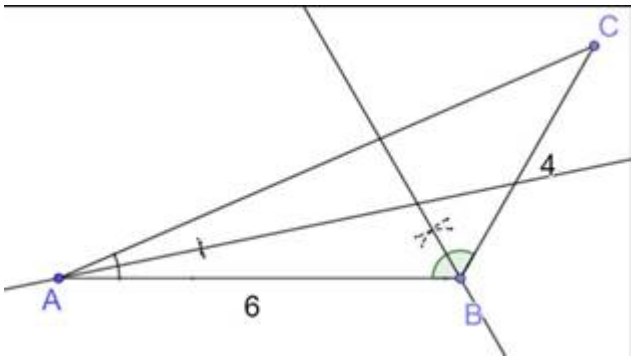
1. Construct a triangle of given dimensions.



2. Draw angle bisector of ∠B.

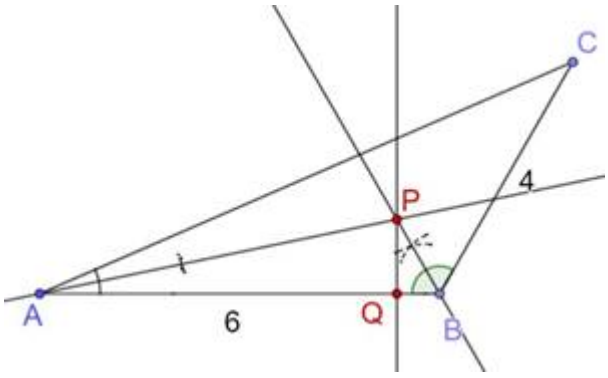


3. Draw angle bisector of ∠A.

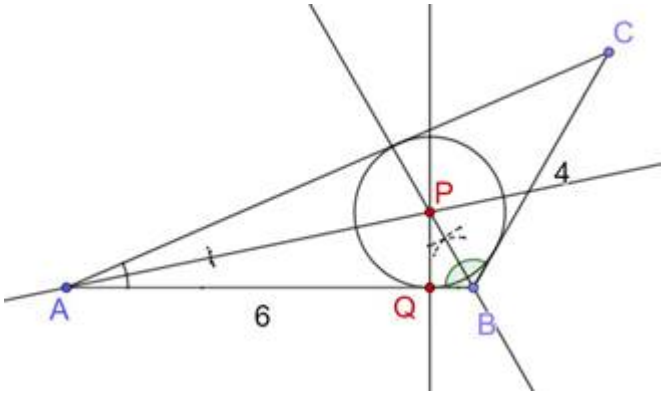


4. They intersect each other at P.

5. From P, drop a perpendicular on the line AB.



6. With P as center and length of perpendicular as the radius, draw a circle.


C
P
4
A
6
Q
B