12. Constructions

Exercise 12

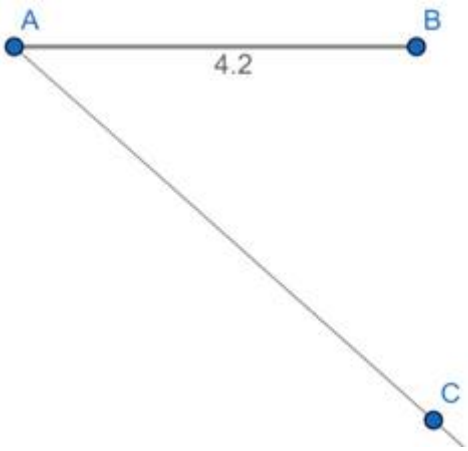
1. Question

Divide a line segment 4.2 cm long internally in the ratio 5:3 Also, write the steps of construction.

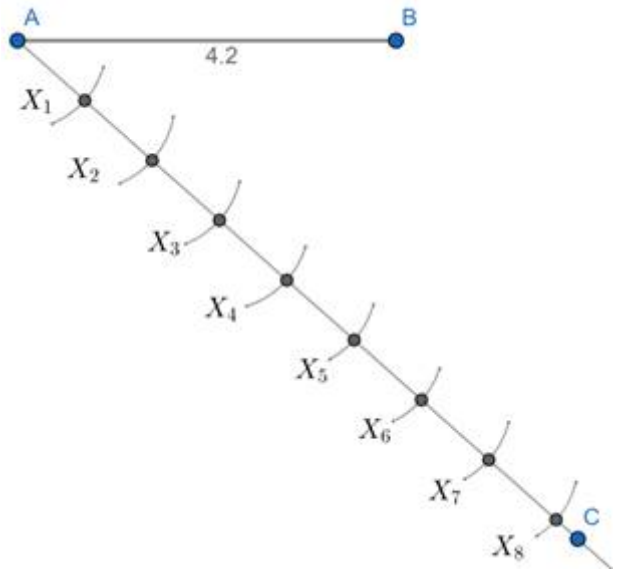
Answer

Step1: Draw a line segment AB of length 4.2 cm

Step2: Draw a line AC at any angle below AB

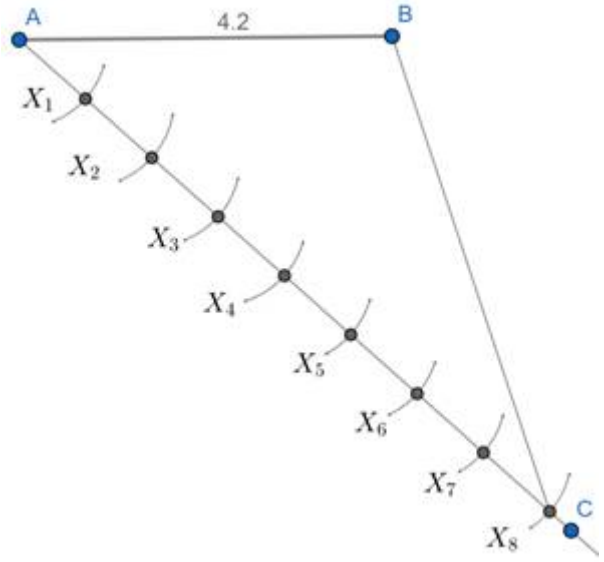


Step3: take any distance in compass and keep the needle of the compass on point A and draw an arc intersecting the line AC. Name the intersection point as X_1. Keeping the distance same in compass keep the needle on point X_1 and mark an arc intersecting AC at X_2. Draw 8 (5:3 given ratio 5 + 3 = 8) such parts i.e. upto X_8



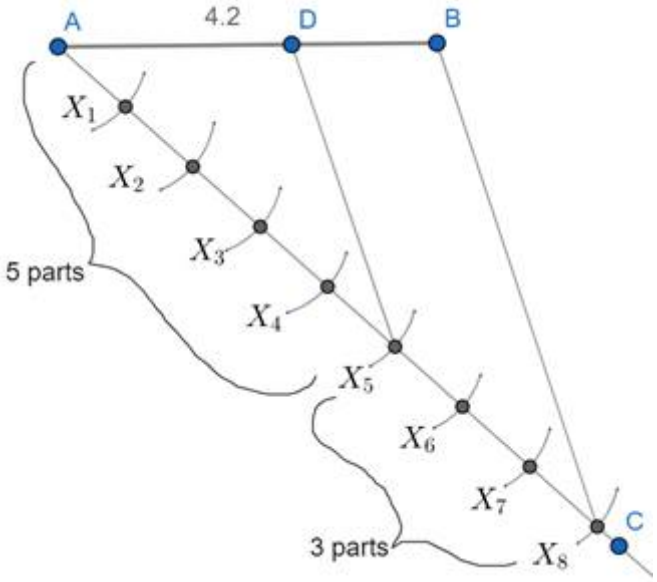
Thus we have made 8 equal parts on line AC

Step4: Join points X_8 and B



Now we have to divide the segment AB in ratio 5:3, i.e. 5 parts and 3 parts.

Step5: from point, X_5 draw a line parallel to BX_8 intersecting AB at D, and we have divided the segment AB in ratio 5:3



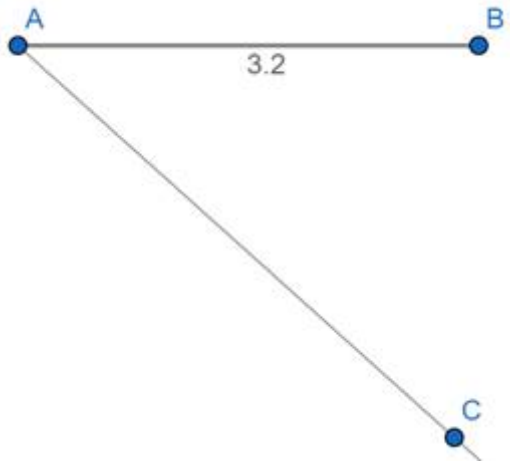
2. Question

Divide a line segment of length 3.2 cm in the ratio of 3:5 internally.

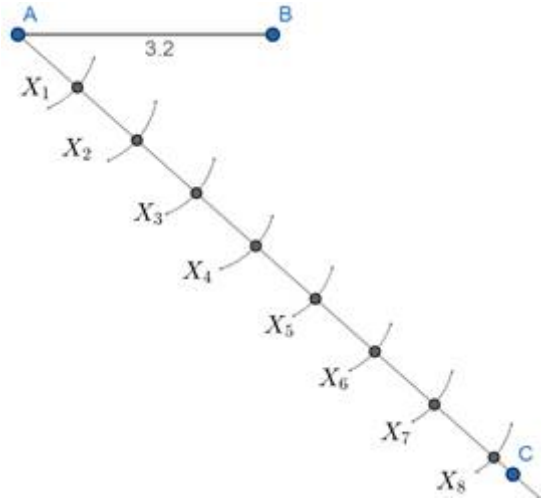
Answer

Step1: Draw a line segment AB of length 3.2 cm

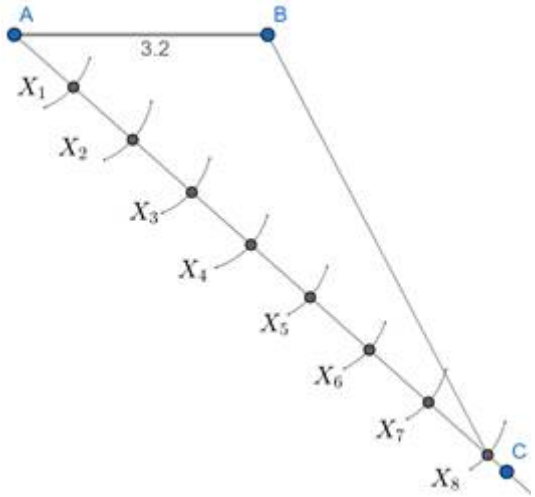
Step2: Draw a line AC at any angle below AB



Step3: take any distance in compass and keep the needle of the compass on point A and draw an arc intersecting the line AC. Name the intersection point as X_1. Keeping the distance same in compass keep the needle on point X_1 and mark an arc intersecting AC at X_2. Draw 8 (3:5 given ratio 3 + 5 = 8) such parts i.e. upto X_8

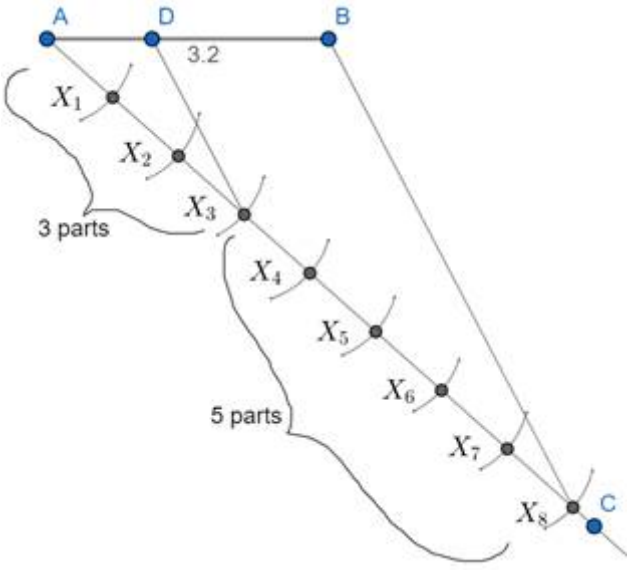


Step4: Join points X_8 and B



Now we have to divide the segment AB in ratio 3:5, i.e. 3 parts and 5 parts.

Step5: from point, X_3 draw a line parallel to BX_8 intersecting AB at D, and we have divided the segment AB in ratio 3:5



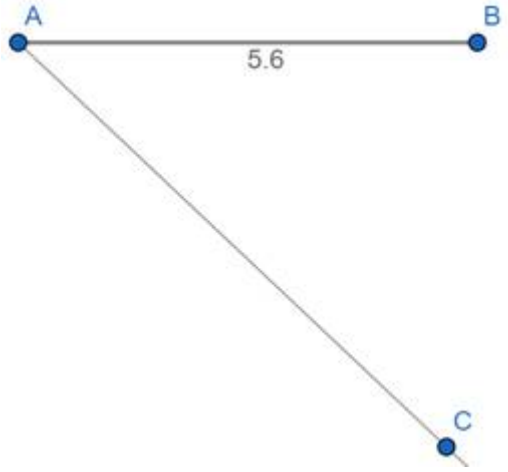
3. Question

Draw a line segment of length 5.6 cm and divide it internally in the ratio 5:8. Measure the two parts.

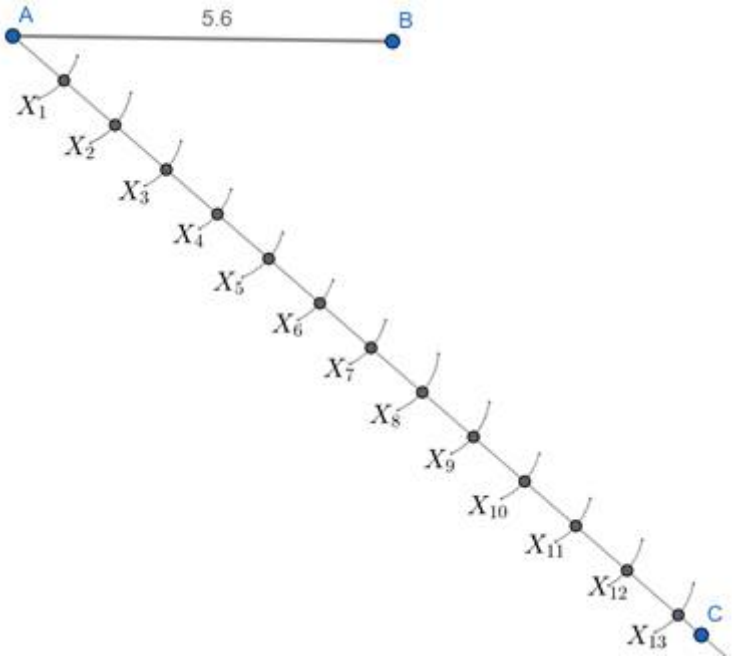
Answer

Step1: Draw a line segment AB of length 5.6 cm

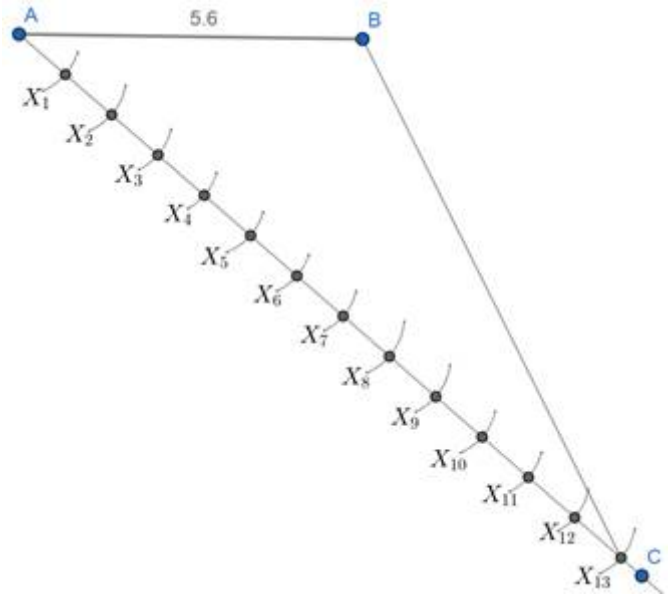
Step2: Draw a line AC at any angle below AB



Step3: take any distance in compass and keep the needle of the compass on point A and draw an arc intersecting the line AC. Name the intersection point as X_1. Keeping the distance same in compass keep the needle on point X_1 and mark an arc intersecting AC at X_2. Draw 13 (5:8 given ratio 5 + 8 = 13) such parts i.e. upto X_{13}



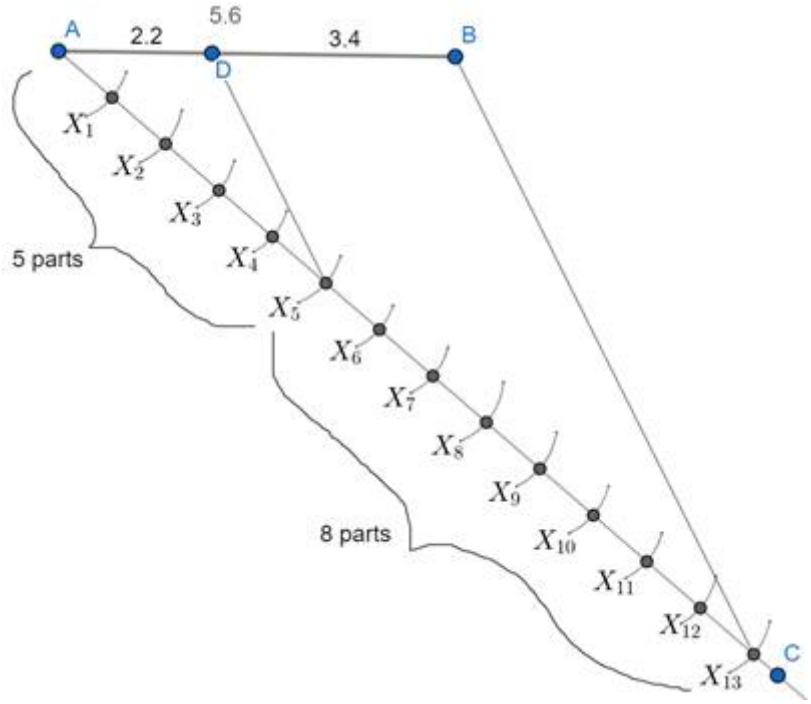
Step4: Join points X_{13} and B



Now we have to divide the segment AB in ratio 5:8, i.e. 5 parts and 8 parts.

Step5: from point, X_5 draw a line parallel to BX_{13} intersecting AB at D, and we have divided the segment AB in ratio 5:8

And measure the length of parts, i.e. AD and DB which are 2.2 cm and 3.4 cm respectively



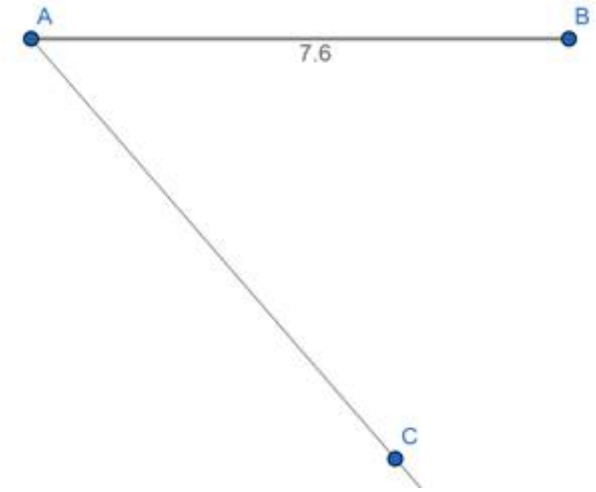
4. Question

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

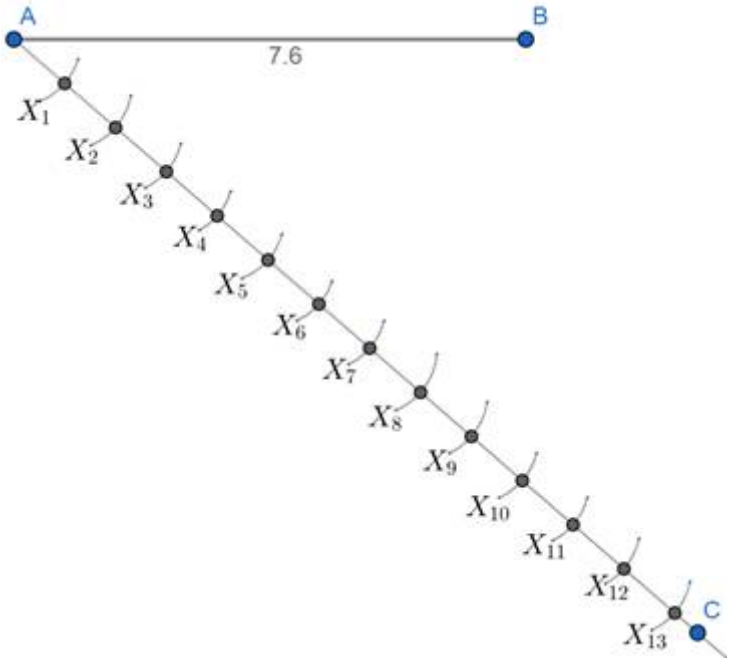
Answer

Step1: Draw a line segment AB of length 7.6 cm

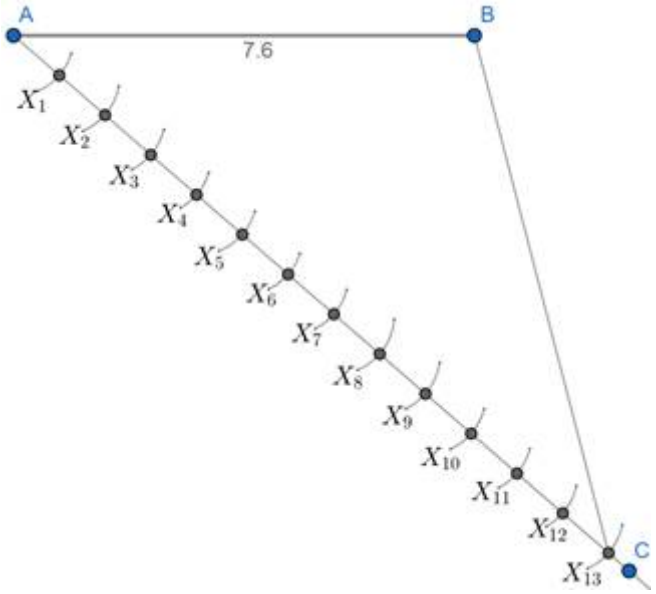
Step2: Draw a line AC at any angle below AB



Step3: Take any distance in compass and keep the needle of the compass on point A and draw an arc intersecting the line AC. Name the intersection point as X_1. Keeping the distance same in compass keep the needle on point X_1 and mark an arc intersecting AC at X_2. Draw 13 (5:8 given ratio 5 + 8 = 13) such parts i.e. upto X_{13}



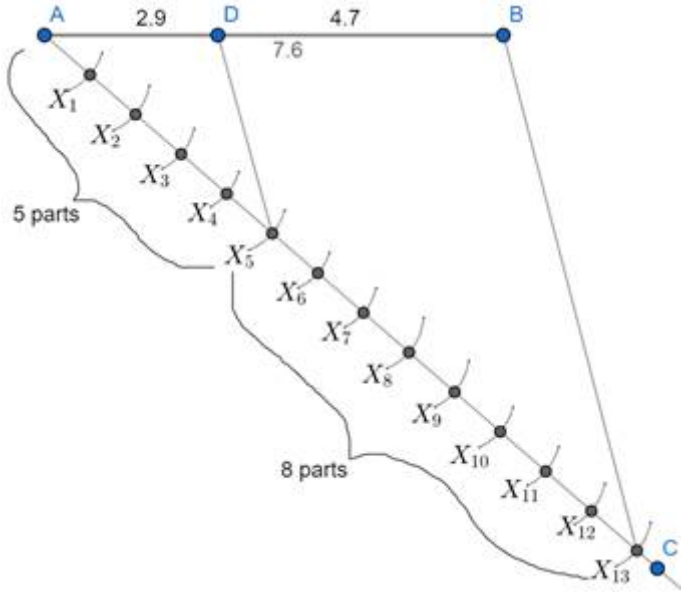
Step4: Join points X_{13} and B



Now we have to divide the segment AB in ratio 5:8, i.e. 5 parts and 8 parts.

Step5: from point, X_5 draw a line parallel to BX_{13} intersecting AB at D, and we have divided the segment AB in ratio 5:8

And measure the length of parts, i.e. AD and DB which are 2.9 cm and 4.7 cm respectively



5 A. Question

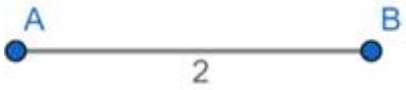
Draw a line segment AB = 2 cm. Divide it externally in the ratio of

5:3

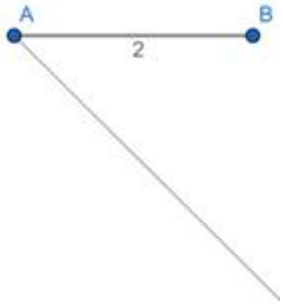
Answer

5:3

Step1: Draw a line segment AB of length 2 cm

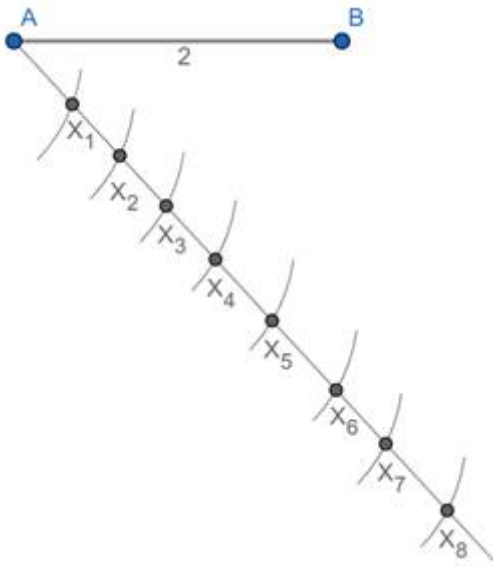


Step2: draw a ray at any angle below AB from A

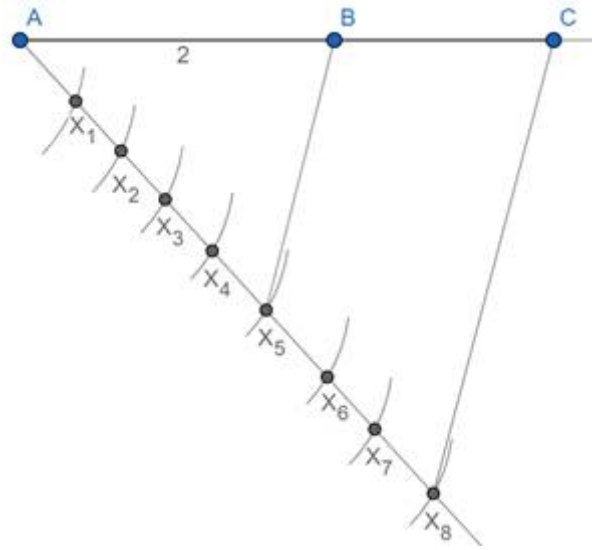


Now we have to divide the segment AB in ratio 5:3 externally which is greater than 1. So 5 parts will be the segment AB and 3 parts will be externally added, so we have to divide the ray into 8 (5 + 3 = 8) parts

Step3: Take any distance in compass and keep the needle of the compass on point A and draw an arc intersecting the ray drawn in step2. Name the intersection point as X_1. Keeping the distance same in compass keep the needle on point X_1 and mark an arc intersecting ray at X_2. Draw 8 such parts, i.e. upto X_8



Step4: Join X_5B. Extend AB and draw a line parallel to X_5B which intersects the extended AB at C. Hence C divides externally the segment AB



5 B. Question

Draw a line segment AB = 2 cm. Divide it externally in the ratio of

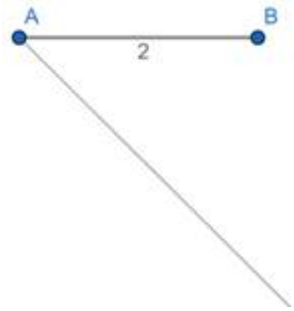
3:5

Answer

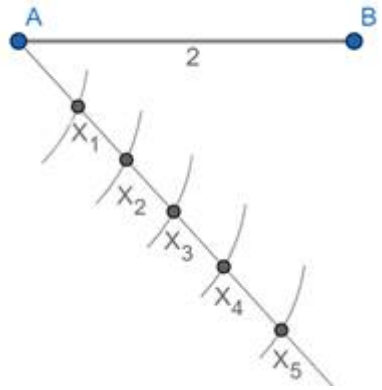
3:5

Step1: Draw a line segment AB of length 2 cm

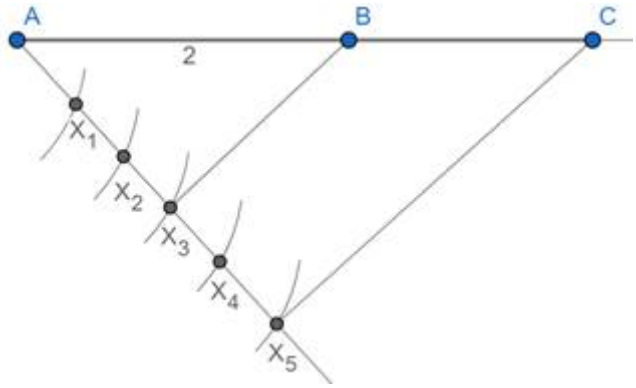
Step2: draw a ray at any angle below AB from A



Step3: Take any distance in compass and keep the needle of the compass on point A and draw an arc intersecting the ray drawn in step2. Name the intersection point as X_1. Keeping the distance same in compass keep the needle on point X_1 and mark an arc intersecting ray at X_2. Draw 5 such parts, i.e. upto X_5



Step4: Join X_3B(X_3 because the segment AB should be 3 parts). Extend AB and draw a line parallel to X_3B which intersects the extended AB at C. Hence C divides externally the segment AB



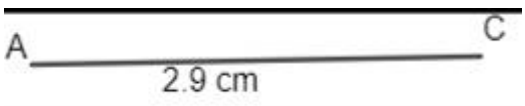
6. Question

Construct a triangle of scale AB = 2.3 cm, BC = 4 cm and AC = 2.9 cm and then construct a triangle similar to a given $\triangle$ ABC whose sides are $\frac{2}{3}$ of the corresponding sides of the triangle. Also, write the steps of construction.

Answer

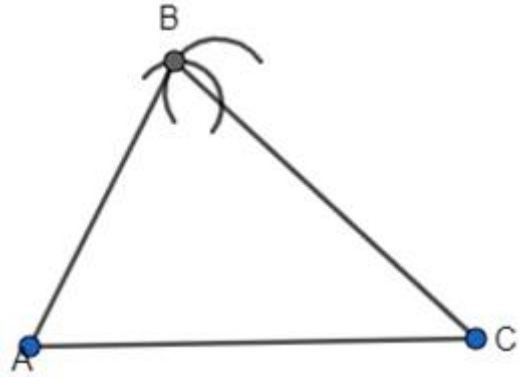
Let the triangle with sides 2.3 cm, 4 cm and 2.9 cm be ΔABC

Step1: construct segment AC of 2.9 cm

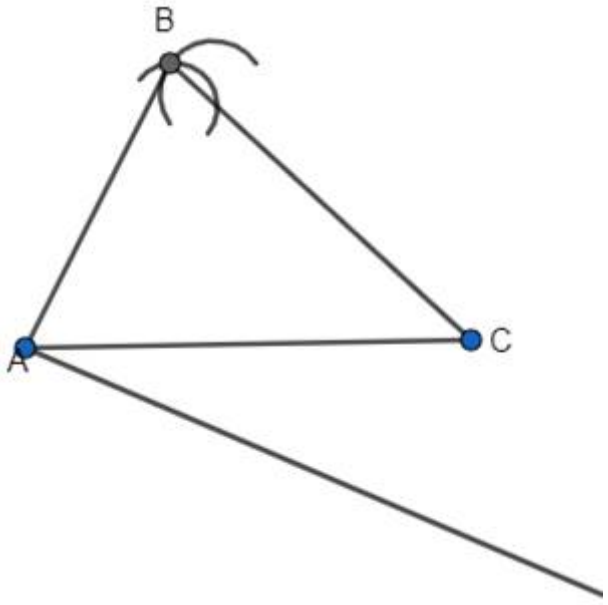


Step2: take distance 2.3 cm in compass keep the needle of the compass on point A and mark an arc above AC

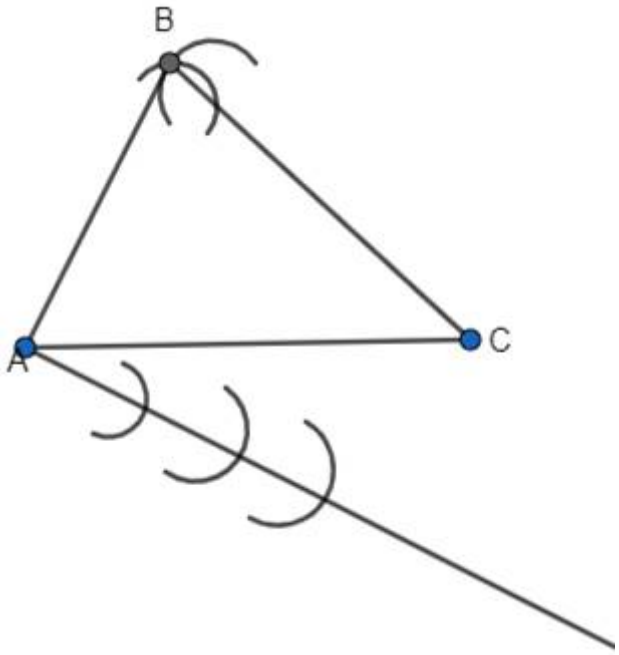
Step3: take distance 4 cm in compass keep the needle of the compass on point C and mark an arc intersecting the arc drawn in step2. Mark intersection point as B join AB and AC



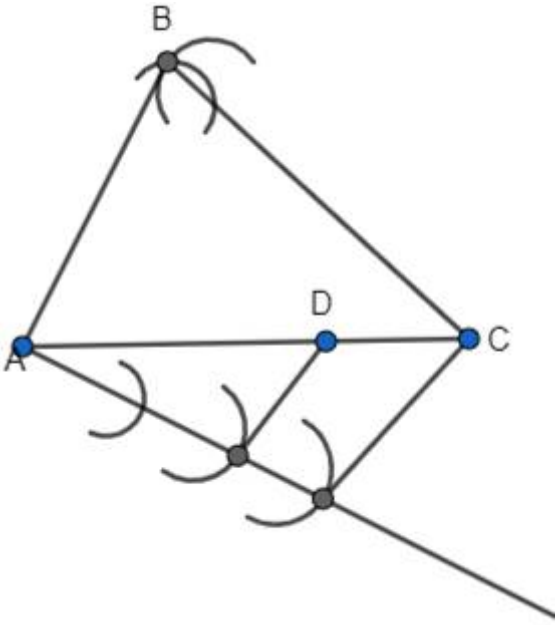
Step4: draw a ray from point A below AC at any angle



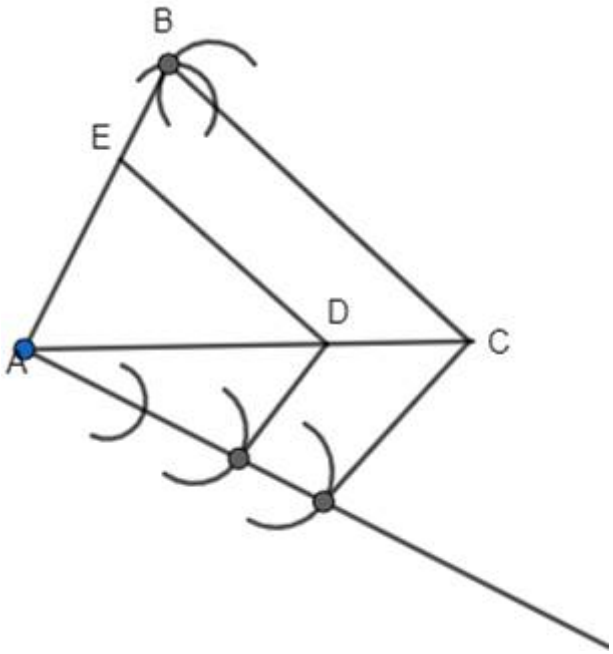
Step5: take any distance in compass and keeping the needle of the compass on point A cut an arc on ray constructed in step4 and name that point X_1. Keeping the distance in compass same keep the needle of the compass on point X_1 and cut an arc on the same ray and mark that point as X_2. Draw 3 such parts (greater of 2 and 3 in 2/3), i.e. by repeating this process mark points upto X_3



Step6: join X_3 and C and from X_2 (because X_2 is the second point 2 being smaller in 2/3) construct line parallel to X_3C and mark the intersection point with AC as D



Step7: construct line parallel to BC from point D and mark the intersection point with AB as E thus ΔADE ~ ΔACB is ready



7. Question

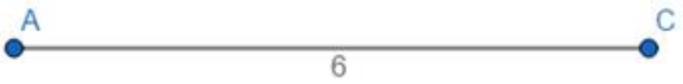
Construct a triangle of sides 4 cm, 5cm and 6cm and then a triangle similar to it whose sides are 2/3 of the corresponding sides of the first triangle.

Answer

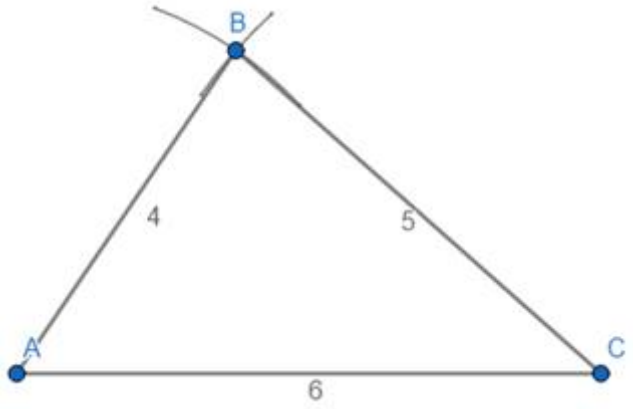
Let the triangle with sides 4 cm,5 cm and 6 cm be ΔABC

Step1: construct segment AC of 6 cm

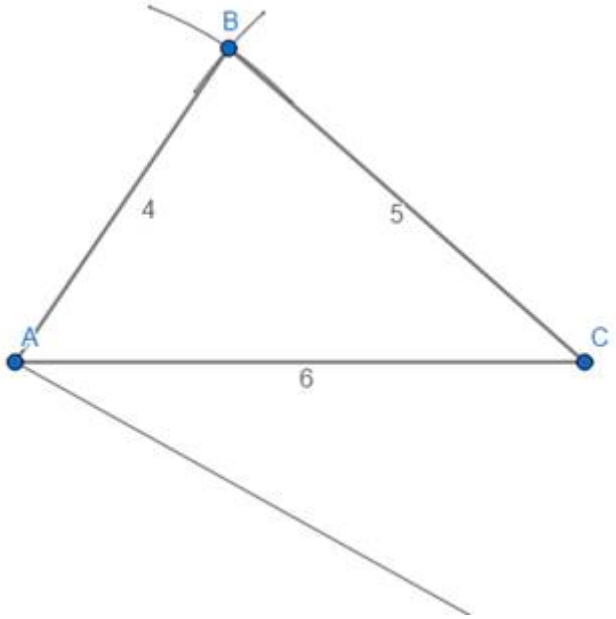
Step2: take distance 4 cm in compass keep the needle of the compass on point A and mark an arc above AC



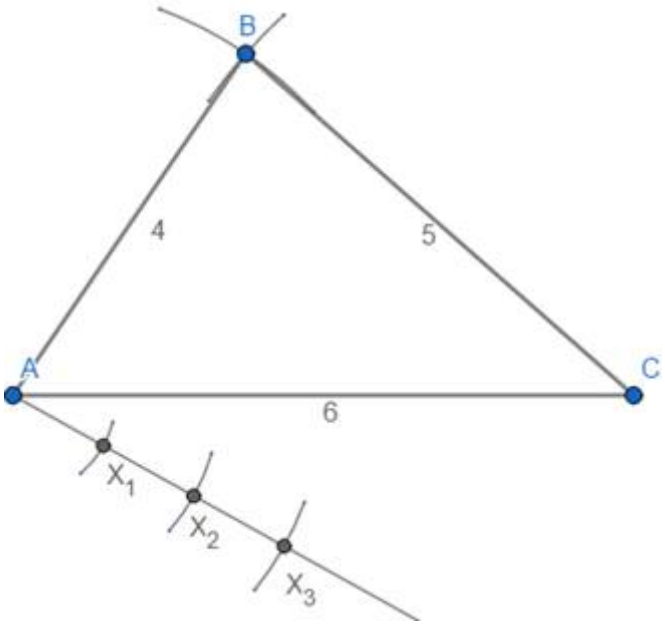
Step3: take distance 5 cm in compass keep the needle of the compass on point C and mark an arc intersecting the arc drawn in step2. Mark intersection point as B join AB and AC



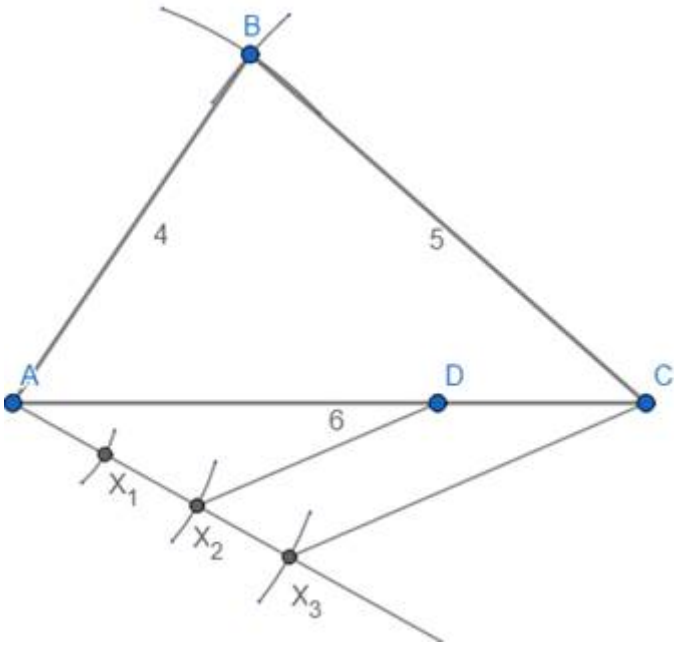
Step4: draw a ray from point A below AC at any angle



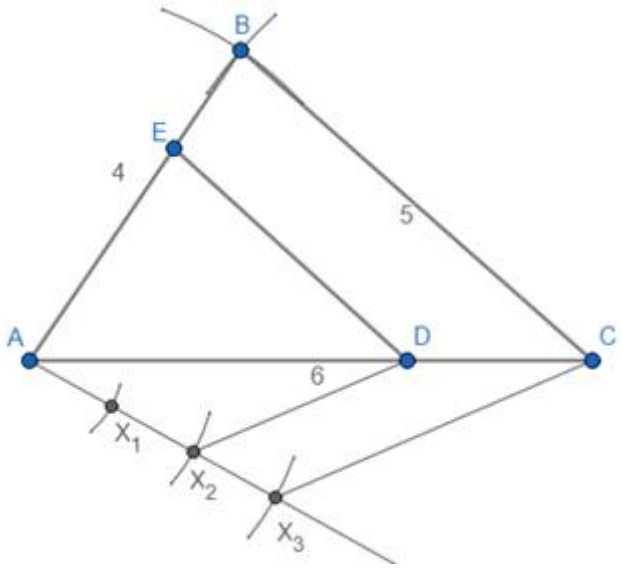
Step5: take any distance in compass and keeping the needle of the compass on point A cut an arc on ray constructed in step4 and name that point X_1. Keeping the distance in compass same keep the needle of the compass on point X_1 and cut an arc on the same ray and mark that point as X_2. Draw 3 such parts (greater of 2 and 3 in 2/3), i.e. by repeating this process mark points upto X_3



Step6: join X_3 and C and from X_2 (because X_2 is the second point 2 being smaller in 2/3) construct line parallel to X_3C and mark the intersection point with AC as D



Step7: construct line parallel to BC from point D and mark the intersection point with AB as E thus $\Delta ADE \sim \Delta ACB$ is ready



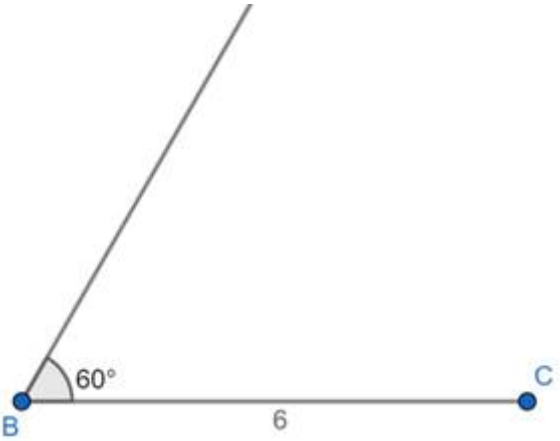
8. Question

Draw a triangle ABC with side BC = 6 cm, AB = 5cm, and ∠ABC = 60°, then construct a triangle whose sides are $\frac{3}{4}$ of the corresponding sides of Δ ABC.

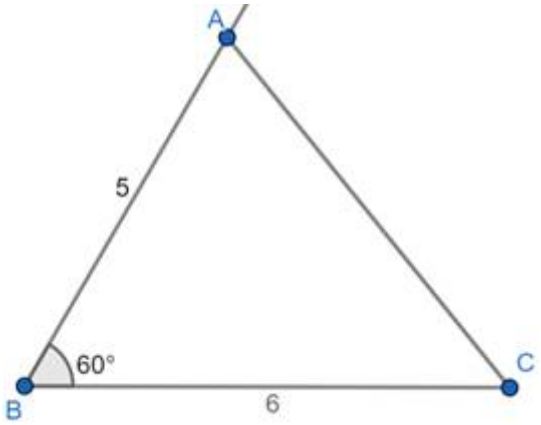
Answer

Step1: Construct segment BC of 6 cm

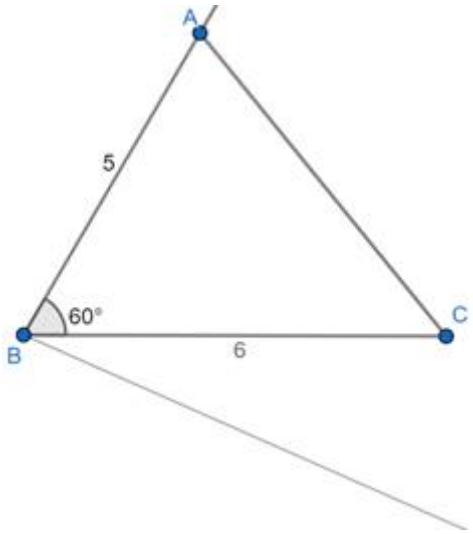
Step2: construct a ray at angle 60° above BC from point B



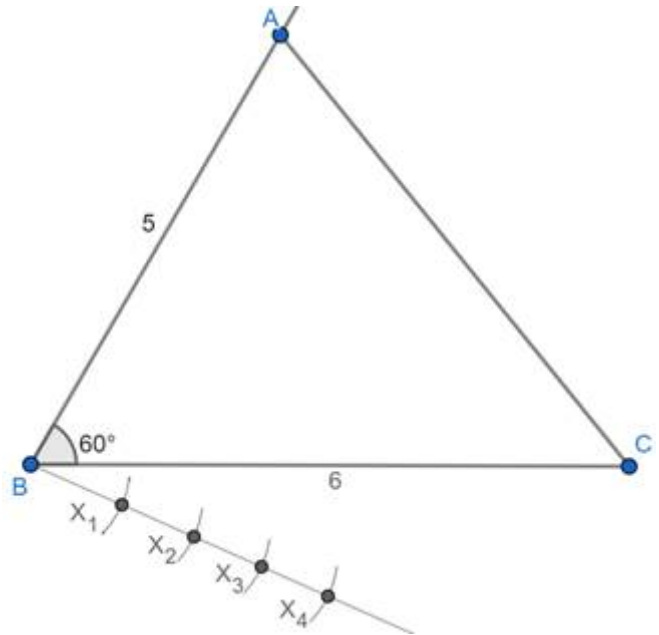
Step3: take 5 cm in compass because of AB = 5 cm, keep the needle of the compass on point B and mark an arc intersecting the ray drawn in step 2. Mark the intersection point as A and join A and C hence ΔABC is ready



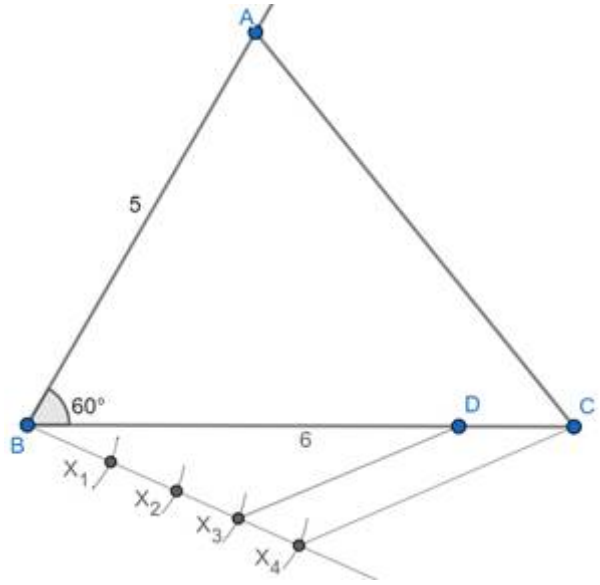
Step4: draw a ray at any angle from point B below BC



Step5: take any distance in compass and keeping the needle of the compass on point A cut an arc on ray constructed in step4 and name that point X_1. Keeping the distance in compass same keep the needle of the compass on point X_1 and cut an arc on the same ray and mark that point as X_2. Draw 4 such parts (greater of 3 and 4 in 3/4), i.e. by repeating this process mark points upto X_4

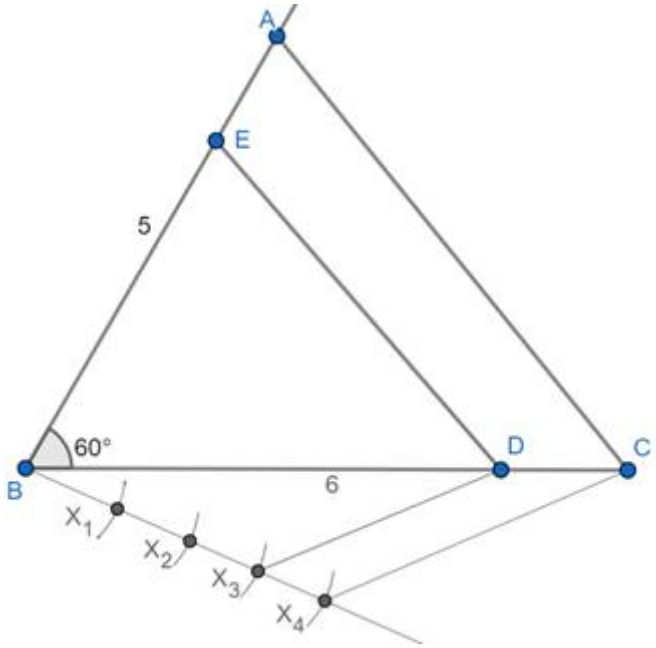


Step6: join X_4 and C and from X_3 (because X_3 is the third point 3 being smaller in 3/4) construct line parallel to X_3C and mark the intersection point with BC as D



BD is three forth of BC

Step7: construct line parallel to AC from point D and mark the intersection point with AB as E thus ΔBDE which have sides three forth of ΔABC is ready.

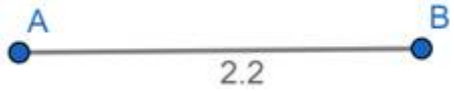


9. Question

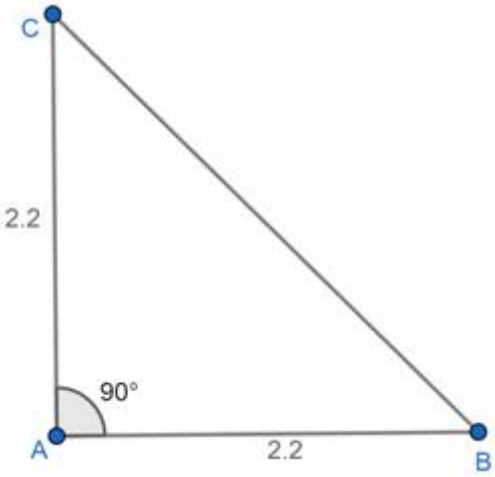
Draw a right triangle in which the sides (other than hypotenuse) are of lengths 2.2 cm and 2.2 cm. Then construct another triangle whose sides are 5/3 times the corresponding sides of the given triangle.

Answer

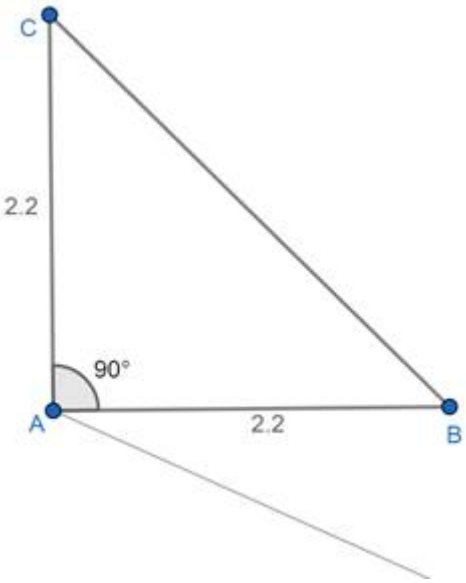
Step1: Construct a segment AB of 2.2 cm



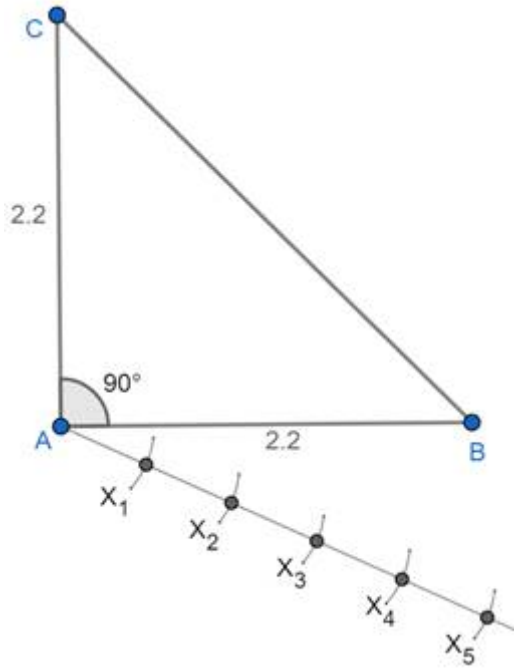
Step2: Construct AC of 2.2 cm at 90°. Join B and C to get right-angled triangle ABC



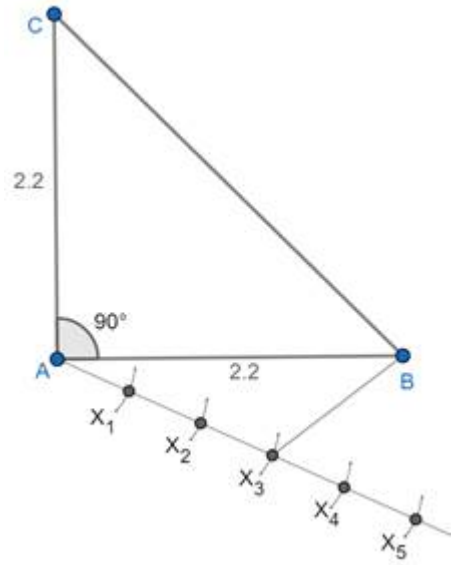
Step3: Draw a ray at any angle from point A below AB



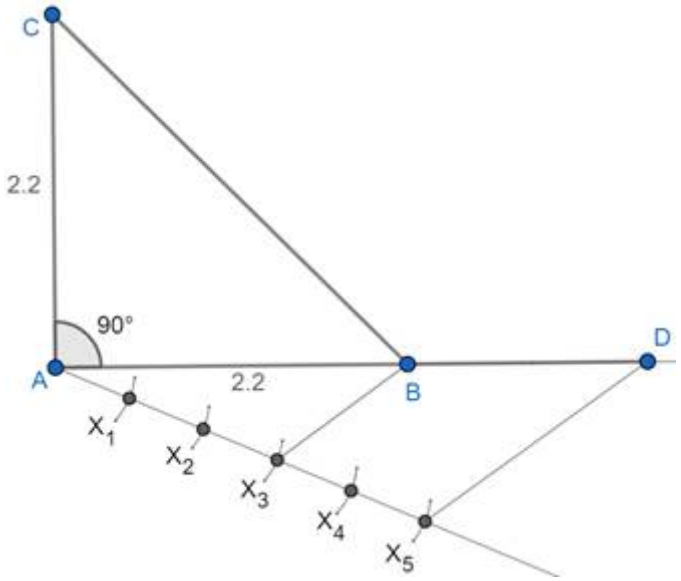
Step4: Take any distance in compass and keeping the needle of the compass on point A cut an arc on ray constructed in step3 and name that point X_1. Keeping the distance in compass same keep the needle of the compass on point X_1 and cut an arc on the same ray and mark that point as X_2. Draw 5 such parts (greater of 5 and 3 in 5/3), i.e. by repeating this process mark points upto X_5



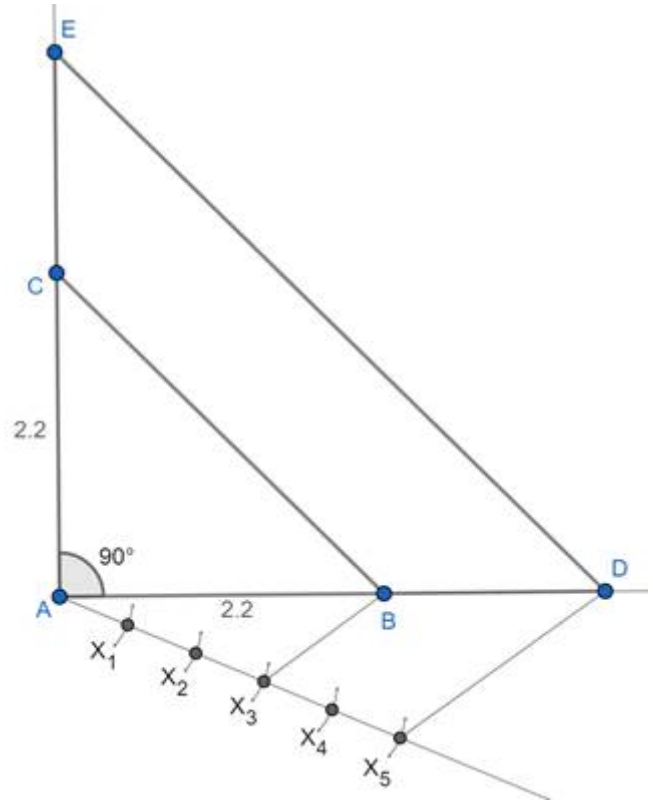
Step5: Join X_3 and B (3 being smaller of 5 and 3 in $\frac{5}{3}$ and not X_5 because the ratio $\frac{5}{3}$ is greater than 1)



Step6: Now extend AB and draw a line parallel to X_3B from X_5 intersecting AB at D



Step7: Extend AC and draw a line parallel to BC from point D intersecting AC at E and ΔADE whose sides are $\frac{5}{3}$ times ΔABC is ready



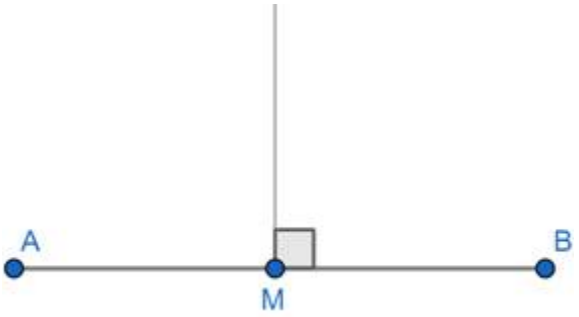
10. Question

Construct an isosceles triangle whose base is 3.2 cm and altitude 1.7 cm and then construct another triangle whose sides are $1\frac{1}{2}$ times the corresponding sides of the isosceles triangle.

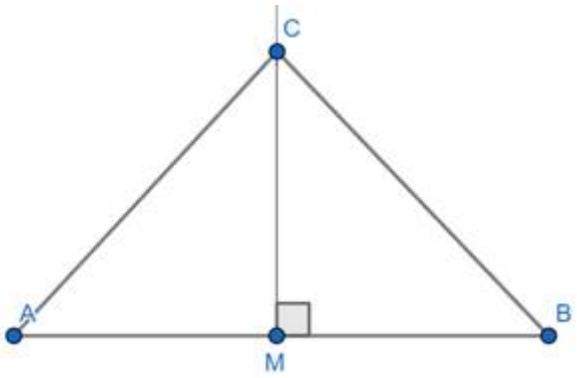
Answer

Step1: Draw the base of triangle AB = 3.2 cm

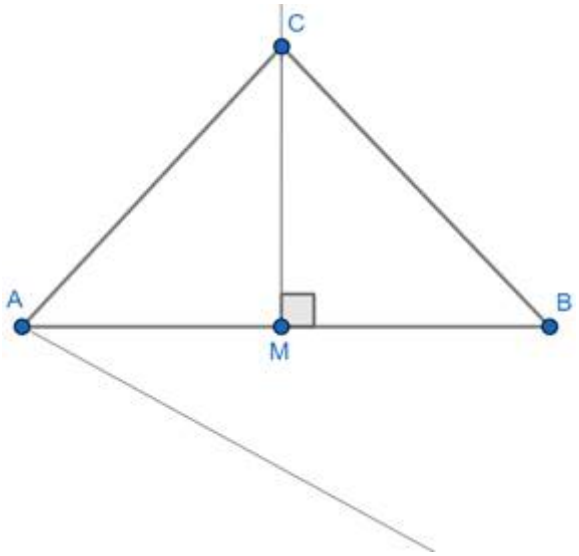
Step2: Using scale mark the centre of AB as M and from M using protractor draw a line perpendicular to AB



Step3: Take distance 1.7 cm in compass keep the needle of the compass on point M and mark an arc intersecting ray drawn in step2. Mark the intersection point as C and join AC and BC.



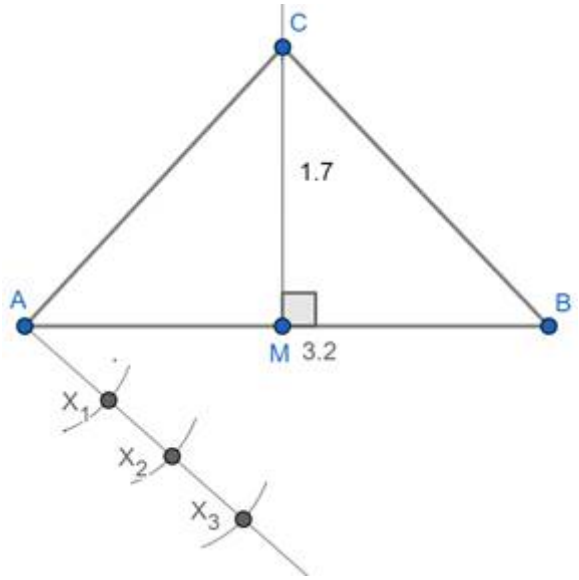
Step4: Draw a ray at any angle below AB from A



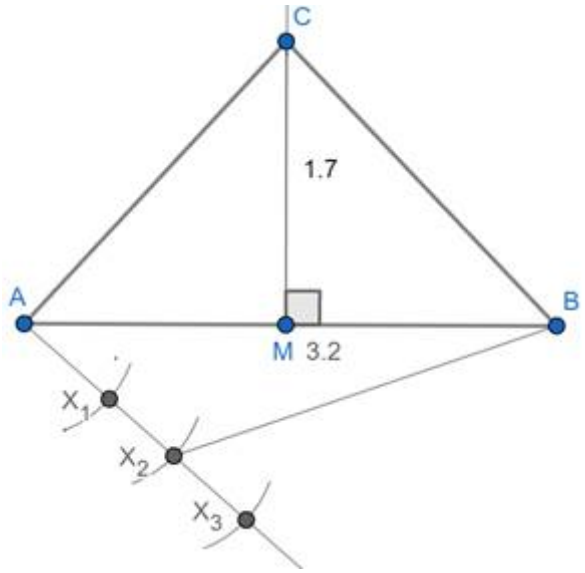
The scaling factor is

$$\Rightarrow 1\frac{1}{2} = \frac{2 \times 1 + 1}{2} = \frac{3}{2}$$

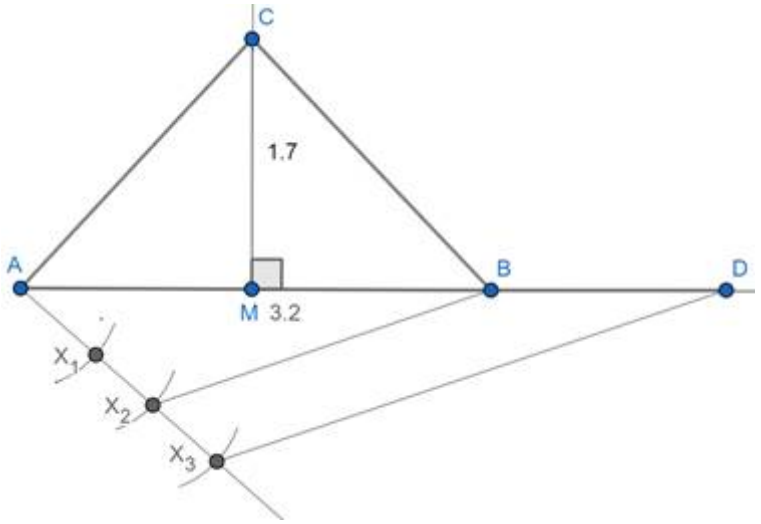
Step5: Take any distance in compass and keeping the needle of the compass on point A cut an arc on ray constructed in step4 and name that point X_1. Keeping the distance in compass same keep the needle of the compass on point X_1 and cut an arc on the same ray and mark that point as X_2. Draw 3 such parts (greater of 3 and 2 in 3/2), i.e. by repeating this process mark points upto X_3



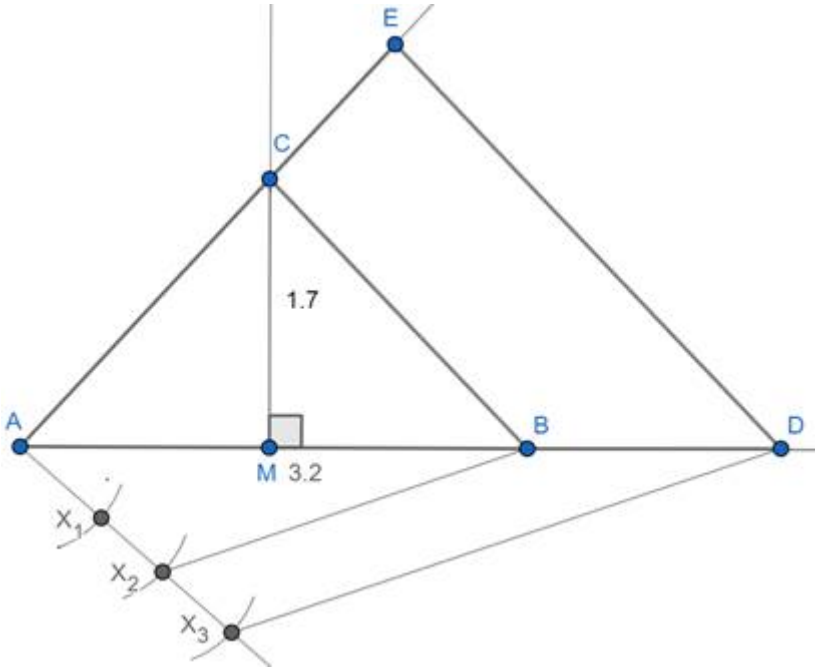
Step6: Join X_2 and B (2 being smaller of 3 and 2 in $\frac{3}{2}$ and not X_3 because the ratio $\frac{3}{2}$ is greater than 1)



Step7: Now extend AB and draw a line parallel to X_2B from X_3 intersecting AB at D



Step8: Extend AC and draw a line parallel to BC from point D intersecting AC at E and ΔADE whose sides are $\frac{3}{2}$ i.e. 1 1/2 times ΔABC is ready



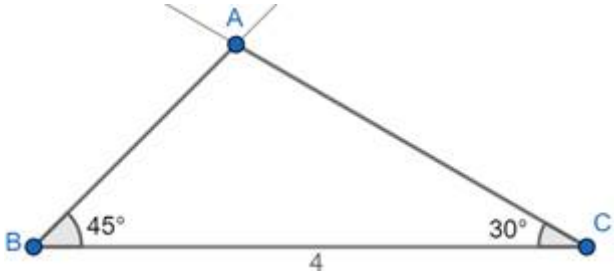
11. Question

Draw triangle ABC with side BC = 4 cm, ∠B = 45°, ∠C = 30°. Then construct a triangle whose sides are $\frac{4}{3}$ times the corresponding sides Δ ABC.

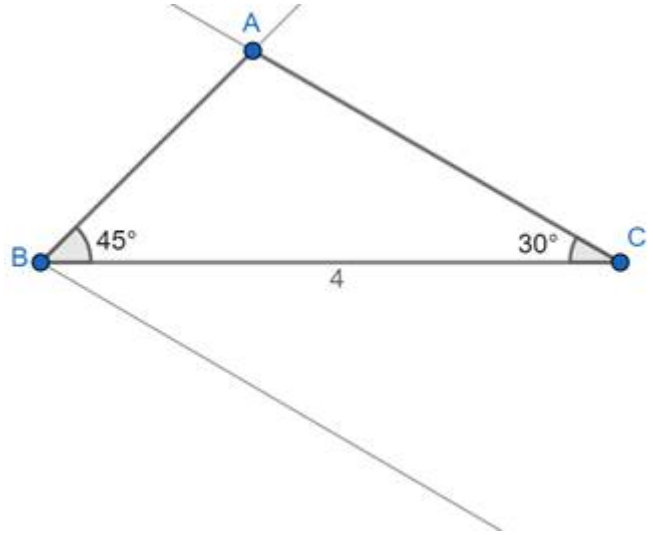
Answer

Step1: Draw segment BC of 4 cm

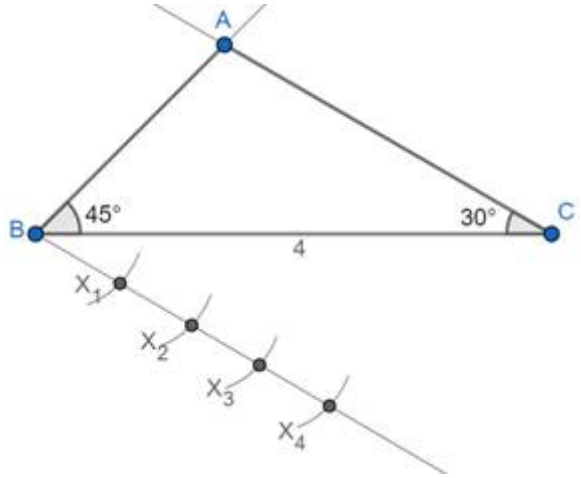
Step2: using protractor draw a ray at angle 45° from point B and a ray at angle 30° from point C. mark intersection of both these rays as point A



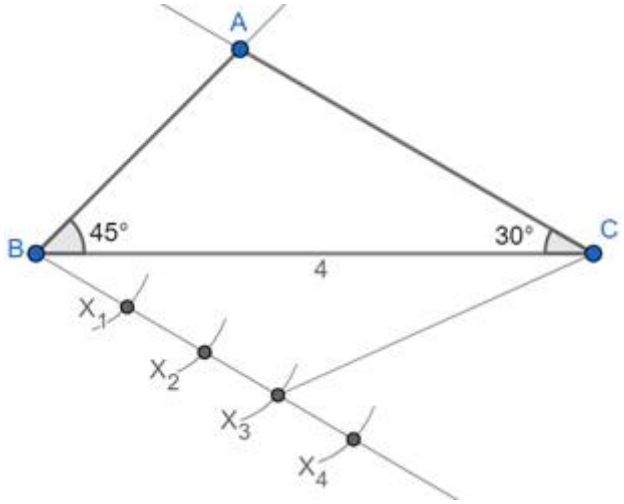
Step3: Draw a ray at any angle below BC from B



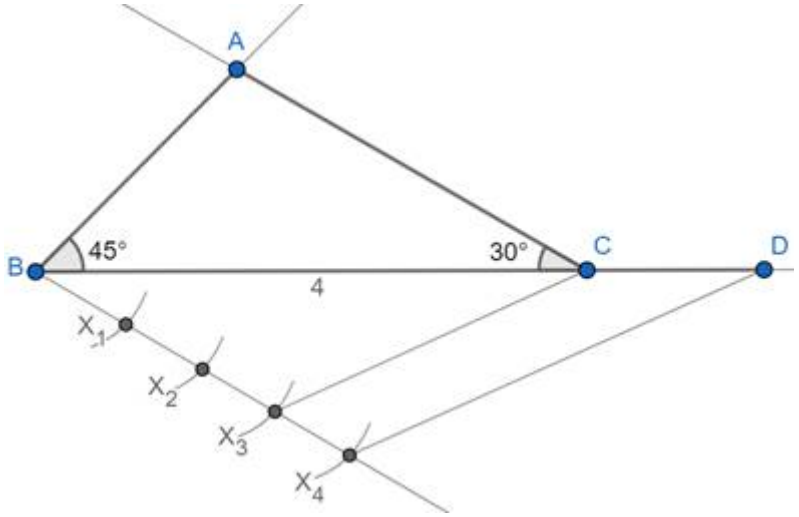
Step4: Take any distance in compass and keeping the needle of the compass on point A cut an arc on ray constructed in step3 and name that point X_1. Keeping the distance in compass same keep the needle of the compass on point X_1 and cut an arc on the same ray and mark that point as X_2. Draw 4 such parts (greater of 4 and 3 in 4/3), i.e. by repeating this process mark points upto X_4



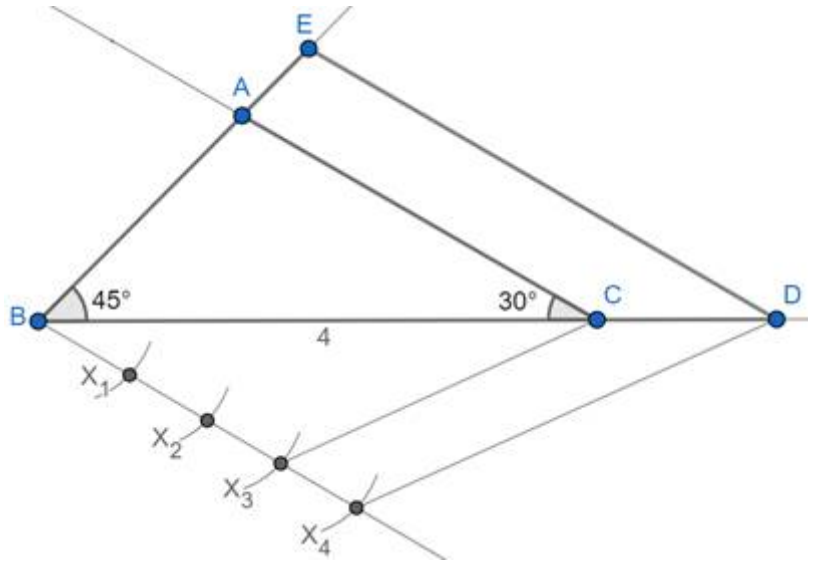
Step5: Join X_3 and C (3 being smaller of 4 and 3 in $\frac{4}{3}$ and not X_4 because the ratio $\frac{4}{3}$ is greater than 1)



Step6: Now extend BC and draw a line parallel to X_3C from X_4 intersecting BC at D



Step7: Draw a line parallel to AC from point D intersecting BA at E and ΔEBD whose sides are $\frac{4}{3}$ times ΔABC is ready



12. Question

Construct a triangle ABC, similar to a given isosceles triangle PQR, with QR = 2.8 cm, PQ = 2.5 cm, such that each of its side $\frac{6}{7}$th of the corresponding sides of the Δ PQR. Also draw the circumcircle of Δ PBC.

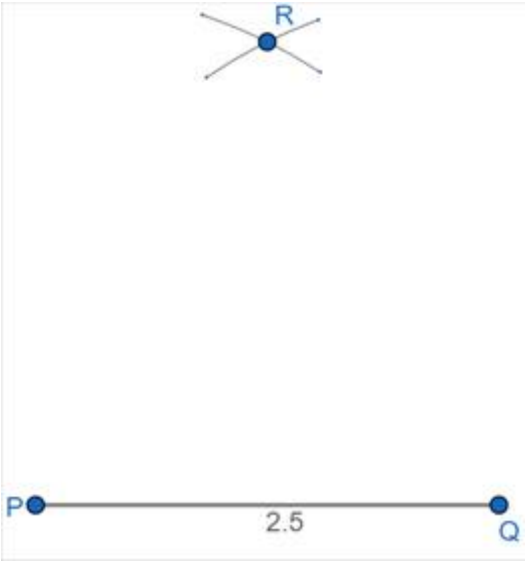
Answer

Note: we have to construct triangle PBC and not ABC

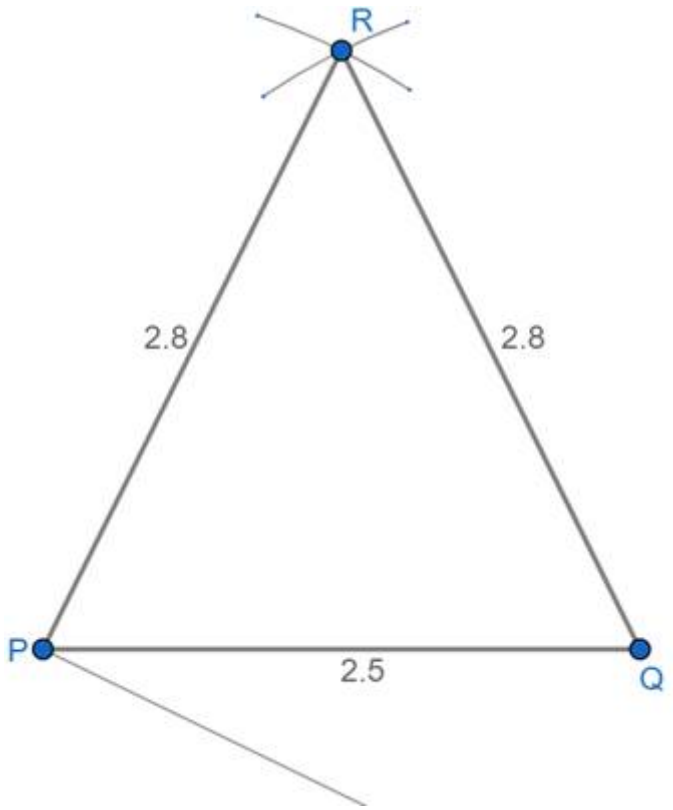
Step1: Draw PQ = 2.5 cm

As ΔPQR is isosceles QR = PR = 2.8 cm

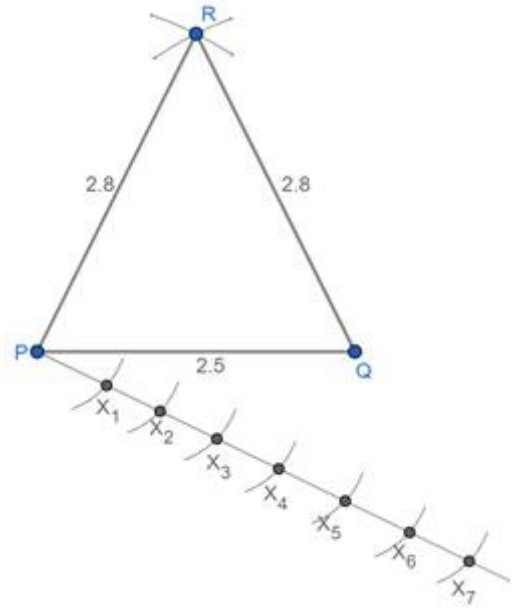
Step2: Take distance 2.8 cm in compass, keep the needle on point P and mark an arc above PQ. Keeping the distance in the compass same keep the needle on point Q and mark an arc intersecting the previous arc. Mark intersection point as R



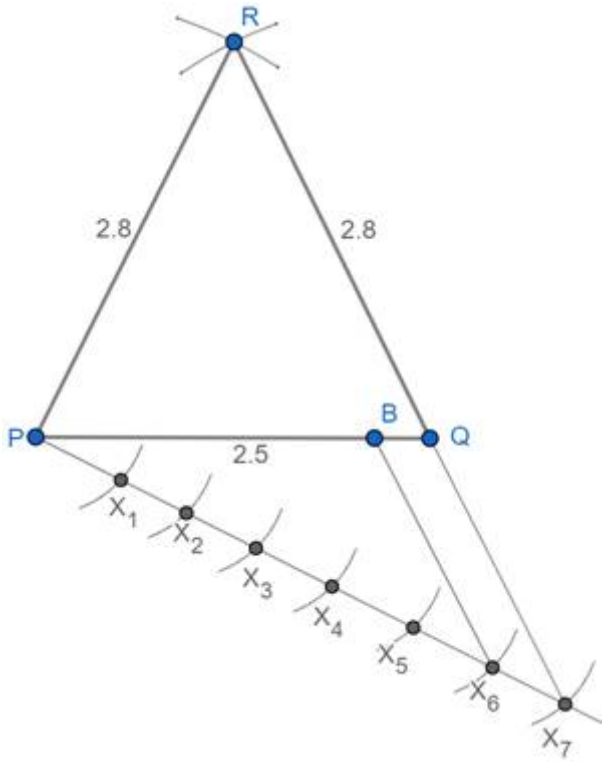
Step3: Join PR and QR and draw a ray from point P below PQ



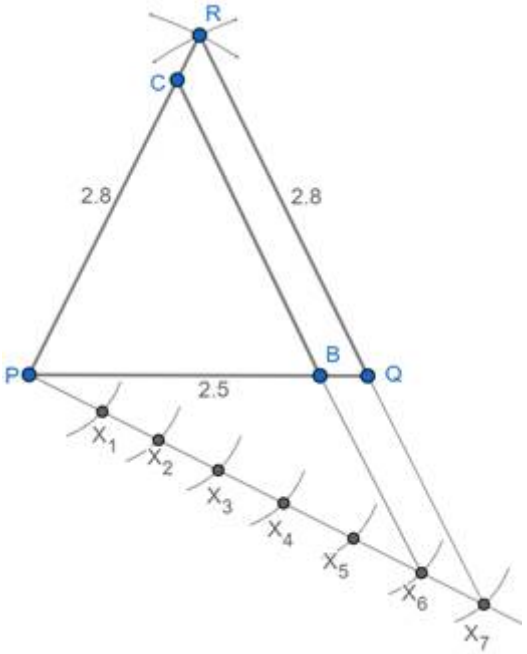
Step4: Take any distance in compass and keeping the needle of the compass on point P cut an arc on ray constructed in step3 and name that point X_1. Keeping the distance in compass same keep the needle of the compass on point X_1 and cut an arc on the same ray and mark that point as X_2. Draw 7 such parts (greater of 6 and 7 in 6/7), i.e. by repeating this process mark points upto X_7



Step5: join X_7 and Q and from X_6 (6 being smaller in $\frac{6}{7}$) draw a line parallel to X_7Q intersecting PQ at B

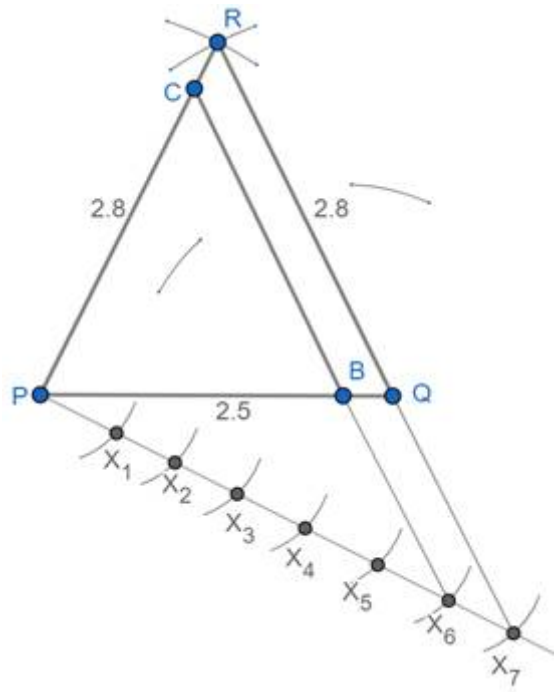


Step6: Draw a line parallel to QR from point B intersecting PR at C and ΔPBC is ready

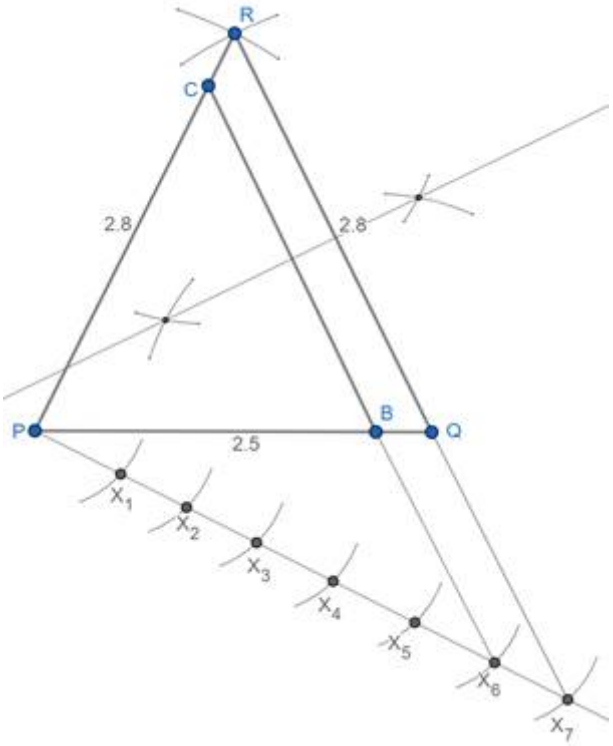


Now to construct the circumcircle of ΔPBC. The centre of circumcircle is the intersection of perpendicular bisectors, and the radius is the distance from the centre to any vertex of the triangle. We will draw perpendicular bisector of PC and BC

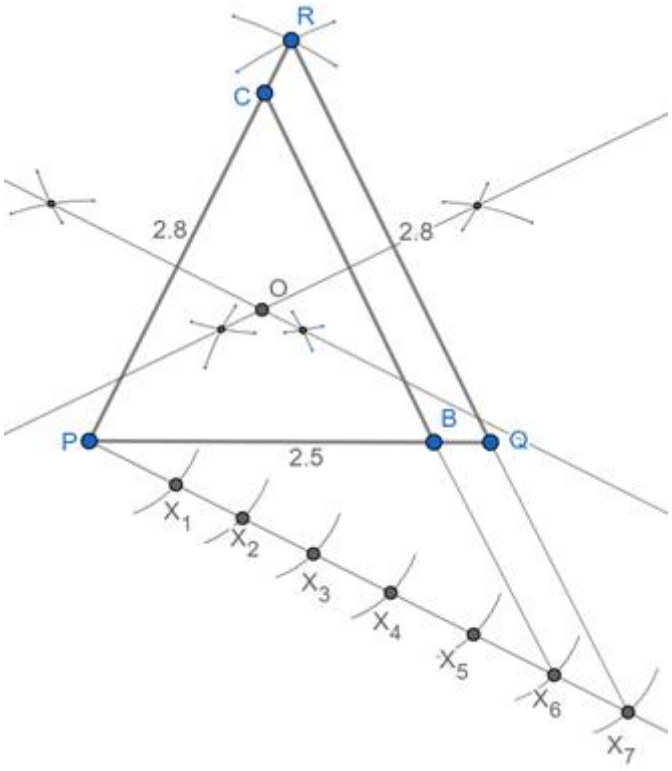
Step7: Take any distance approximately greater than half of BC in compass. Keep the needle of the compass on point B and mark arcs to both sides of BC.



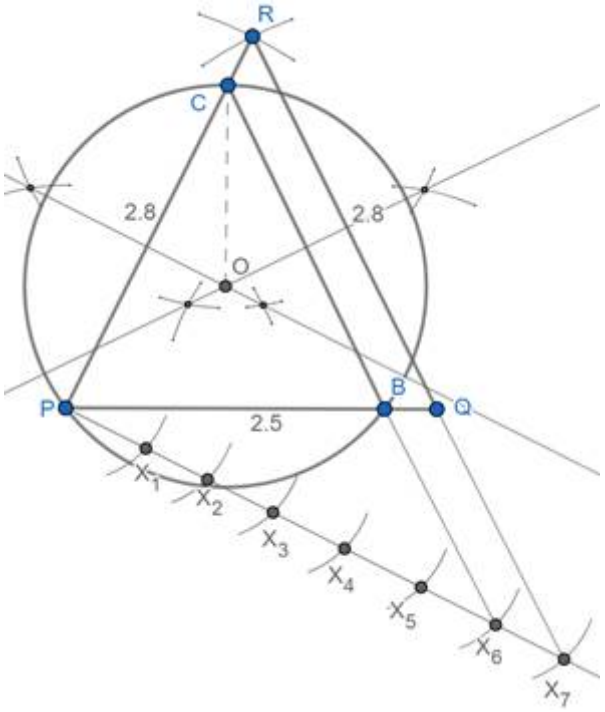
Step8: Keeping the distance in the compass same keep the needle on point C and mark arcs intersecting arcs drawn in step7. Draw a line between these intersecting arcs



Step9: Repeat step7 and step8 to draw perpendicular bisector for PC and mark the intersection point of both perpendicular bisectors as O



Step10: Keep the needle of the compass on point O and draw circle taking radius OC. Circumcentre of ΔPBC is ready



13. Question

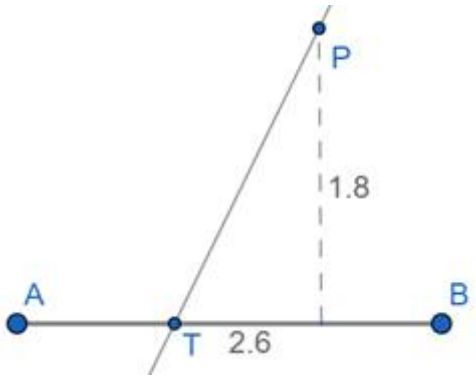
Construct a ΔABC in which AB = 2.6 cm ∠B = 60° and altitude CD = 1.8 cm. Construct a ΔAQR similar to ΔABC, such that each side of ΔAQR is 1.5 times that of the corresponding side of ΔABC.

Answer

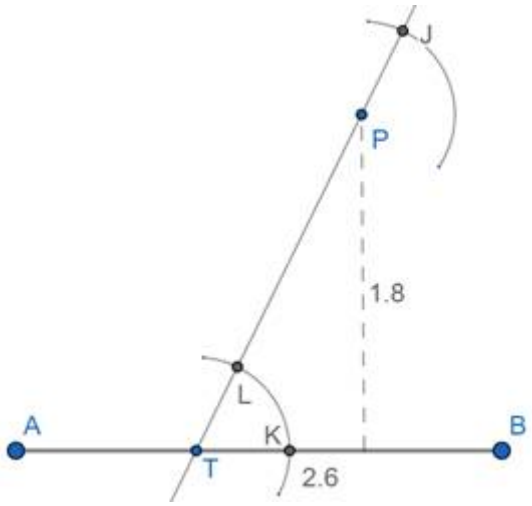
Step1: Construct AB = 2.6 cm

First, we have to make a line parallel to AB at 1.8 cm

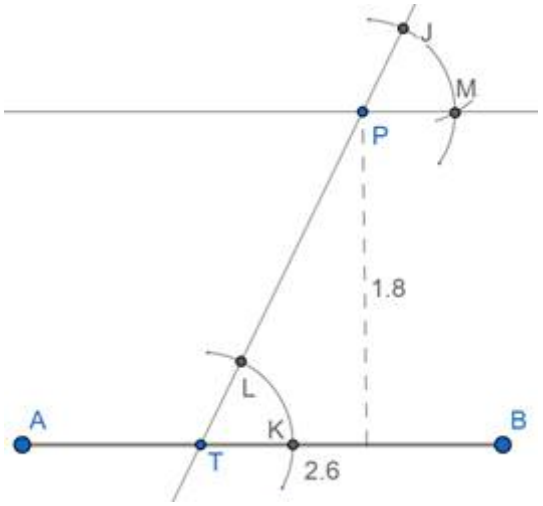
Step2: Mark a point P at 1.8 cm from segment AB above it. Draw a line passing through point P and intersecting AB at T as shown



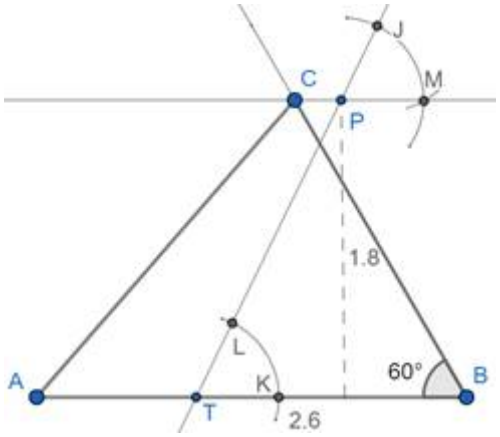
Step3: Take any distance in compass keep the needle on point T and mark an arc intersecting AB and PT at K and L respectively. Keeping the distance in compass same keep the needle on point P and draw an arc which intersects line TP at J



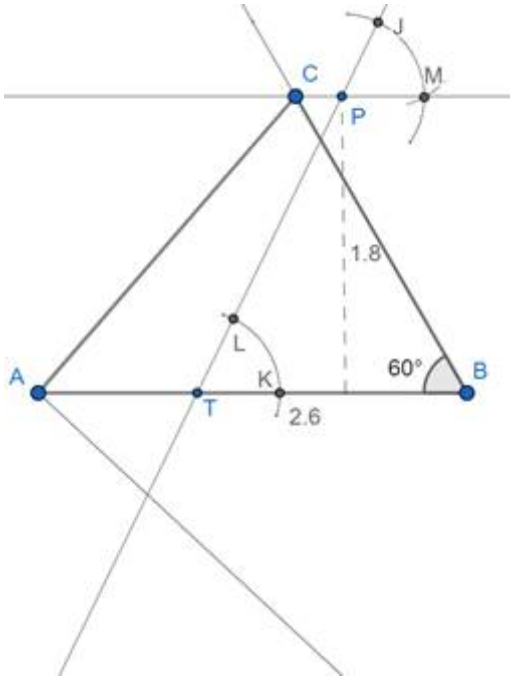
Step4: Take the distance of arc LK in compass and keep the needle on point J and draw an arc intersecting the arc passing from J at point M. Draw a line through point M and N and is parallel to AB



Step5: Draw the line at 60° from point B intersecting the line drawn in step4 at point C. Join AC and BC



Step6: draw a ray at any angle below BA from point A

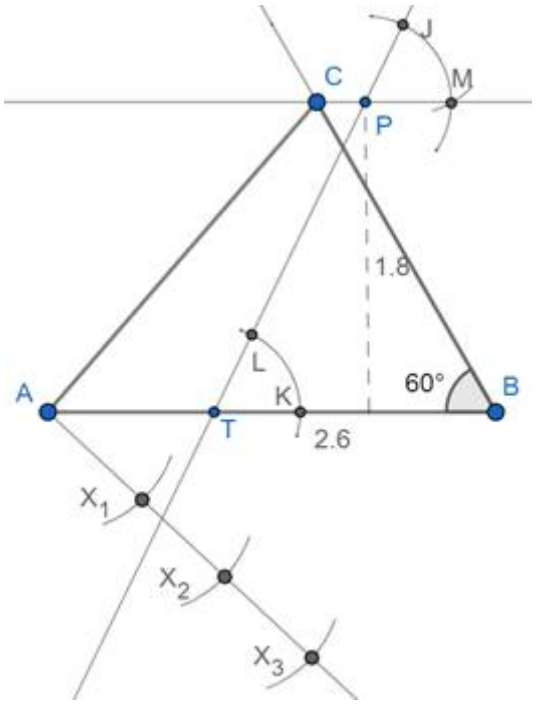


Now we have to construct the triangle AQR which is 1.5 times that of the corresponding side of ΔABC

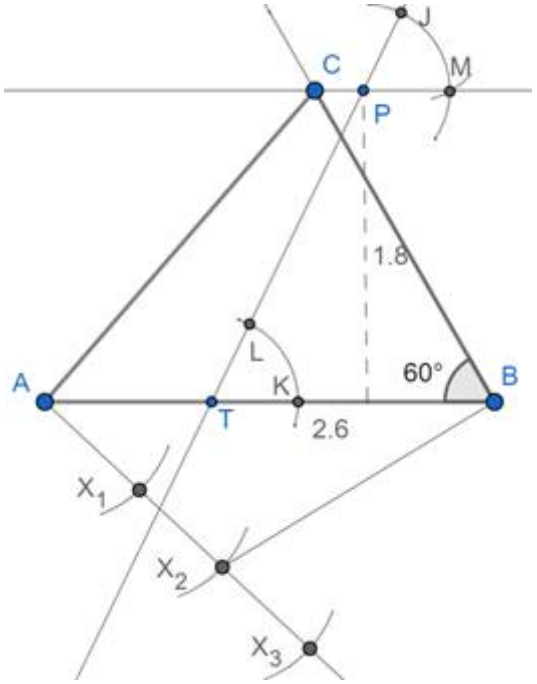
$$\Rightarrow 1.5 = \frac{3}{2}$$

The scaling factor is $\frac{3}{2}$

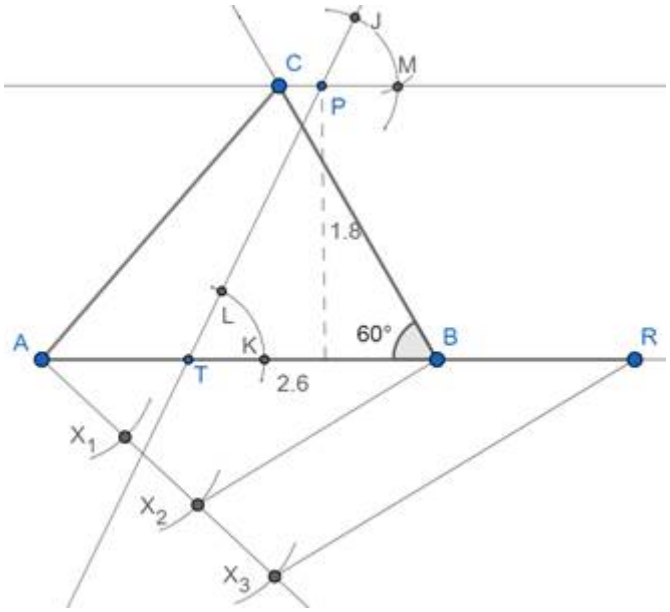
Step7: Take any distance in compass and keeping the needle of the compass on point A and cut an arc on ray constructed in step6 and name that point X_1. Keeping the distance in compass same keep the needle of the compass on point X_1 and cut an arc on the same ray and mark that point as X_2. Draw 3 such parts (greater of 3 and 2 in 3/2), i.e. by repeating this process mark points upto X_3



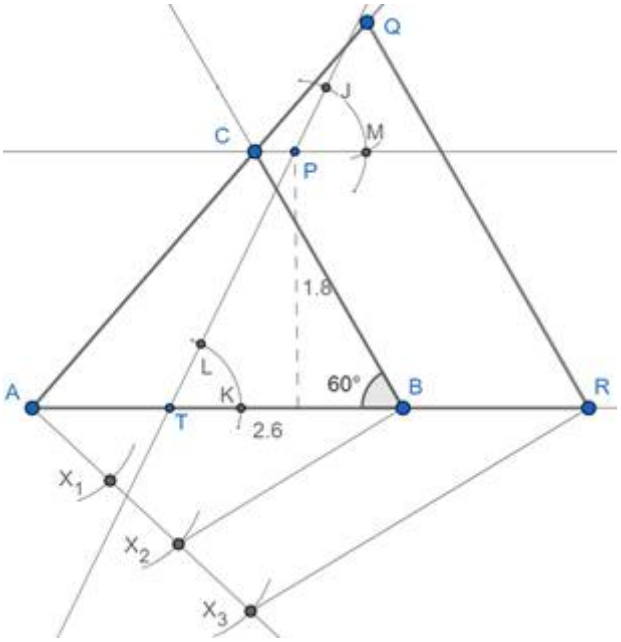
Step8: Join X_2 and B (2 being smaller of 3 and 2 in $\frac{3}{2}$ and not X_3 because the ratio $\frac{3}{2}$ is greater than 1)



Step9: Extend AB and draw a line parallel to X_2B from X_3 intersecting AB at R



Step10: Extend AC and draw a line parallel to BC from R intersecting AC at Q and Δ AQR is ready



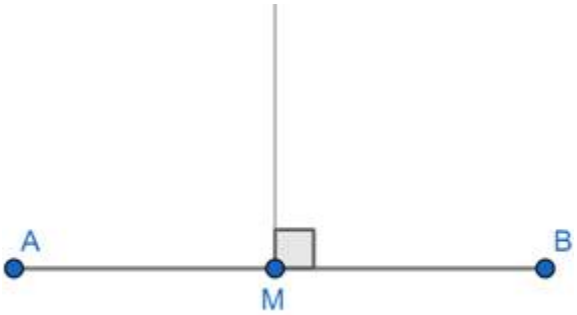
14. Question

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.

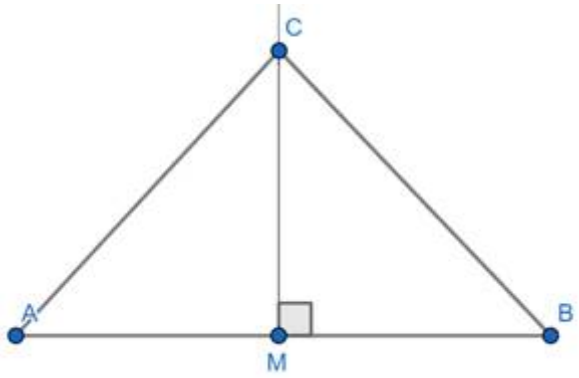
Answer

Step1: Draw the base of triangle AB = 8 cm

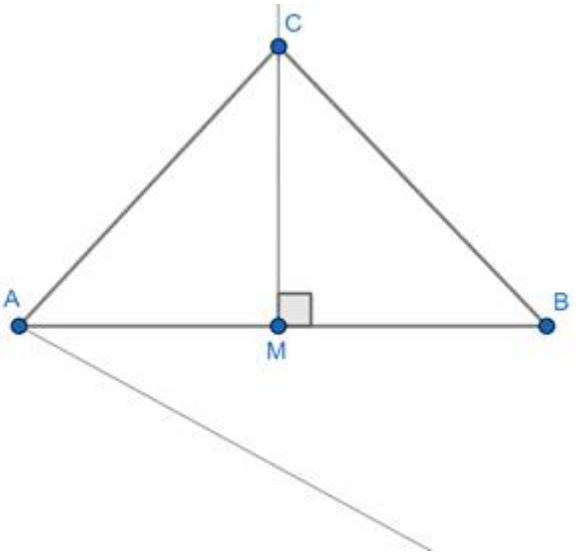
Step2: Using scale mark the centre of AB as M and from M using protractor draw a line perpendicular to AB



Step3: Take distance 4 cm in compass keep the needle of the compass on point M and mark an arc intersecting ray drawn in step2. Mark the intersection point as C and join AC and BC.



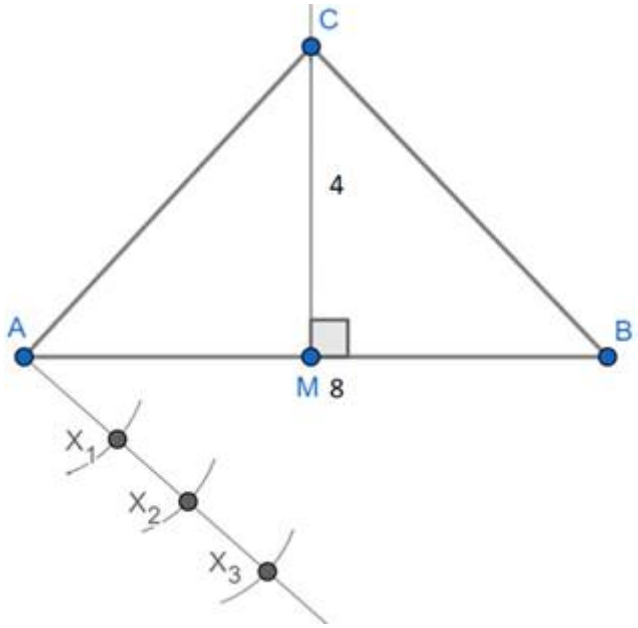
Step4: Draw a ray at any angle below AB from A



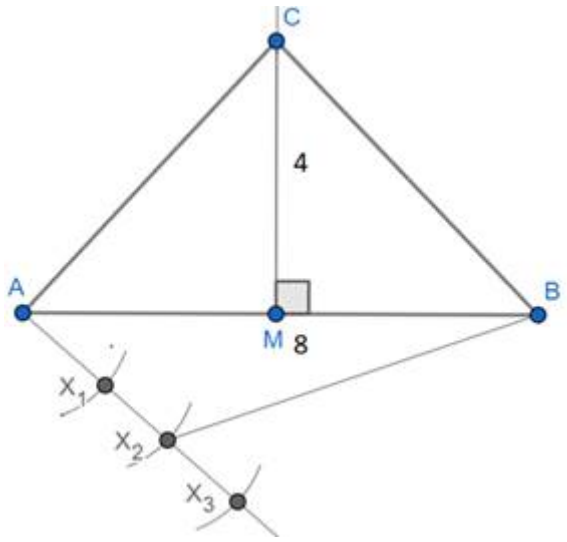
The scaling factor is

$$\Rightarrow 1\frac{1}{2} = \frac{2 \times 1 + 1}{2} = \frac{3}{2}$$

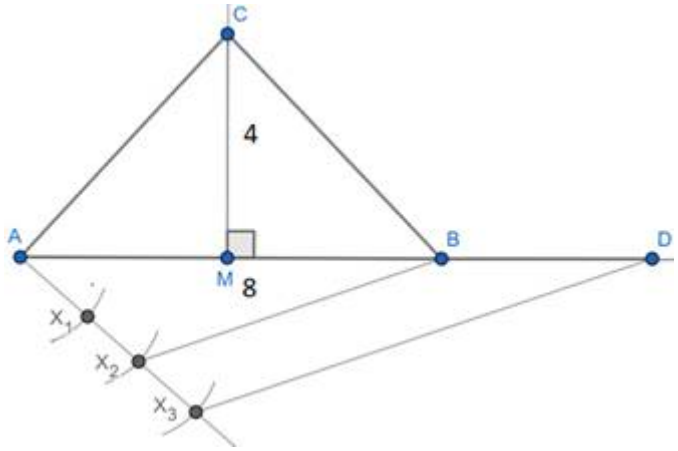
Step5: Take any distance in compass and keeping the needle of the compass on point A cut an arc on ray constructed in step4 and name that point X_1. Keeping the distance in compass same keep the needle of the compass on point X_1 and cut an arc on the same ray and mark that point as X_2. Draw 3 such parts (greater of 3 and 2 in 3/2), i.e. by repeating this process mark points upto X_3



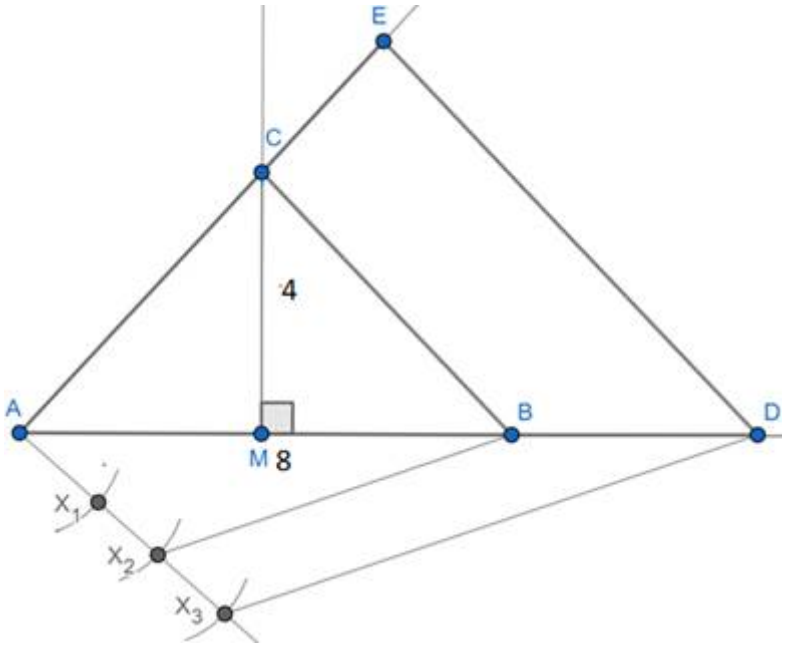
Step6: Join X_2 and B (2 being smaller of 3 and 2 in $\frac{3}{2}$ and not X_3 because the ratio $\frac{3}{2}$ is greater than 1)



Step7: Now extend AB and draw a line parallel to X_2B from X_3 intersecting AB at D



Step8: Extend AC and draw a line parallel to BC from point D intersecting AC at E and ΔADE whose sides are $\frac{3}{2}$ i.e. 1 1/2 times ΔABC is ready

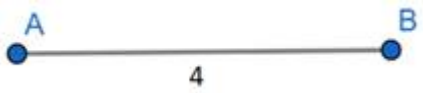


15. Question

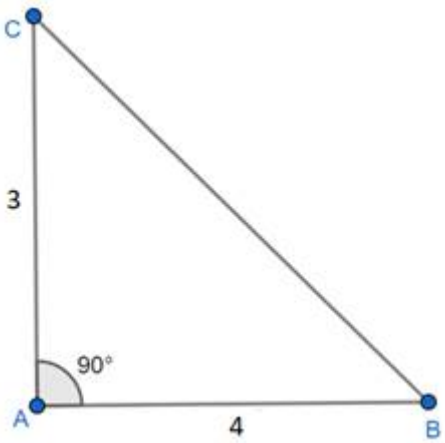
Draw a right triangle in which the sides (other than hypotenuse) are the length 4cm and 3cm. Then construct another triangle whose sides are $\frac{5}{3}$ times the corresponding sides of the given triangle.

Answer

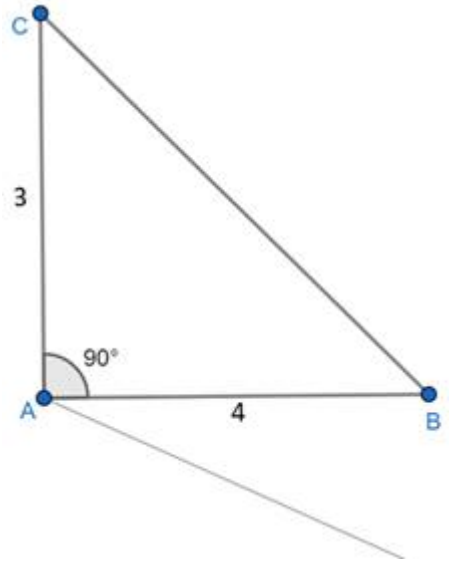
Step1: Construct a segment AB of 4 cm



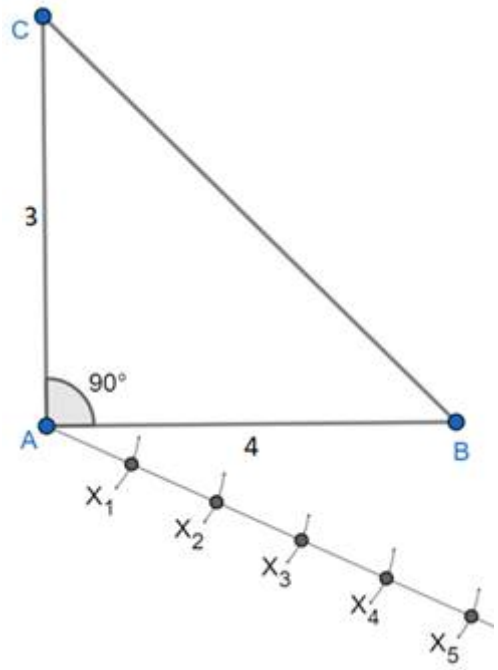
Step2: Construct AC of 3 cm at 90°. Join B and C to get right-angled triangle ABC



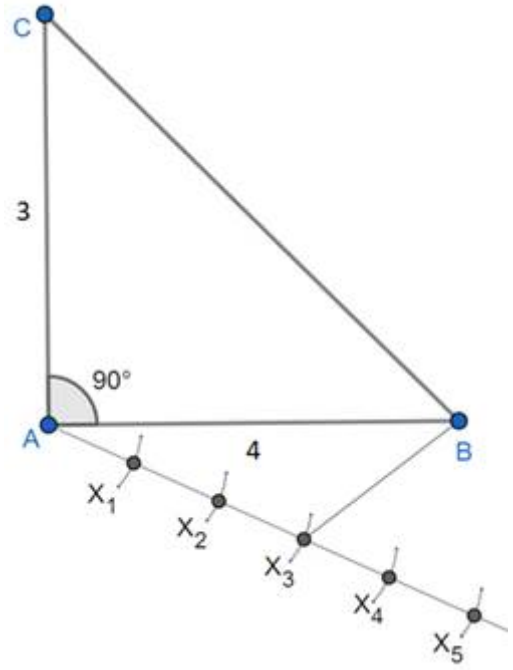
Step3: Draw a ray at any angle from point A below AB



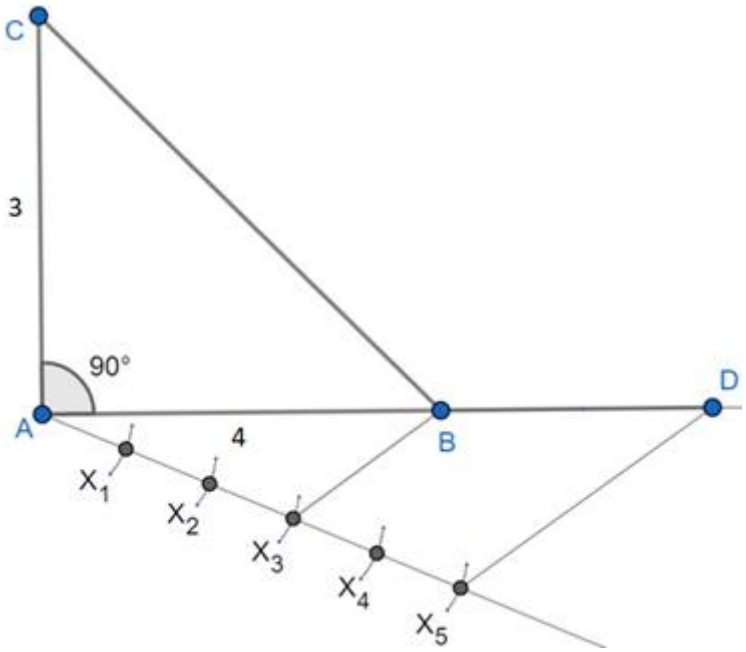
Step4: Take any distance in compass and keeping the needle of the compass on point A cut an arc on ray constructed in step3 and name that point X_1. Keeping the distance in compass same keep the needle of the compass on point X_1 and cut an arc on the same ray and mark that point as X_2. Draw 5 such parts (greater of 5 and 3 in 5/3), i.e. by repeating this process mark points upto X_5



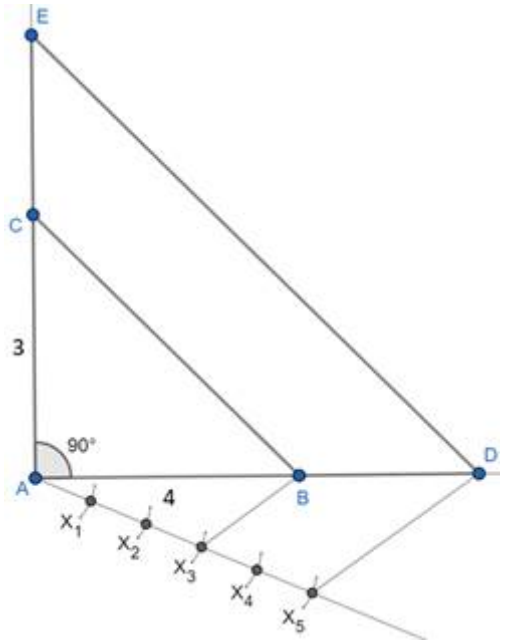
Step5: Join X_3 and B (3 being smaller of 5 and 3 in $\frac{5}{3}$ and not X_5 because the ratio $\frac{5}{3}$ is greater than 1)



Step6: Now extend AB and draw a line parallel to X_3B from X_5 intersecting AB at D



Step7: Extend AC and draw a line parallel to BC from point D intersecting AC at E and ΔADE whose sides are $\frac{5}{3}$ times ΔABC is ready



16. Question

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

Answer

Note: I think one more angle should have been given I am taking ∠B = 45°

Sum of angles of a triangle is 180°

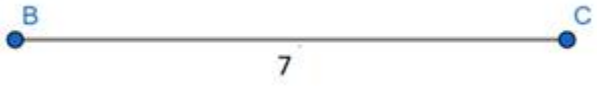
⇒ ∠A + ∠B + ∠C = 180°

⇒ 105° + 45° + ∠C = 180°

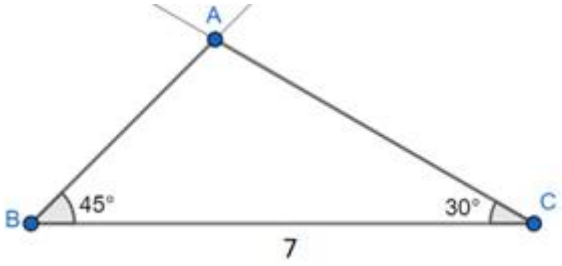
⇒ ∠C = 180° - 150°

⇒ ∠C = 30°

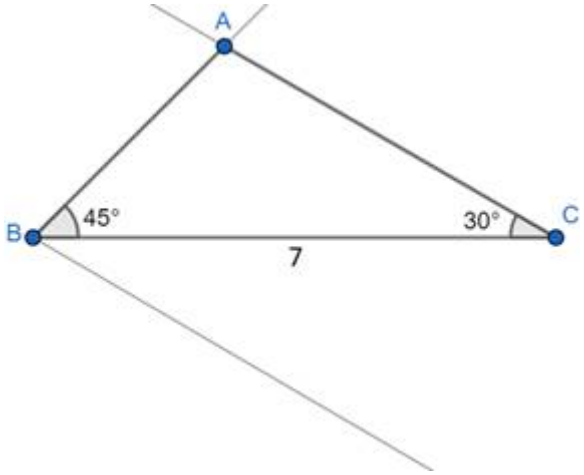
Step1: Draw segment BC of 7 cm



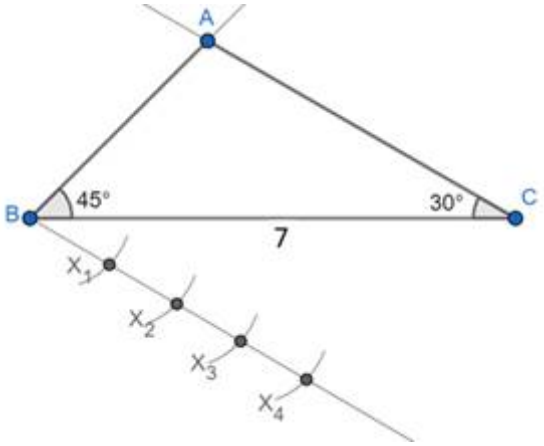
Step2: using protractor draw a ray at angle 45° from point B and a ray at angle 30° from point C. mark intersection of both these rays as point A



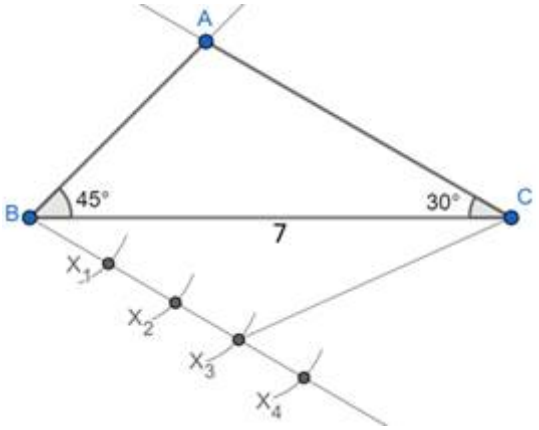
Step3: Draw a ray at any angle below BC from B



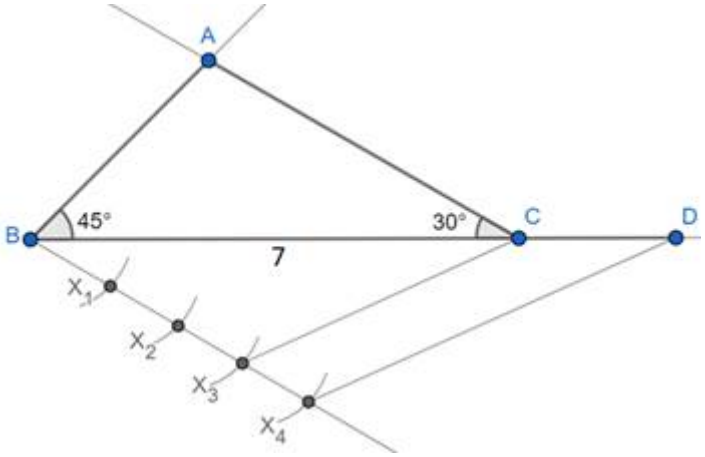
Step4: Take any distance in compass and keeping the needle of the compass on point A cut an arc on ray constructed in step3 and name that point X_1. Keeping the distance in compass same keep the needle of the compass on point X_1 and cut an arc on the same ray and mark that point as X_2. Draw 4 such parts (greater of 4 and 3 in 4/3), i.e. by repeating this process mark points upto X_4



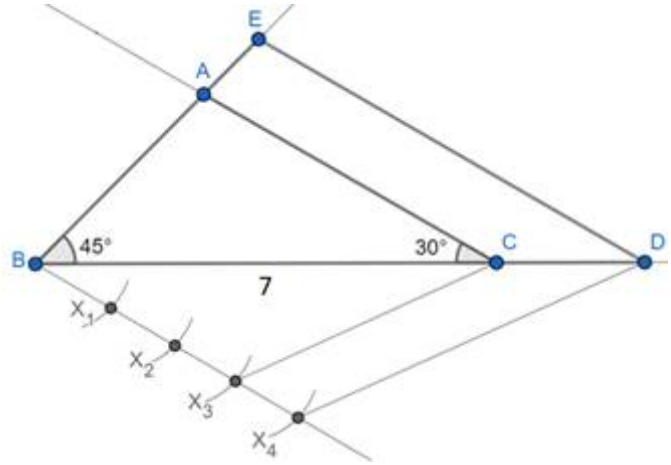
Step5: Join X_3 and C (3 being smaller of 4 and 3 in $\frac{4}{3}$ and not X_4 because the ratio $\frac{4}{3}$ is greater than 1)



Step6: Now extend BC and draw a line parallel to X_3C from X_4 intersecting BC at D



Step7: Draw a line parallel to AC from point D intersecting BA at E and ΔEBD whose sides are $\frac{4}{3}$ times ΔABC is ready



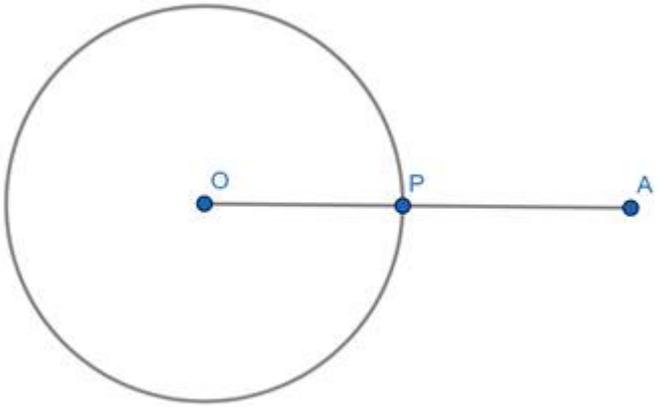
17. Question

Draw a circle with radius 4cm. Mark a point on it. Draw a tangent at P to the circle.

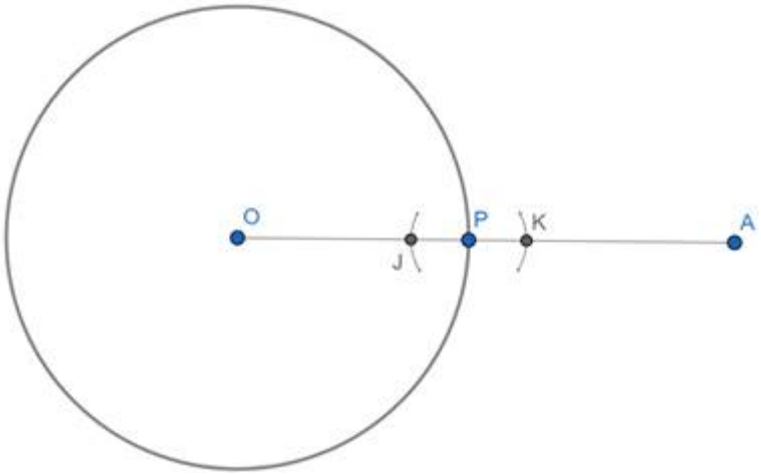
Answer

Step1: Take distance 4 cm in compass and draw a circle with centre O

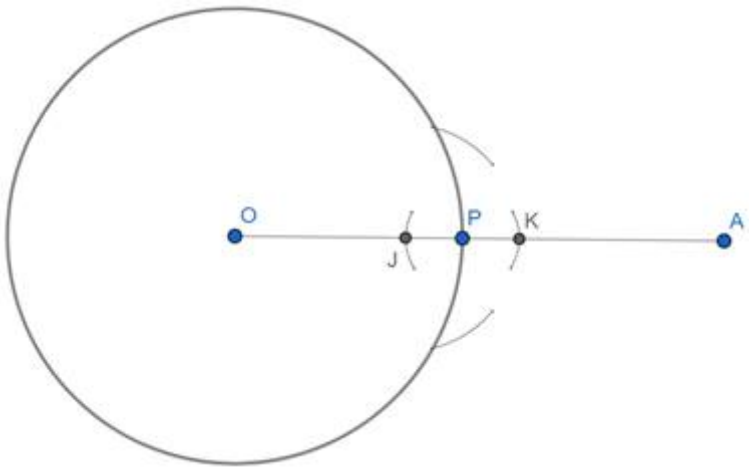
Step2: Take a point P on the circle and draw a line segment OA passing through P as shown



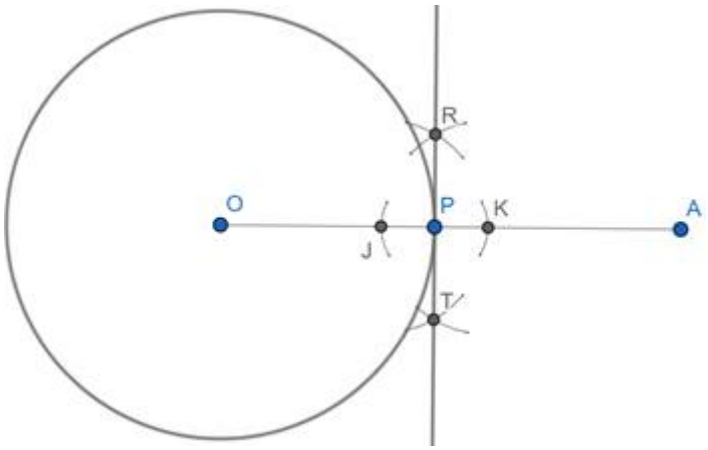
Step3: take any distance in compass keep the needle of the compass on point P and mark arcs to the left and right of P intersecting OA at J and K respectively



Step4: Take any distance in compass greater than JP, keep the needle on point J and mark arcs above and below OA.



Step6: Keeping the distance in the compass same as in step4, keep the needle on point K and mark arcs intersecting the arcs drawn in step4 at points R and T. Draw a line passing through R and T which is the tangent to circle at point P

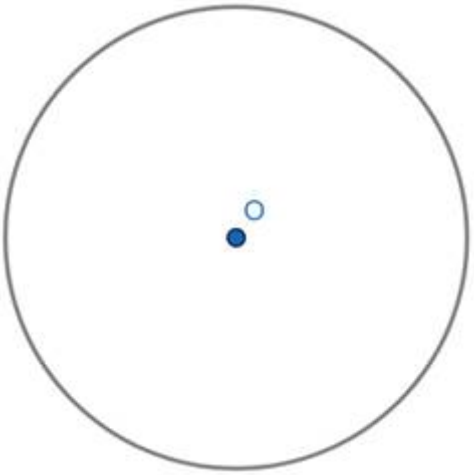


18. Question

Draw a circle of radius 3cm. Draw any diameter of the circle. At the end points of the diameter of the circle, draw tangents to the circle. Any they parallel?

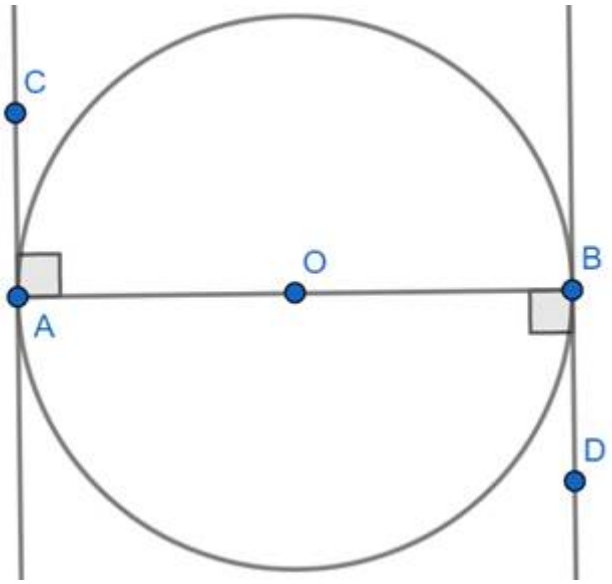
Answer

Step1: Take distance 3 cm in compass and draw a circle with centre O



Step2: Draw diameter AB. We know that the radius is perpendicular to the tangent. Using protractor draw lines at 90° from point A and B

Take points C and D on tangents as shown



⇒ ∠BAC = ∠ABD …both 90° as the radius is perpendicular to the tangent
∠BAC and ∠ABD are alternate angles for the two tangents with transversal as AB.

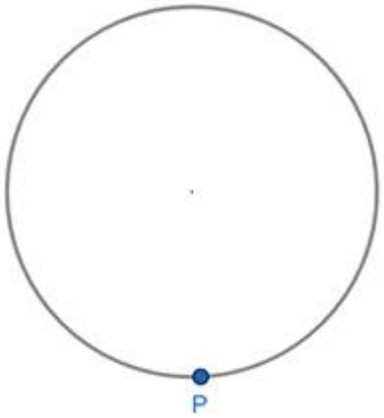
As alternate angles are equal the tangents are parallel.

19. Question

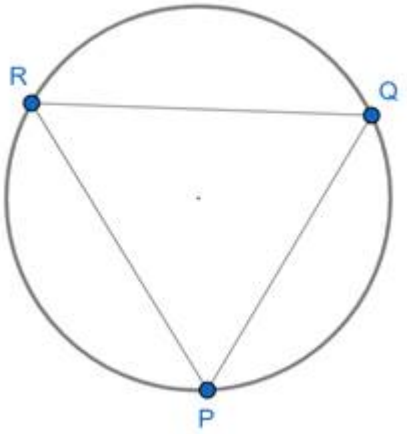
Draw a circle of radius 5cm. Take a point P on the circle. Draw the tangent of the circle at point P without using the centre of the circle.

Answer

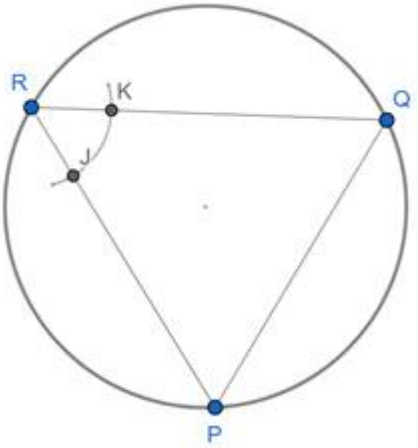
Step1: Take distance 5 cm in compass and draw a circle and take a point P on circle



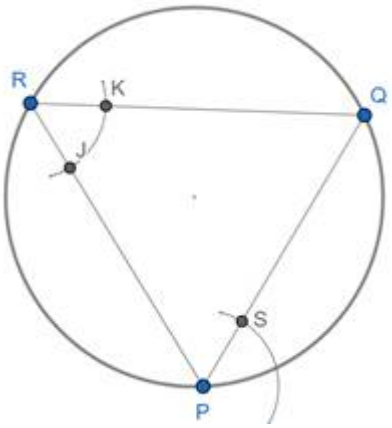
Step2: Draw a chord PQ and subtend an angle ∠PRQ on the major arc of the circle



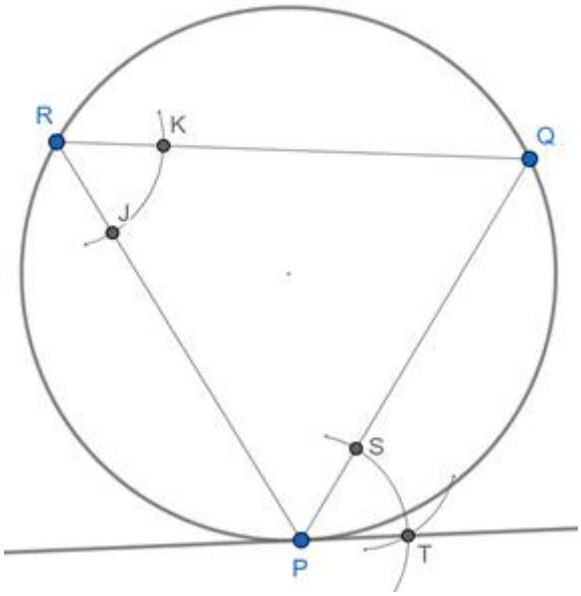
Using the alternate segment theorem, we will draw an ∠QPT congruent to ∠PRQ so that the line passing through PT will be tangent to circle at point PStep3: Take any distance in compass keep the needle on point R and mark an arc intersecting PR and QR at J and K respectively



Step4: Keeping the distance in the compass same as that in step3 keep the needle on P and mark an arc intersecting PQ at S



Step5: Measure the distance of arc JK in compass, keep the needle on point S and mark an arc intersecting the arc drawn in step4 at point T. Draw line passing through point P and T and it is the tangent.

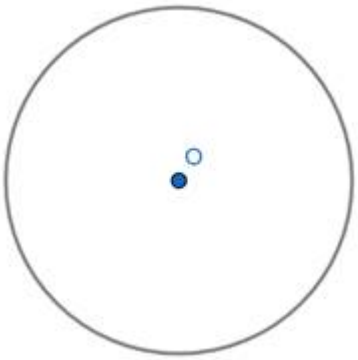


20. Question

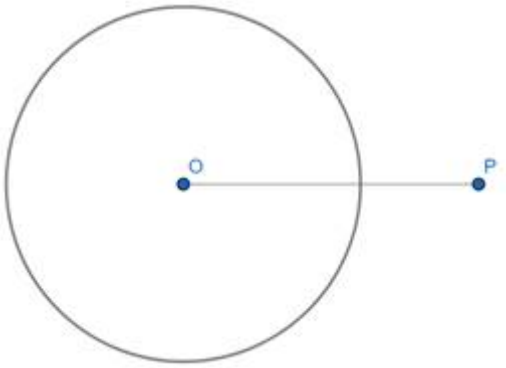
Draw a circle of radius 6cm. From a point 10cm away from its centre, construct the pair of tangents to the circle and measure their lengths.

Answer

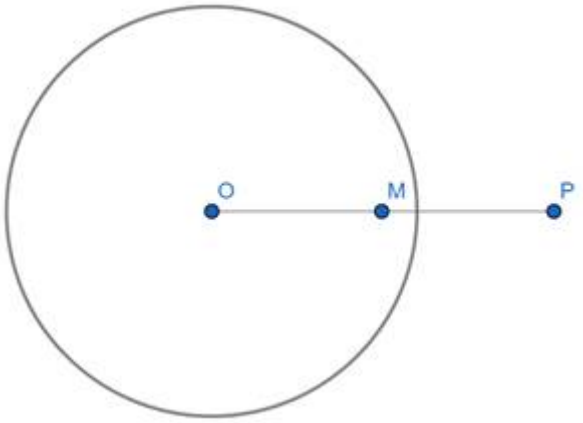
Step1: Draw circle of radius 6 cm with centre O



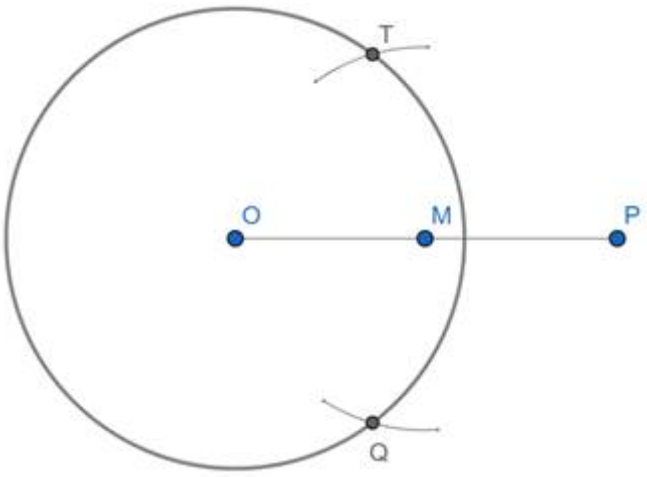
Step2: Draw segment OP of 10 cm



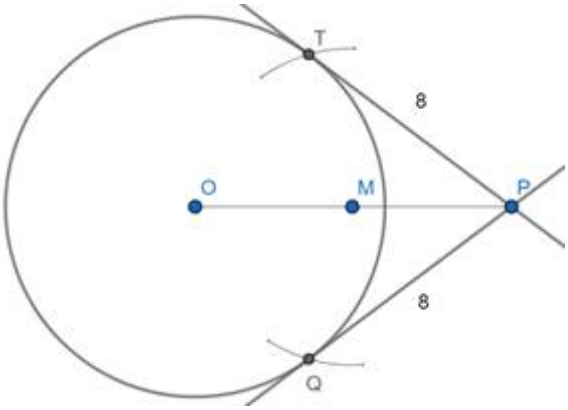
Step3: Using scale take midpoint of OP as M



Step4: take distance MP in compass and draw arcs intersecting the circle at points T and Q as shown



Step5: Draw lines passing through PT and PQ which are the required tangents and measure length PT and PQ them with scale

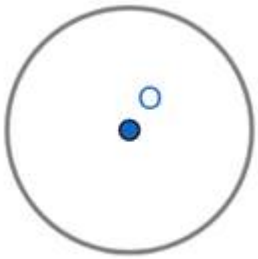


21. Question

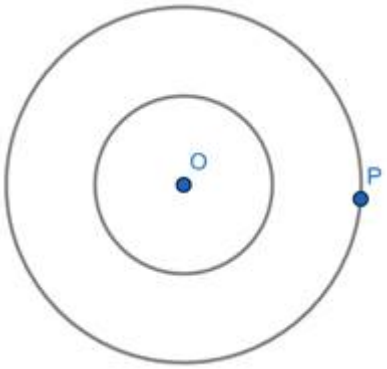
Draw two concentric circles with centre O and radii 2 cm and 4 cm. From a point on the outer circle draw a tangent to the inner circle.

Answer

Step1: Draw a circle of radius 2 cm with centre O by taking 2 cm in compass. This is the inner circle

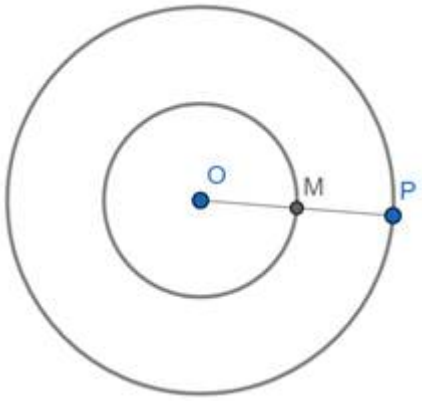


Step2: Now take 4 cm in compass keep the needle on point O and draw a circle. This is the outer circle. Take any point P on the outer circle

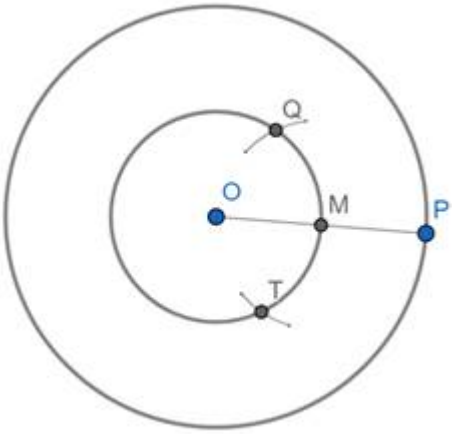


Now we have to draw a tangent from point P to the inner circle. This is the same as drawing tangents to circle from an external point.

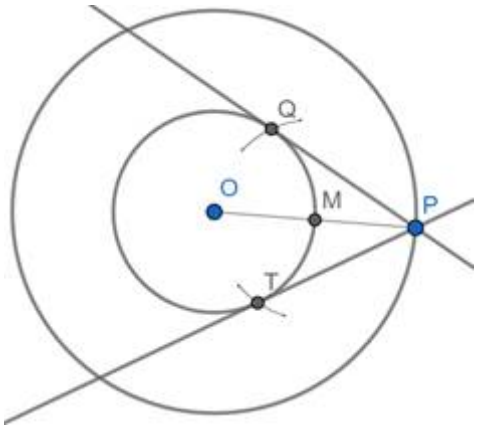
Step4: Join OP and using scale mark the midpoint of OP which will lie on the inner circle



Step5: Take the distance MO in compass keep the needle on point M and mark arcs cutting the inner circle at point Q and T as shown



Step6: Construct a line passing through PQ and PT which are the required tangents

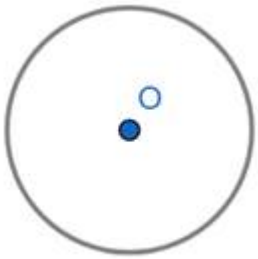


22. Question

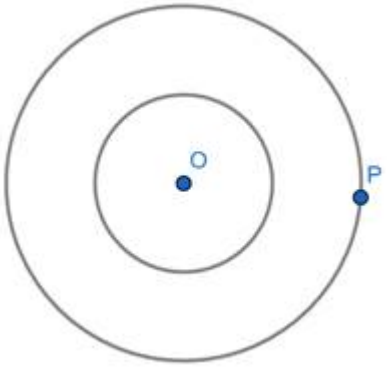
Draw a circle of radius 4cm form a point on the concentric circle of radius 6cm and measure its length. Also, verify the measurement by actual calculation.

Answer

Step1: Draw a circle of radius 4 cm with centre O by taking 4 cm in compass. This is the inner circle

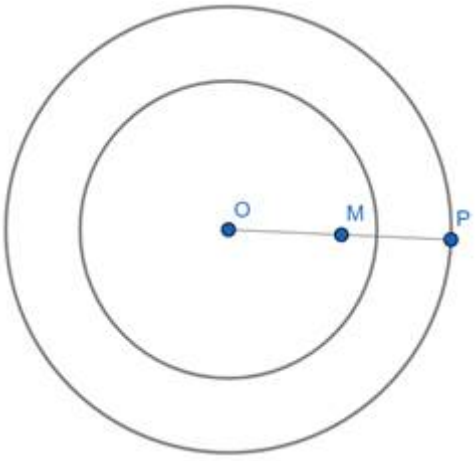


Step2: Now take 6 cm in compass keep the needle on point O and draw a circle. This is the outer circle. Take any point P on the outer circle

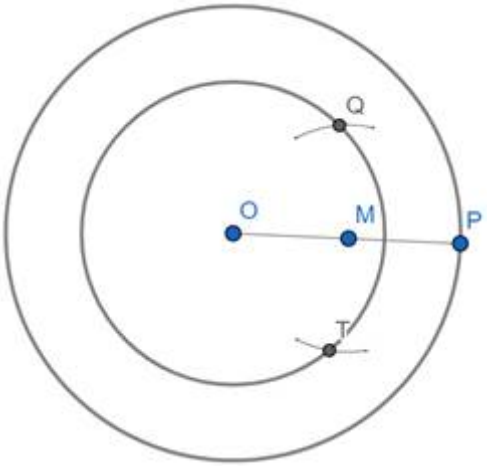


Now we have to draw a tangent from point P to the inner circle. This is the same as drawing tangents to circle from an external point.

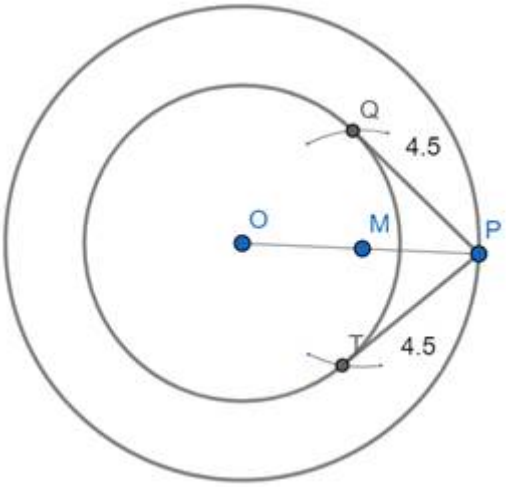
Step4: Join OP and using scale mark the midpoint of OP as M



Step5: Take the distance MO in compass keep the needle on point M and mark arcs cutting the inner circle at point Q and T as shown



Step6: Construct a line passing through PQ and PT which are the required tangents and measure the lengths PQ and PT using a scale



For verification

Let's join OQ

$\Rightarrow \angle OQP = 90°$ ...radius OQ is perpendicular to tangent PQ at the point of contact Q

Consider ΔOQP

$\Rightarrow OQ = 4$ cm ...radius of inner circle

$\Rightarrow OP = 6$ cm ...radius of outer circle

Using Pythagoras

$\Rightarrow OP^2 = OQ^2 + PQ^2$

$\Rightarrow 6^2 = 4^2 + PQ^2$

$\Rightarrow 36 = 16 + PQ^2$

$\Rightarrow PQ^2 = 20$

$\Rightarrow PQ = \sqrt{20}$

$\Rightarrow PQ = \sqrt{(5 \times 4)}$

$\Rightarrow PQ = 2\sqrt{5}$

$\Rightarrow PQ = 4.5$ cm

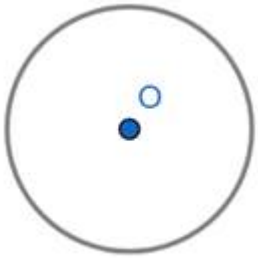
Hence verified

23. Question

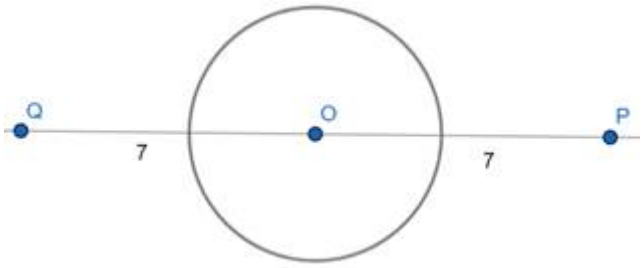
Draw a circle of radius 3cm. Take two points P and Q on one of its extended diameter each at a distance of 7cm from its centre. Draw tangents to the circle from these two points P and Q.

Answer

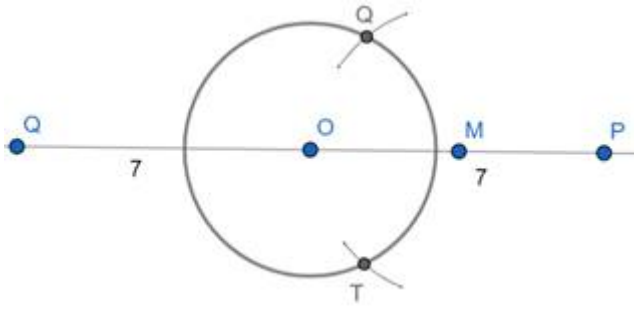
Step1: Take 3 cm in compass and draw a circle with centre O



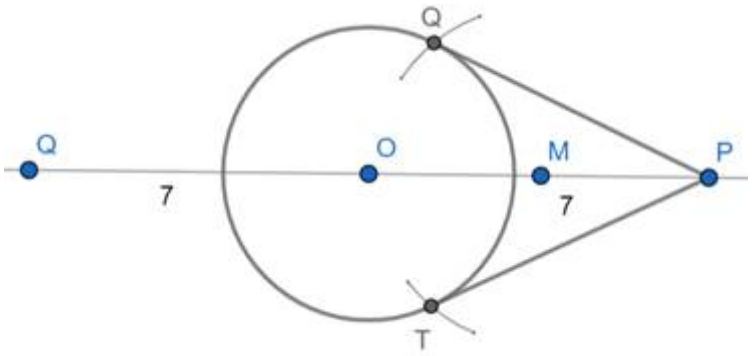
Step2: Draw a straight line passing through the centre and mark points P and Q on both sides of O at 7 cm each.



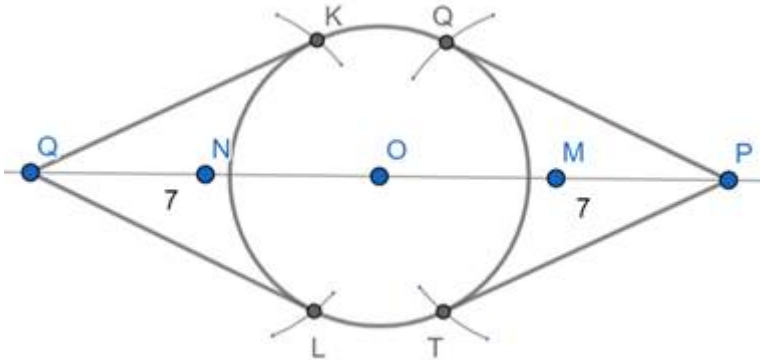
Step3: Using scale mark the midpoint of OP as M. Keep the needle on M take distance MO in compass and mark arcs intersecting the circle at point Q and T as shown



Step4: Join points PT and PQ thus PT and PQ are required tangents from point P



Step5: Similarly repeat steps step3 and step4 for tangents from point Q. Take midpoint as N then centre as N and radius NO cut arcs on the circle at K, and L. QK and QL will be the required tangents from point Q

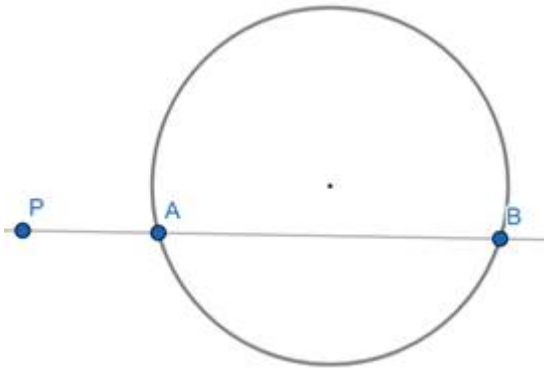


24. Question

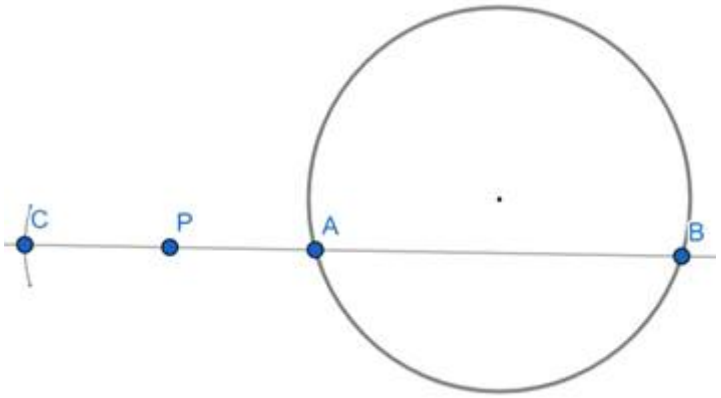
Draw a circle of radius 5cm. Take a point P outside the circle. Construct a pair of tangents from P to the circle without using its centre.

Answer

Step1: Take distance 5 cm in compass and draw a circle. Take any point P outside the circle and draw a straight line which cuts the circle at A and B where AB is the chord

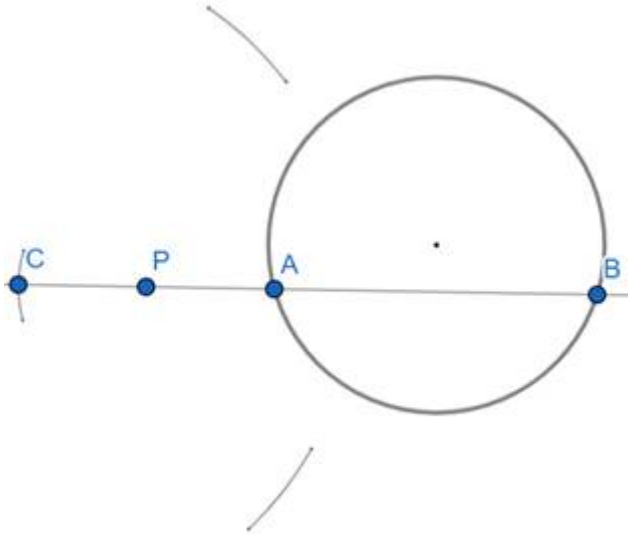


Step2: Take distance PA in compass and keep the needle on point P and mark arc to the left of P intersecting the line at C. Hence we have PA = PC

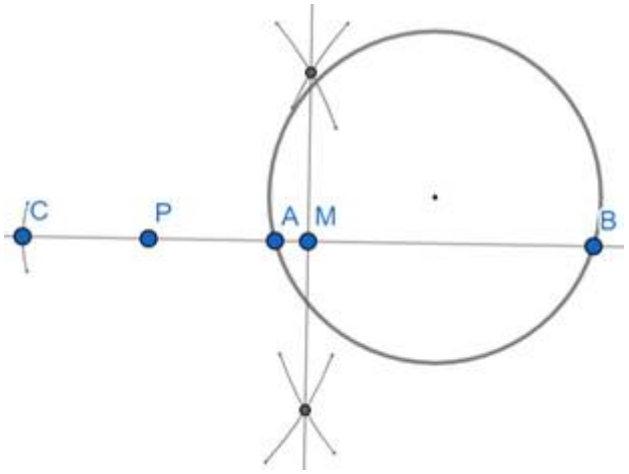


Now we have to draw perpendicular bisector of BC

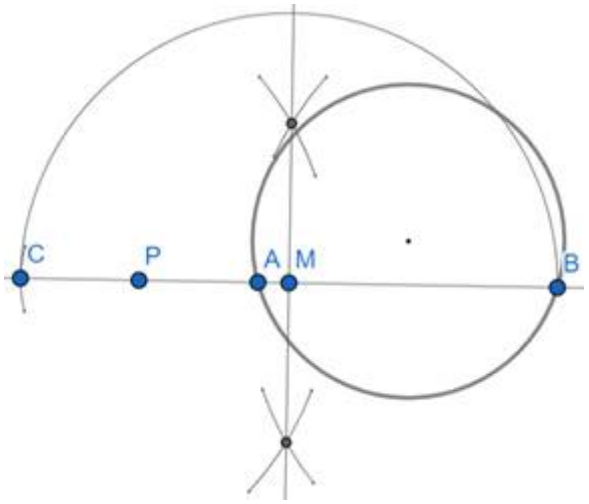
Step3: Take any distance in compass approximately greater than half of CB and keeping the needle on point C mark arcs above and below CB



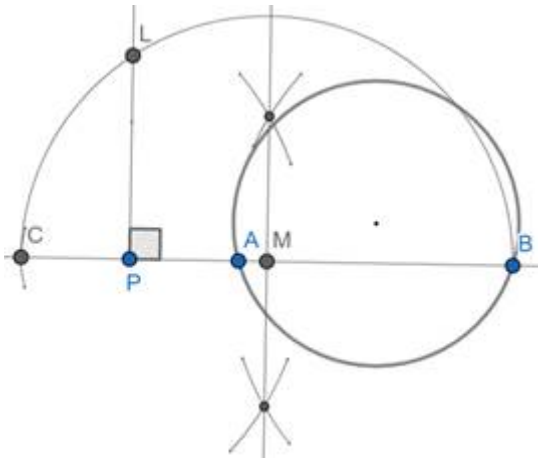
Step4: Keeping the distance in the compass same as that of in step3 keep the needle on B and mark arcs intersecting the arcs drawn in step3. Join these intersection points we get the perpendicular bisector of CB at M



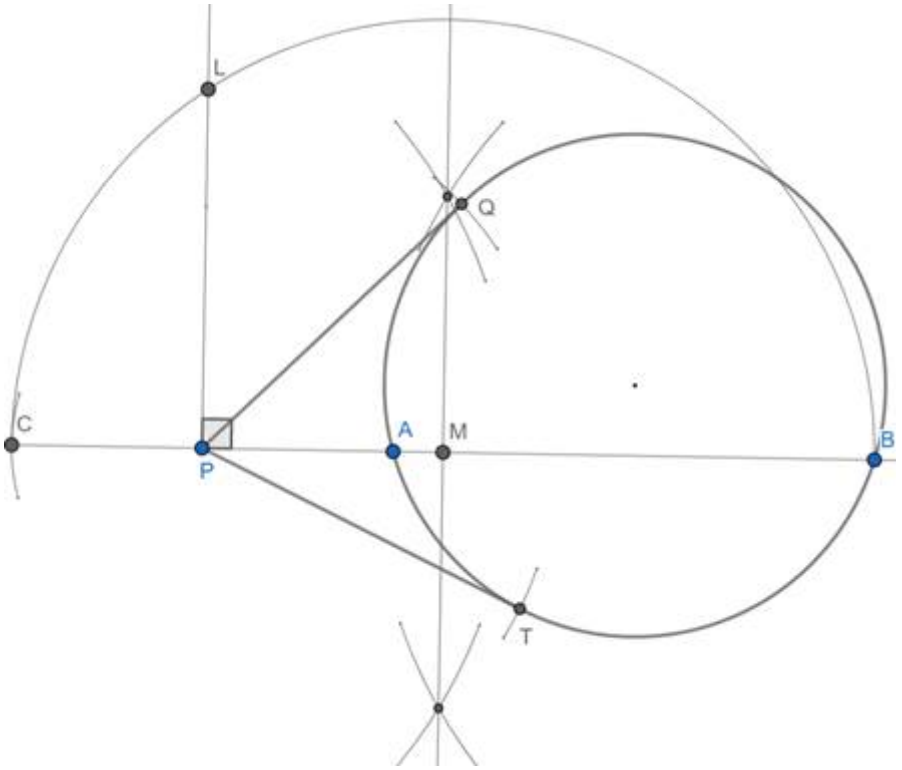
Step5: Take distance MB in compass keep the needle on point M and draw a semicircle as shown



Step6: Using protractor draw a line from P perpendicular to CB intersecting the semicircle drawn in step5 at L



Step7: Take distance PL in compass, keep the needle on P and mark arc intersecting the circle at Q and T. Join PT and PQ thus PT and PQ are the required triangles

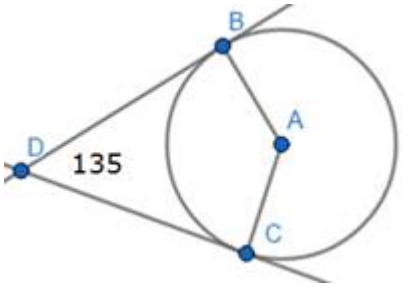


25. Question

Draw a circle of radius 4 cm. Draw two tangents to the circle such that they include an angle of 135°.

Answer

Consider a rough figure as shown DB and DC are tangents centre of circle is A



In quadrilateral ABDC

∠BDC = 135° …given

∠DBA = 90° …radius is perpendicular to tangent at point of contact

∠DCA = 90° …radius is perpendicular to tangent at point of contact

As the sum of angles of a quadrilateral is 360°

⇒ ∠BDC + ∠DBA + ∠DCA + ∠BAC = 360°

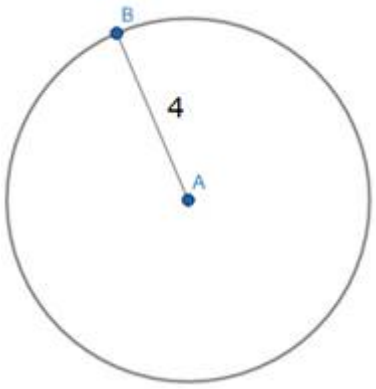
⇒ 135° + 90° + 90° + ∠BAC = 360°

⇒ 315° + ∠BAC = 360°

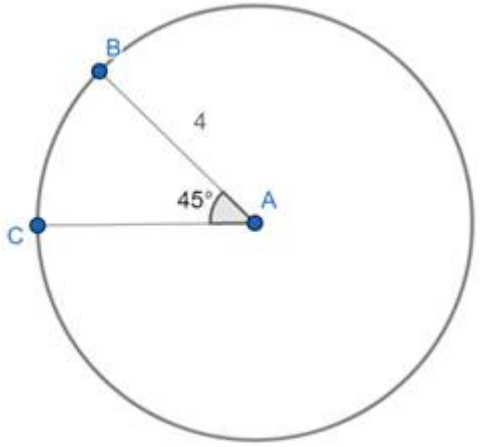
⇒ ∠BAC = 45°

Now let us construct

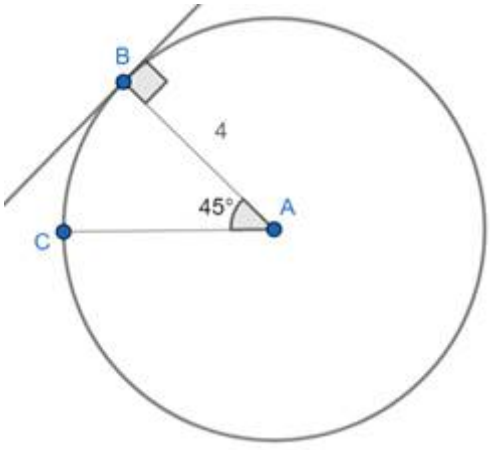
Step1: Construct a circle of radius 4 cm mark the centre as A and draw radius AB



Step2: Using protractor draw the line at 45° to AB from point A and mark its intersection point with a circle as C join AC

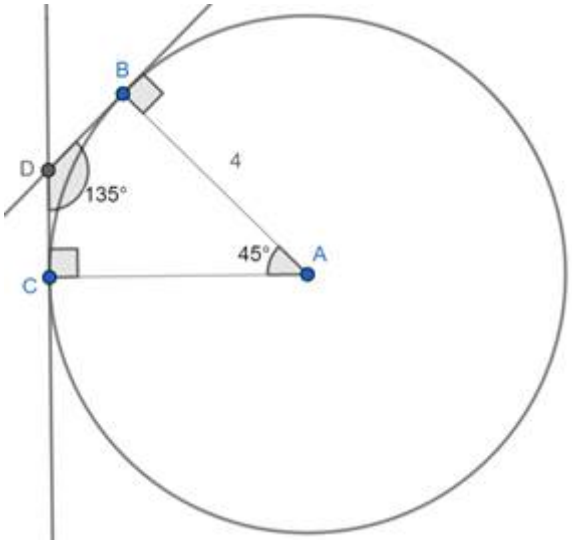


Step3: Using protractor draw a line perpendicular to AB from point B because tangent is perpendicular to the radius. Thus this line is tangent to circle at point B



Step4: Using protractor draw a line perpendicular to AC from point C and mark the intersection point with a line drawn in step3 as D

Hence tangents DB and DC are ready at angle 135°

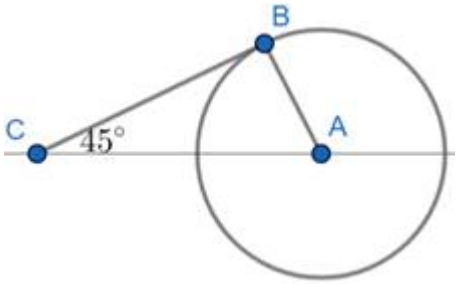


26. Question

Draw a circle of radius 5cm. Draw any line through the centre of the circle. Draw a tangent to the circle making an angle of 45° with the line. What is the length of the tangent?

Answer

Consider a rough figure as shown CB is tangent and centre of the circle is A. CA is a line passing through the centre



∠BCA = 45° …given

∠CBA = 90° …radius is perpendicular to the tangent

Consider ΔABC

⇒ ∠ABC + ∠ACB + ∠BAC = 180° …sum of angles of triangle

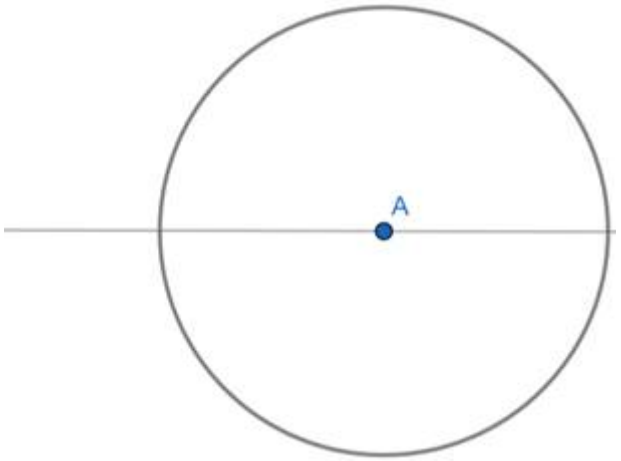
⇒ 90° + 45° + ∠BAC = 180°

⇒ 135° + ∠BAC = 180°

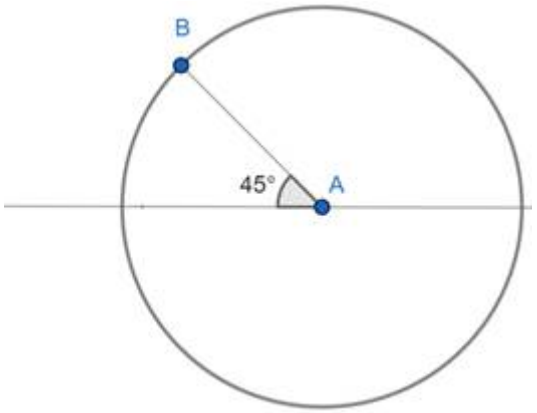
⇒ ∠BAC = 45°

Now let us construct

Step1: Take distance 5 cm in compass and draw a circle with centre A and draw a line passing through A

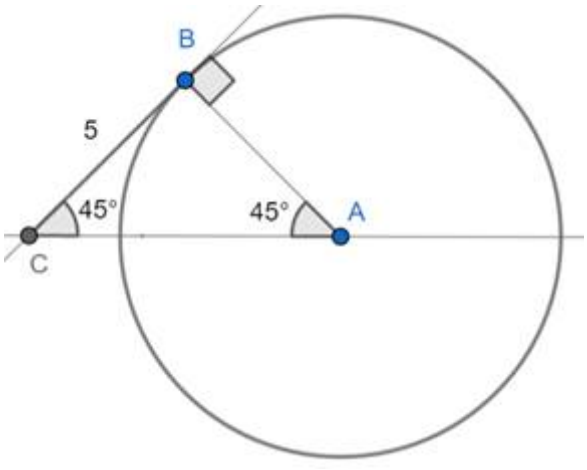


Step2: Using protractor draw the line at 45° to the line drawn in step1 from point A intersecting circle at B



Step3: Using protractor draw a line perpendicular to AB from point B because the radius is perpendicular to the tangent. Mark the intersection of this line with a line passing through the centre as C hence CB is the required tangent at 45°

Measure the length CB with a scale which is the length of the tangent



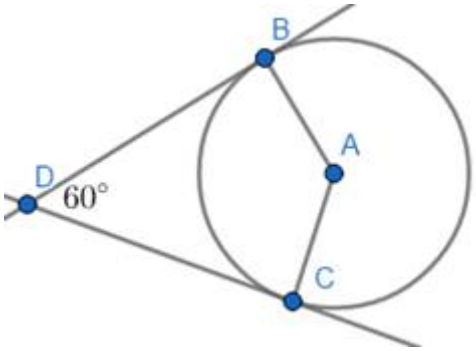
CB = 5 cm length of tangent is 5 cm

27. Question

Draw a pair of tangents to a circle of radius 2.3 cm which is inclined to each other at an angle of 60°.

Answer

Consider a rough figure as shown DB and DC are tangents centre of circle is A



In quadrilateral ABDC

∠BDC = 60° …given

∠DBA = 90° …radius is perpendicular to tangent at point of contact

∠DCA = 90° …radius is perpendicular to tangent at point of contact

As the sum of angles of a quadrilateral is 360°

⇒ ∠BDC + ∠DBA + ∠DCA + ∠BAC = 360°

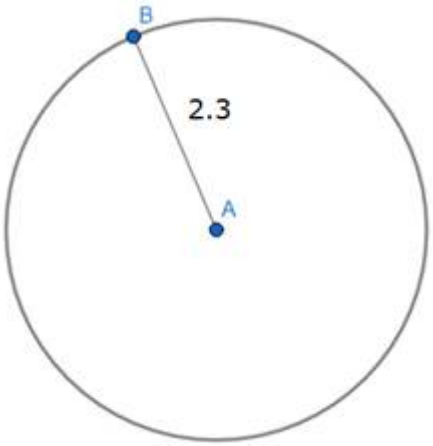
⇒ 60° + 90° + 90° + ∠BAC = 360°

⇒ 240° + ∠BAC = 360°

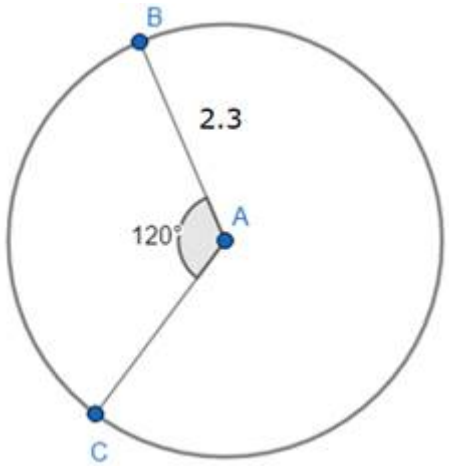
⇒ ∠BAC = 120°

Now let us construct

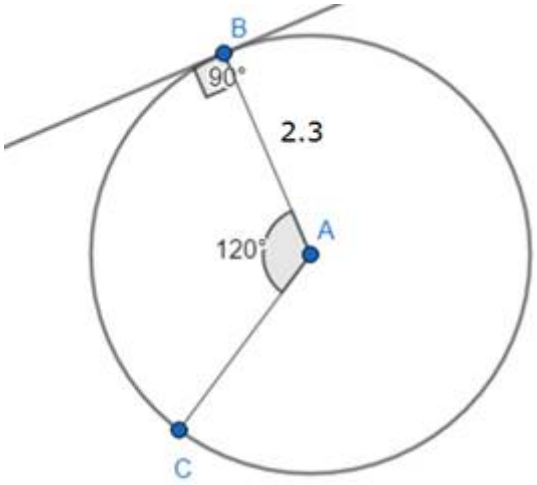
Step1: Construct a circle of radius 2.3 cm mark the centre as A and draw radius AB



Step2: Using protractor draw the line at 120° to AB from point A and mark its intersection point with a circle as C join AC

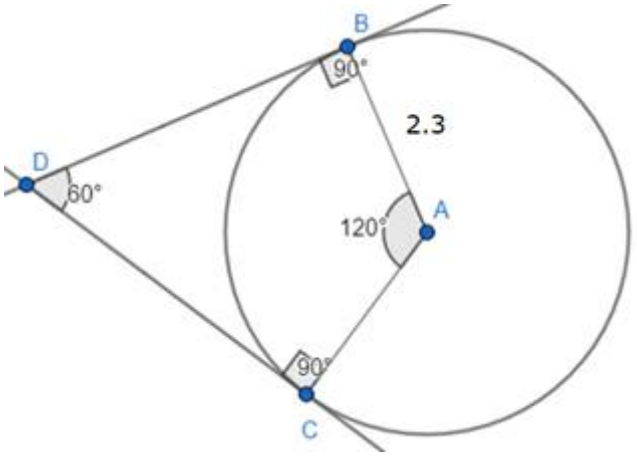


Step3: Using protractor draw a line perpendicular to AB from point B because tangent is perpendicular to the radius. Thus this line is tangent to circle at point B



Step4: Using protractor draw a line perpendicular to AC from point C and mark the intersection point with a line drawn in step3 as D

Hence tangents DB and DC are ready at angle 60°


B
90°
2.3
D
60°
120°
A
90°
C