Exercise 11.1

Question 1:

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

Answer:

A line segment of length 7.6 cm can be divided in the ratio of 5:8 as follows.

Step 1 Draw line segment AB of 7.6 cm and draw a ray AX making an acute angle with line segment AB.

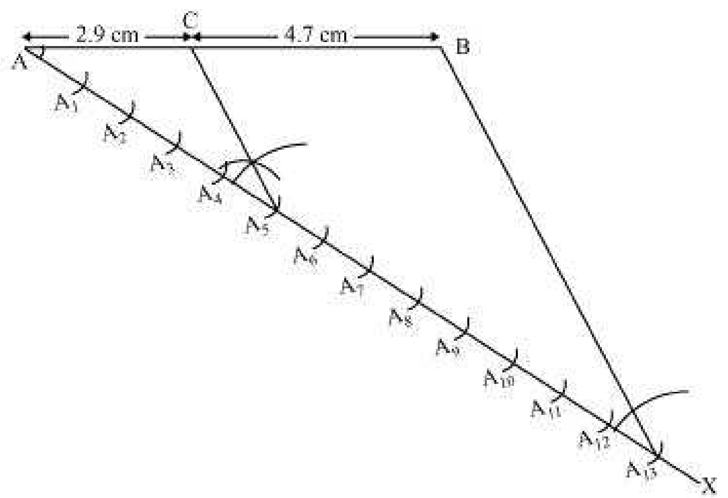
Step 2 Locate 13 (= 5 + 8) points, A_1, A_2, A_3, A_4 ……. A_{13}, on AX such that $AA_1 = A_1A_2 = A_2A_3$ and so on.

Step 3 Join BA_{13}.

Step 4 Through the point A_5, draw a line parallel to BA_{13} (by making an angle equal to $\angle AA_{13}B$) at A_5 intersecting AB at point C.

C is the point dividing line segment AB of 7.6 cm in the required ratio of 5:8.

The lengths of AC and CB can be measured. It comes out to 2.9 cm and 4.7 cm respectively.



Justification

The construction can be justified by proving that

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

By construction, we have $A_5C \parallel A_{13}B$. By applying Basic proportionality theorem for the triangle $AA_{13}B$, we obtain

$$\frac{AC}{CB}=\frac{AA_5}{A_5A_{13}} \quad \ldots (1)$$

From the figure, it can be observed that AA_5 and A_5A_{13} contain 5 and 8 equal divisions of line segments respectively.

$$\therefore \frac{AA_5}{A_5A_{13}}=\frac{5}{8} \quad \ldots (2)$$

On comparing equations (1) and (2), we obtain

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

This justifies the construction.

Question 2:

Construct a triangle of sides 4 cm, 5cm and 6cm and then a triangle similar to it whose sides are $\frac{2}{3}$ of the corresponding sides of the first triangle.

Give the justification of the construction.

Answer:

Step 1

Draw a line segment AB = 4 cm. Taking point A as centre, draw an arc of 5 cm radius. Similarly, taking point B as its centre, draw an arc of 6 cm radius. These arcs will intersect each other at point C. Now, AC = 5 cm and BC = 6 cm and ΔABC is the required triangle.

Step 2

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

Step 3

Locate 3 points A_1, A_2, A_3 (as 3 is greater between 2 and 3) on line AX such that $AA_1 = A_1A_2 = A_2A_3$.

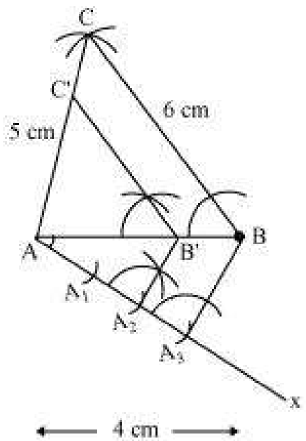
Step 4

Join BA_3 and draw a line through A_2 parallel to BA_3 to intersect AB at point B'.

Step 5

Draw a line through B' parallel to the line BC to intersect AC at C'.

ΔAB'C' is the required triangle.



Justification

The construction can be justified by proving that

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

By construction, we have B'C' || BC

$\therefore \angle AB'C' = \angle ABC$ (Corresponding angles)

In ΔAB'C' and ΔABC,

$\angle AB'C' = \angle ABC$ (Proved above)

$\angle B'AC' = \angle BAC$ (Common)

$\therefore \Delta AB'C' \sim \Delta ABC$ (AA similarity criterion)

$$\Rightarrow \frac{AB'}{AB} = \frac{B'C'}{BC} = \frac{AC'}{AC} \quad \ldots (1)$$

In $\Delta AA_2B'$ and ΔAA_3B,

$\angle A_2AB' = \angle A_3AB$ (Common)

$\angle AA_2B' = \angle AA_3B$ (Corresponding angles)

$\therefore \Delta AA_2B' \sim \Delta AA_3B$ (AA similarity criterion)

$$\Rightarrow \frac{AB'}{AB} = \frac{AA_2}{AA_3}$$

$$\Rightarrow \frac{AB'}{AB} = \frac{2}{3} \quad \ldots(2)$$

From equations (1) and (2), we obtain

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

$$\Rightarrow AB' = \frac{2}{3}AB,\ B'C' = \frac{2}{3}BC,\ AC' = \frac{2}{3}AC$$

This justifies the construction.

Question 3:

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

Give the justification of the construction.

Answer:

Step 1

Draw a line segment AB of 5 cm. Taking A and B as centre, draw arcs of 6 cm and 5 cm radius respectively. Let these arcs intersect each other at point C. ΔABC is the required triangle having length of sides as 5 cm, 6 cm, and 7 cm respectively.

Step 2

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

Step 3

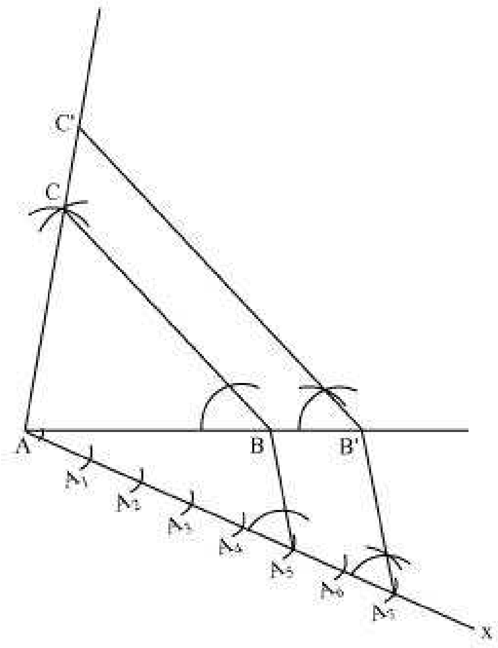
Locate 7 points, A_1, A_2, A_3, A_4 A_5, A_6, A_7 (as 7 is greater between 5and 7), on line AX such that $AA_1 = A_1A_2 = A_2A_3 = A_3A_4 = A_4A_5 = A_5A_6 = A_6A_7$.

Step 4

Join BA_5 and draw a line through A_7 parallel to BA_5 to intersect extended line segment AB at point B'.

Step 5

Draw a line through B' parallel to BC intersecting the extended line segment AC at C'. ΔAB'C' is the required triangle.



Justification

The construction can be justified by proving that

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

In ΔABC and ΔAB'C',

∠ABC = ∠AB'C' (Corresponding angles)

∠BAC = ∠B'AC' (Common)

$\therefore$ ΔABC ~ ΔAB'C' (AA similarity criterion)

$$\Rightarrow \frac{AB}{AB'} = \frac{BC}{B'C'} = \frac{AC}{AC'} \quad ... (1)$$

In ΔAA_5B and $\Delta AA_7B'$,

$\angle A_5AB = \angle A_7AB'$ (Common)

$\angle AA_5B = \angle AA_7B'$ (Corresponding angles)

$\therefore$ $\Delta AA_5B \sim \Delta AA_7B'$ (AA similarity criterion)

$$\Rightarrow \frac{AB}{AB'} = \frac{AA_5}{AA_7}$$

$$\Rightarrow \frac{AB}{AB'} = \frac{5}{7} \quad ...(2)$$

On comparing equations (1) and (2), we obtain

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

$$\Rightarrow AB' = \frac{7}{5}AB,\ B'C' = \frac{7}{5}BC,\ AC' = \frac{7}{5}AC$$

This justifies the construction.

Question 4:

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

Give the justification of the construction.

Answer:

Let us assume that ΔABC is an isosceles triangle having CA and CB of equal lengths, base AB of 8 cm, and AD is the altitude of 4 cm.

A ΔAB'C' whose sides are $\frac{3}{2}$ times of ΔABC can be drawn as follows.

Step 1

Draw a line segment AB of 8 cm. Draw arcs of same radius on both sides of the line segment while taking point A and B as its centre. Let these arcs intersect each other at O and O'. Join OO'. Let OO' intersect AB at D.

Step 2

Taking D as centre, draw an arc of 4 cm radius which cuts the extended line segment OO' at point C. An isosceles ΔABC is formed, having CD (altitude) as 4 cm and AB (base) as 8 cm.

Step 3

Draw a ray AX making an acute angle with line segment AB on the opposite side of vertex C.

Step 4

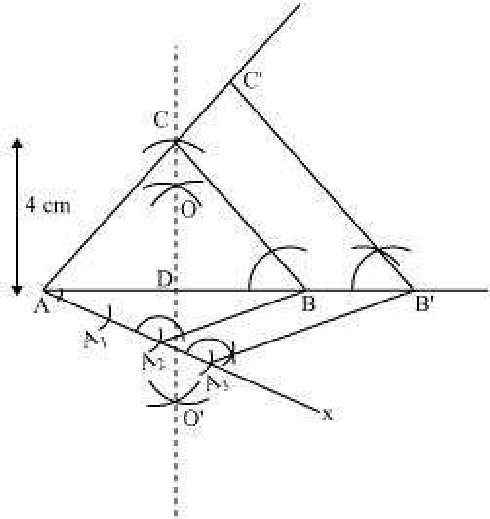
Locate 3 points (as 3 is greater between 3 and 2) A_1, A_2, and A_3 on AX such that $AA_1 = A_1A_2 = A_2A_3$.

Step 5

Join BA_2 and draw a line through A_3 parallel to BA_2 to intersect extended line segment AB at point B'.

Step 6

Draw a line through B' parallel to BC intersecting the extended line segment AC at C'. ΔAB'C' is the required triangle.



Justification

The construction can be justified by proving that

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

In ΔABC and ΔAB'C',

∠ABC = ∠AB'C' (Corresponding angles)

∠BAC = ∠B'AC' (Common)

∴ ΔABC ~ ΔAB'C' (AA similarity criterion)

$$\Rightarrow \frac{AB}{AB'} = \frac{BC}{B'C'} = \frac{AC}{AC'} \quad \dots (1)$$

In ΔAA_2B and $\Delta AA_3B'$,

$\angle A_2AB = \angle A_3AB'$ (Common)

$\angle AA_2B = \angle AA_3B'$ (Corresponding angles)

∴ $\Delta AA_2B \sim \Delta AA_3B'$ (AA similarity criterion)

$$\Rightarrow \frac{AB}{AB'} = \frac{AA_2}{AA_3}$$

$$\Rightarrow \frac{AB}{AB'} = \frac{2}{3} \quad \dots (2)$$

On comparing equations (1) and (2), we obtain

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

$$\Rightarrow AB' = \frac{3}{2}AB,\ B'C' = \frac{3}{2}BC,\ AC' = \frac{3}{2}AC$$

This justifies the construction.

Question 5:

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

Answer:

A ΔA'BC' whose sides are $\frac{3}{4}$ of the corresponding sides of ΔABC can be drawn as follows.

Step 1

Draw a ΔABC with side BC = 6 cm, AB = 5 cm and ∠ABC = 60°.

Step 2

Draw a ray BX making an acute angle with BC on the opposite side of vertex A.

Step 3

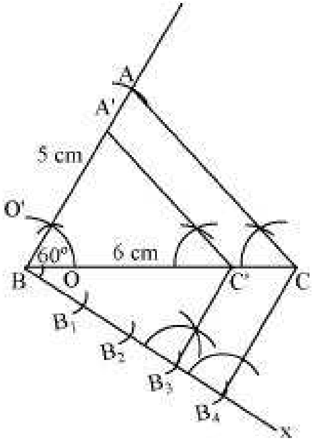
Locate 4 points (as 4 is greater in 3 and 4), B_1, B_2, B_3, B_4, on line segment BX.

Step 4

Join B_4C and draw a line through B_3, parallel to B_4C intersecting BC at C'.

Step 5

Draw a line through C' parallel to AC intersecting AB at A'. ΔA'BC' is the required triangle.



Justification

The construction can be justified by proving

$$A'B = \frac{3}{4}AB,\ BC' = \frac{3}{4}BC,\ A'C' = \frac{3}{4}AC$$

In ΔA'BC' and ΔABC,

∠A'C'B = ∠ACB (Corresponding angles)

∠A'BC' = ∠ABC (Common)

∴ ΔA'BC' ~ ΔABC (AA similarity criterion)

$$\Rightarrow \frac{A'B}{AB} = \frac{BC'}{BC} = \frac{A'C'}{AC} \quad \dots (1)$$

In $\Delta BB_3C'$ and ΔBB_4C,

$\angle B_3BC' = \angle B_4BC$ (Common)

$\angle BB_3C' = \angle BB_4C$ (Corresponding angles)

∴ $\Delta BB_3C' \sim \Delta BB_4C$ (AA similarity criterion)

$$\Rightarrow \frac{BC'}{BC} = \frac{BB_3}{BB_4}$$

$$\Rightarrow \frac{BC'}{BC} = \frac{3}{4} \quad \dots (2)$$

From equations (1) and (2), we obtain

$$\frac{A'B}{AB} = \frac{BC'}{BC} = \frac{A'C'}{AC} = \frac{3}{4}$$

$\Rightarrow A'B = \frac{3}{4}AB,\ BC' = \frac{3}{4}BC,\ A'C' = \frac{3}{4}AC$

This justifies the construction.

Question 6:

Draw a triangle ABC with side BC = 7 cm, ∠B = 45°, ∠A = 105°. Then, construct a triangle whose sides are $\frac{4}{3}$ times the corresponding side of ΔABC. Give the justification of the construction.

Answer:

∠B = 45°, ∠A = 105°

Sum of all interior angles in a triangle is 180°.

∠A + ∠B + ∠C = 180°

105° + 45° + ∠C = 180°

∠C = 180° − 150°

∠C = 30°

The required triangle can be drawn as follows.

Step 1

Draw a ΔABC with side BC = 7 cm, ∠B = 45°, ∠C = 30°.

Step 2

Draw a ray BX making an acute angle with BC on the opposite side of vertex A.

Step 3

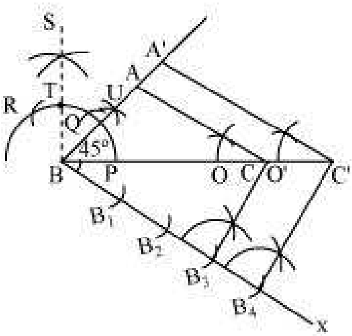
Locate 4 points (as 4 is greater in 4 and 3), B_1, B_2, B_3, B_4, on BX.

Step 4

Join B_3C. Draw a line through B_4 parallel to B_3C intersecting extended BC at C'.

Step 5

Through C', draw a line parallel to AC intersecting extended line segment at C'. ΔA'BC' is the required triangle.



Justification

The construction can be justified by proving that

$$A'B = \frac{4}{3}AB,\ BC' = \frac{4}{3}BC,\ A'C' = \frac{4}{3}AC$$

In ΔABC and ΔA'BC',

$\angle$ABC = $\angle$A'BC' (Common)

$\angle$ACB = $\angle$A'C'B (Corresponding angles)

$\therefore$ ΔABC ~ ΔA'BC' (AA similarity criterion)

$$\Rightarrow \frac{AB}{A'B} = \frac{BC}{BC'} = \frac{AC}{A'C'} \quad \ldots (1)$$

In ΔBB_3C and $\Delta BB_4C'$,

$\angle B_3BC = \angle B_4BC'$ (Common)

$\angle BB_3C = \angle BB_4C'$ (Corresponding angles)

$\therefore \Delta BB_3C \sim \Delta BB_4C'$ (AA similarity criterion)

$$\Rightarrow \frac{BC}{BC'} = \frac{BB_3}{BB_4}$$

$$\Rightarrow \frac{BC}{BC'} = \frac{3}{4} \quad \ldots (2)$$

On comparing equations (1) and (2), we obtain

$$\frac{AB}{A'B} = \frac{BC}{BC'} = \frac{AC}{A'C'} = \frac{3}{4}$$

$$\Rightarrow A'B = \frac{4}{3}AB, BC' = \frac{4}{3}BC, A'C' = \frac{4}{3}AC$$

This justifies the construction.

Question 7:

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

Answer:

It is given that sides other than hypotenuse are of lengths 4 cm and 3 cm. Clearly, these will be perpendicular to each other.

The required triangle can be drawn as follows.

Step 1

Draw a line segment AB = 4 cm. Draw a ray SA making 90° with it.

Step 2

Draw an arc of 3 cm radius while taking A as its centre to intersect SA at C. Join BC. ΔABC is the required triangle.

Step 3

Draw a ray AX making an acute angle with AB, opposite to vertex C.

Step 4

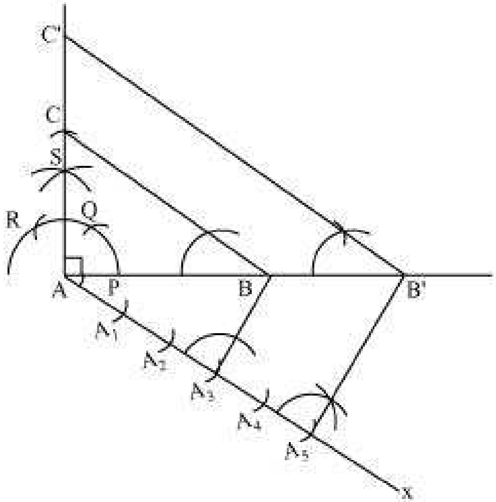
Locate 5 points (as 5 is greater in 5 and 3), A_1, A_2, A_3, A_4, A_5, on line segment AX such that $AA_1 = A_1A_2 = A_2A_3 = A_3A_4 = A_4A_5$.

Step 5

Join A_3B. Draw a line through A_5 parallel to A_3B intersecting extended line segment AB at B'.

Step 6

Through B', draw a line parallel to BC intersecting extended line segment AC at C'. ΔAB'C' is the required triangle.



Justification

The construction can be justified by proving that

$$AB' = \frac{5}{3}AB,\ B'C' = \frac{5}{3}BC,\ AC' = \frac{5}{3}AC$$

In ΔABC and ΔAB'C',

$\angle ABC = \angle AB'C'$ (Corresponding angles)

$\angle BAC = \angle B'AC'$ (Common)

$\therefore$ ΔABC ~ ΔAB'C' (AA similarity criterion)

$$\Rightarrow \frac{AB}{AB'} = \frac{BC}{B'C'} = \frac{AC}{AC'} \quad \ldots (1)$$

In ΔAA_3B and $\Delta AA_5B'$,

$\angle A_3AB = \angle A_5AB'$ (Common)

$\angle AA_3B = \angle AA_5B'$ (Corresponding angles)

$\therefore \Delta AA_3B \sim \Delta AA_5B'$ (AA similarity criterion)

$$\Rightarrow \frac{AB}{AB'} = \frac{AA_3}{AA_5}$$

$$\Rightarrow \frac{AB}{AB'} = \frac{3}{5} \qquad \ldots(2)$$

On comparing equations (1) and (2), we obtain

$$\frac{AB}{AB'} = \frac{BC}{B'C'} = \frac{AC}{AC'} = \frac{3}{5}$$

$$\Rightarrow AB' = \frac{5}{3}AB,\ B'C' = \frac{5}{3}BC,\ AC' = \frac{5}{3}AC$$

This justifies the construction.

Exercise 11.2

Question 1:

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

Answer:

A pair of tangents to the given circle can be constructed as follows.

Step 1

Taking any point O of the given plane as centre, draw a circle of 6 cm radius. Locate a point P, 10 cm away from O. Join OP.

Step 2

Bisect OP. Let M be the mid-point of PO.

Step 3

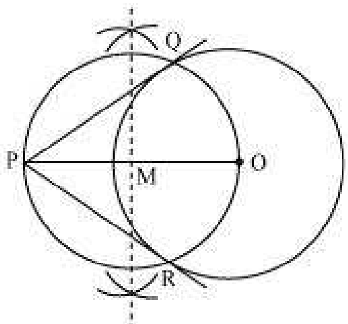
Taking M as centre and MO as radius, draw a circle.

Step 4

Let this circle intersect the previous circle at point Q and R.

Step 5

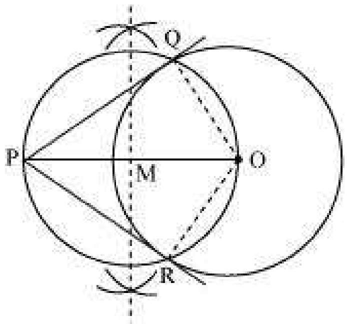
Join PQ and PR. PQ and PR are the required tangents.



The lengths of tangents PQ and PR are 8 cm each.

Justification

The construction can be justified by proving that PQ and PR are the tangents to the circle (whose centre is O and radius is 6 cm). For this, join OQ and OR.



$\angle$PQO is an angle in the semi-circle. We know that angle in a semi-circle is a right angle.

$\therefore \angle PQO = 90°$

$\Rightarrow OQ \perp PQ$

Since OQ is the radius of the circle, PQ has to be a tangent of the circle. Similarly, PR is a tangent of the circle

Question 2:

Construct a tangent to a circle of radius 4 cm from a point on the concentric circle of radius 6 cm and measure its length. Also verify the measurement by actual calculation. Give the justification of the construction.

Answer:

Tangents on the given circle can be drawn as follows.

Step 1

Draw a circle of 4 cm radius with centre as O on the given plane.

Step 2

Draw a circle of 6 cm radius taking O as its centre. Locate a point P on this circle and join OP.

Step 3

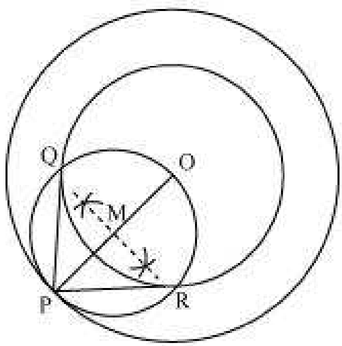
Bisect OP. Let M be the mid-point of PO.

Step 4

Taking M as its centre and MO as its radius, draw a circle. Let it intersect the given circle at the points Q and R.

Step 5

Join PQ and PR. PQ and PR are the required tangents.



It can be observed that PQ and PR are of length 4.47 cm each.

In ΔPQO,

Since PQ is a tangent,

$\angle PQO = 90°$

PO = 6 cm

QO = 4 cm

Applying Pythagoras theorem in ΔPQO, we obtain

$PQ^2 + QO^2 = PQ^2$

$PQ^2 + (4)^2 = (6)^2$

$PQ^2 + 16 = 36$

$PQ^2 = 36 - 16$

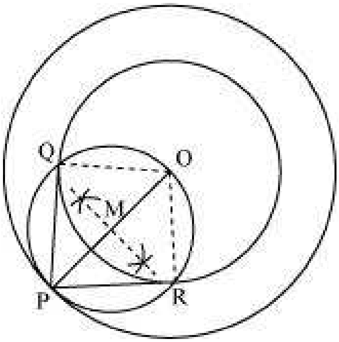
$PQ^2 = 20$

$PQ = 2\sqrt{5}$

PQ = 4.47 cm

Justification

The construction can be justified by proving that PQ and PR are the tangents to the circle (whose centre is O and radius is 4 cm). For this, let us join OQ and OR.



∠PQO is an angle in the semi-circle. We know that angle in a semi-circle is a right angle.

∴ ∠PQO = 90°

⇒ OQ ⊥ PQ

Since OQ is the radius of the circle, PQ has to be a tangent of the circle. Similarly, PR is a tangent of the circle

Question 3:

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

Answer:

The tangent can be constructed on the given circle as follows.

Step 1

Taking any point O on the given plane as centre, draw a circle of 3 cm radius.

Step 2

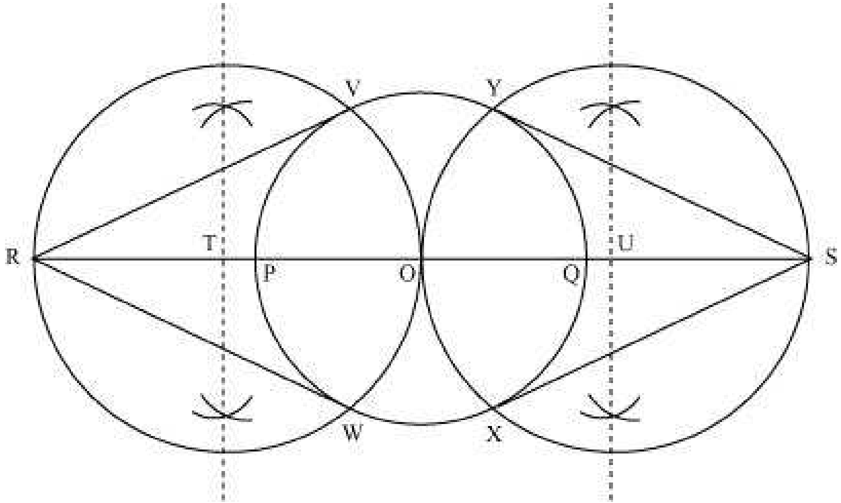
Take one of its diameters, PQ, and extend it on both sides. Locate two points on this diameter such that OR = OS = 7 cm

Step 3

Bisect OR and OS. Let T and U be the mid-points of OR and OS respectively.

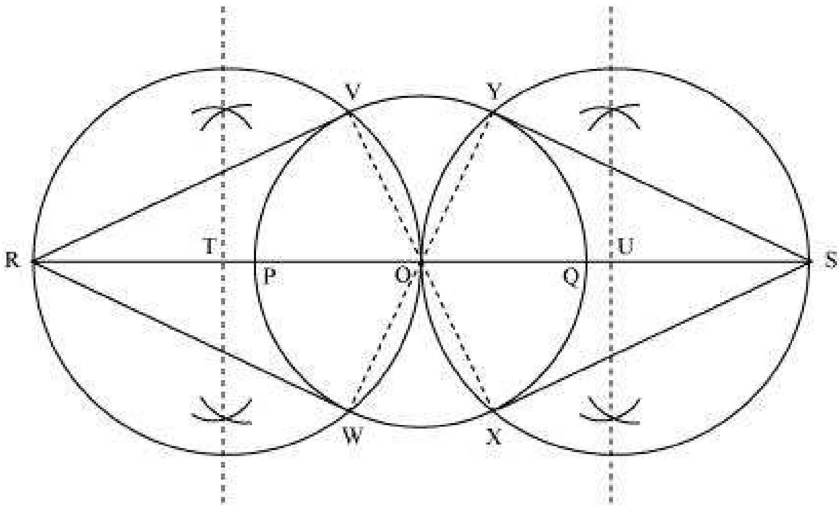
Step 4

Taking T and U as its centre and with TO and UO as radius, draw two circles. These two circles will intersect the circle at point V, W, X, Y respectively. Join RV, RW, SX, and SY. These are the required tangents.



Justification

The construction can be justified by proving that RV, RW, SY, and SX are the tangents to the circle (whose centre is O and radius is 3 cm). For this, join OV, OW, OX, and OY.



∠RVO is an angle in the semi-circle. We know that angle in a semi-circle is a right angle.

$\therefore \angle RVO = 90°$

$\Rightarrow OV \perp RV$

Since OV is the radius of the circle, RV has to be a tangent of the circle. Similarly, OW, OX, and OY are the tangents of the circle

Question 4:

Draw a pair of tangents to a circle of radius 5 cm which are inclined to each other at an angle of 60°. Give the justification of the construction.

Answer:

The tangents can be constructed in the following manner:

Step 1

Draw a circle of radius 5 cm and with centre as O.

Step 2

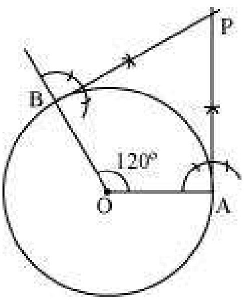
Take a point A on the circumference of the circle and join OA. Draw a perpendicular to OA at point A.

Step 3

Draw a radius OB, making an angle of 120° (180° − 60°) with OA.

Step 4

Draw a perpendicular to OB at point B. Let both the perpendiculars intersect at point P. PA and PB are the required tangents at an angle of 60°.



Justification

The construction can be justified by proving that $\angle APB = 60°$

By our construction

$\angle OAP = 90°$

$\angle OBP = 90°$

And $\angle AOB = 120°$

We know that the sum of all interior angles of a quadrilateral = 360°

$\angle OAP + \angle AOB + \angle OBP + \angle APB = 360°$

$90° + 120° + 90° + \angle APB = 360°$

$\angle APB = 60°$

This justifies the construction.

Question 5:

Draw a line segment AB of length 8 cm. Taking A as centre, draw a circle of radius 4 cm and taking B as centre, draw another circle of radius 3 cm. Construct tangents to each circle from the centre of the other circle. Give the justification of the construction.

Answer:

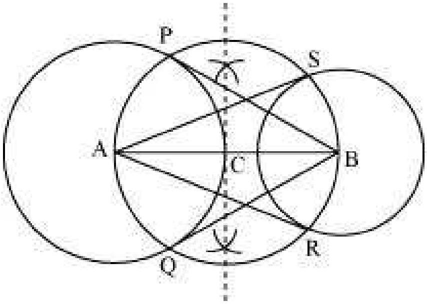
The tangents can be constructed on the given circles as follows.

Step 1

Draw a line segment AB of 8 cm. Taking A and B as centre, draw two circles of 4 cm and 3 cm radius.

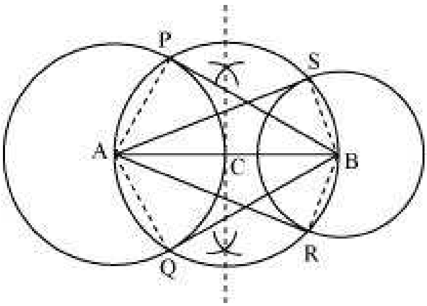
Step 2

Bisect the line AB. Let the mid-point of AB be C. Taking C as centre, draw a circle of AC radius which will intersect the circles at points P, Q, R, and S. Join BP, BQ, AS, and AR. These are the required tangents.



Justification

The construction can be justified by proving that AS and AR are the tangents of the circle (whose centre is B and radius is 3 cm) and BP and BQ are the tangents of the circle (whose centre is A and radius is 4 cm). For this, join AP, AQ, BS, and BR.



$\angle$ASB is an angle in the semi-circle. We know that an angle in a semi-circle is a right angle.

$\therefore$ $\angle$ASB = 90°

$\Rightarrow$ BS $\perp$ AS

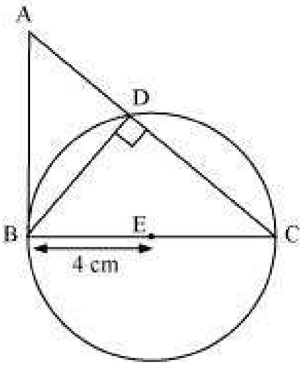
Since BS is the radius of the circle, AS has to be a tangent of the circle. Similarly, AR, BP, and BQ are the tangents.

Question 6:

Let ABC be a right triangle in which AB = 6 cm, BC = 8 cm and $\angle$B = 90°. BD is the perpendicular from B on AC. The circle through B, C, and D is drawn. Construct the tangents from A to this circle. Give the justification of the construction.

Answer:

Consider the following situation. If a circle is drawn through B, D, and C, BC will be its diameter as ∠BDC is of measure 90°. The centre E of this circle will be the mid-point of BC.



The required tangents can be constructed on the given circle as follows.

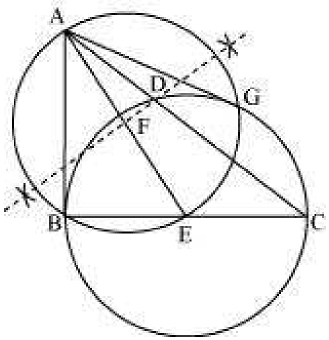
Step 1

Join AE and bisect it. Let F be the mid-point of AE.

Step 2

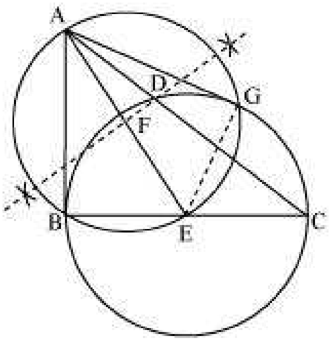
Taking F as centre and FE as its radius, draw a circle which will intersect the circle at point B and G. Join AG.

AB and AG are the required tangents.



Justification

The construction can be justified by proving that AG and AB are the tangents to the circle. For this, join EG.



∠AGE is an angle in the semi-circle. We know that an angle in a semi-circle is a right angle.

∴ ∠AGE = 90°

⇒ EG ⊥ AG

Since EG is the radius of the circle, AG has to be a tangent of the circle.

Already, ∠B = 90°

⇒ AB ⊥ BE

Since BE is the radius of the circle, AB has to be a tangent of the circle.

Question 7:

Draw a circle with the help of a bangle. Take a point outside the circle. Construct the pair of tangents from this point to the circles. Give the justification of the construction.

Answer:

The required tangents can be constructed on the given circle as follows.

Step 1

Draw a circle with the help of a bangle.

Step 2

Take a point P outside this circle and take two chords QR and ST.

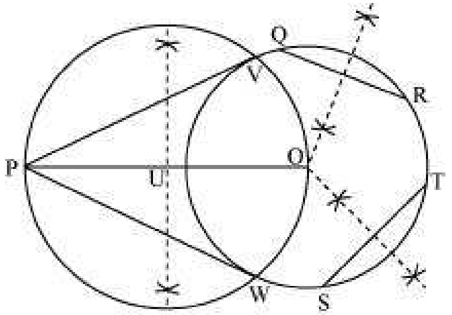
Step 3

Draw perpendicular bisectors of these chords. Let them intersect each other at point O.

Step 4

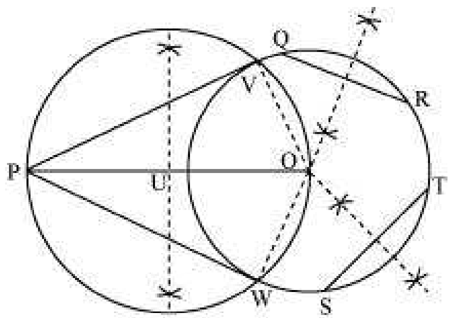
Join PO and bisect it. Let U be the mid-point of PO. Taking U as centre, draw a circle of radius OU, which will intersect the circle at V and W. Join PV and PW.

PV and PW are the required tangents.



Justification

The construction can be justified by proving that PV and PW are the tangents to the circle. For this, first of all, it has to be proved that O is the centre of the circle. Let us join OV and OW.



We know that perpendicular bisector of a chord passes through the centre. Therefore, the perpendicular bisector of chords QR and ST pass through the centre. It is clear that the intersection point of these perpendicular bisectors is the centre of the circle. ∠PVO is an angle in the semi-circle. We know that an angle in a semi-circle is a right angle.

∴ ∠PVO = 90°

⇒ OV ⊥ PV

Since OV is the radius of the circle, PV has to be a tangent of the circle. Similarly, PW is a tangent of the circle.