CBSE NCERT Solutions for Class 10 Mathematics Chapter 11

Back of Chapter Questions

In each of the following, give the justification of the construction also:

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

Solution:

Steps of Construction:

(1) Draw line segment AB of 7.6 cm and draw any ray AX making an acute angle with AB.

(2) Locate 13(= 5 + 8) points $A_1, A_2, A_3, A_4 \ldots\ldots A_{13}$ on AX so that

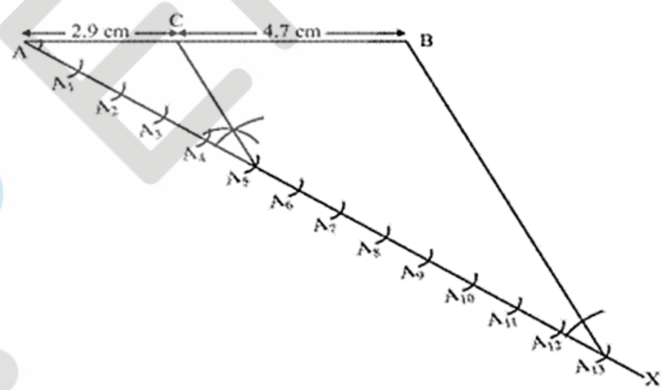
$AA_1 = A_1A_2 = A_2A_3 = \ldots = A_{12}A_{13}$

(3) Join BA_{13}.

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

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

We can measure the approximate lengths of AC and CB. The length of AC and CB comes to 2.9 cm and 4.7 cm respectively.



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

Solution:

The steps of construction are as follows:

(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.

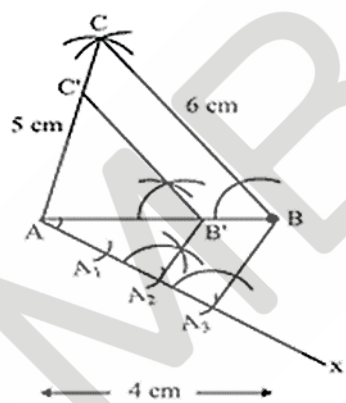
(2) Draw any ray AX making an acute angle with AB on opposite side of vertex C.

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

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

(5) Draw a line through B' parallel to the line BC to intersect AC at C'. $\Delta AB'C'$ is the required triangle.

Diagram:



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

Solution:

The steps of construction are as follows:

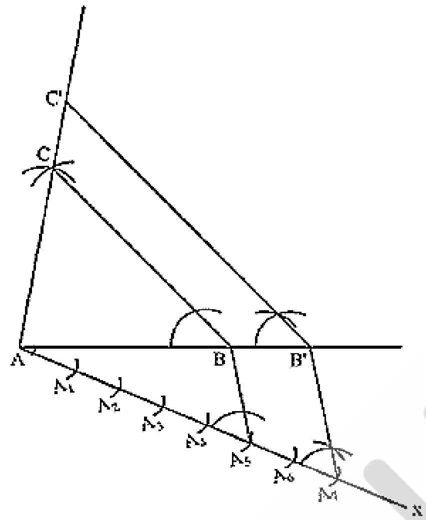
(1) Draw a line segment AB of 5 cm. Taking A and B as centre, draw arcs of 6 cm and 7 cm radius respectively. Let these arcs intersect each other at point C. ΔABC is the required triangle having length of sides as 5 cm, 6 cm and 7 cm respectively.

(2) Draw any ray AX making an acute angle with line AB on opposite side of vertex C.

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

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

(5) Draw a line through B′ parallel o BC intersecting the extended line segment AC at C′. ΔAB′C′ is required triangle.



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

Solution:

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

Now, the steps of construction are as follows:

(1) Draw a line segment AB of 8 cm. Draw arcs of same radius on both sides of 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

(2) Take D as centre and draw an arc of 4 cm radius which cuts the extended line segment OO′ at point C. Now an isosceles Δ ABC is formed, having CD (attitude) as 4 cm and AB (base) as 8 cm.

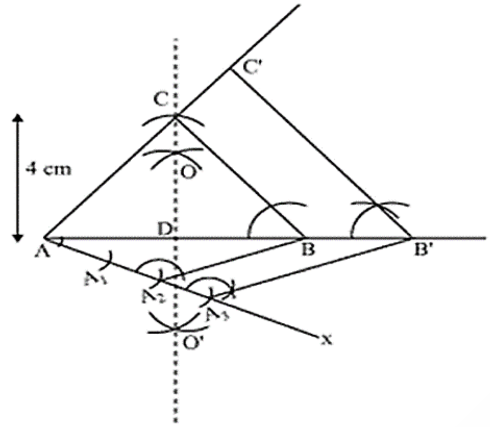
(3) Draw any ray AX making an acute angle with line segment AB on opposite side of vertex C.

(4) Locate 3 points (as 3 is greater between 3 and 2) on AX such that

$AA_1 = A_1A_2 = A_2A_3$.

(5) Join BA_2 and draw a line through A_3 parallel to BA_2 to intersect extended line segment AB at point B′.

(6) Draw a line through B′ parallel to BC intersecting the extended line segment AC at C′. Δ AB′C′ is the required triangle.



5. Draw a triangle ABC with side BC = 6 cm, AB = 5 cm and $\angle ABC = 60^o$. Then construct a triangle whose sides are $\frac{3}{4}$ of the corresponding sides of the triangle ABC.

Solution:

The steps of construction are as follows:

(1) Draw a line segment BC of length 6 cm. Draw an arc of any radius while taking B as centre. Let it intersect line BC at point O. Now taking O as centre draw another arc to cut the previous arc at point O′. Join BO′ which is the ray making 60^o with line BC.

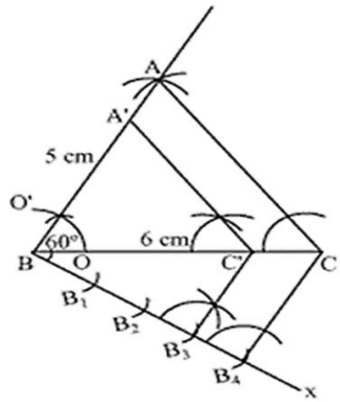
(2) Now draw an arc of 5 cm radius while taking B as centre, intersecting extended line segment BO′ at point A. Join AC. Δ ABC is having AB = 5 cm. BC = 6 cm and $\angle ABC = 60^o$.

(3) Draw any ray BX making an acute angle with BC on opposite side of vertex A.

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

(5) Join B_4C and draw a line through B_3, parallel to B_4C intersecting BC at C′.

(6) Draw a line through C′ parallel to AC intersecting AB at A′. ΔA′BC′ is the required triangle.



6. Draw a triangle ABC with side BC = 7 cm, $\angle B = 45^o, \angle A = 105^o$. Then, construct a triangle whose sides are $\frac{4}{3}$ times the corresponding sides of Δ ABC.

Solution:

$$\angle B = 45^o, \angle A = 105^o$$

It is known that the sum of all interior angles in a triangle is 180^o

$$\angle A + \angle B + \angle C = 180^o$$

$$\Rightarrow 105^o + 45^o + \angle C = 180^o$$

$$\Rightarrow \angle C = 180^o - 150^o = 30^o$$

Now, the steps of construction are as follows:

(1) Draw a line segment BC = 7 cm. Draw an arc of any radius while taking B as centre. Let it intersects BC at P. Draw an arc from P, of same radius as before, to intersect this arc at Q. From Q, again draw an arc, of same radius as before, to cut the arc at R. Now from points Q and R draw arcs of same radius as before, to intersect each other at S. Join BS.

Let BS intersect the arc at T. From T and P draw arcs of same radius as before to intersect each other at U. Join BU which is making 45^o with BC.

(2) Draw an arc of any radius taking C as its centre. Let it intersects BC at O. Taking O as centre, draw an arc of same radius intersecting the previous arc at O′. Now taking O and O′ s centre, draw arcs of same radius as before, to intersect each at Y. Join CY which is making 30^o to BC.

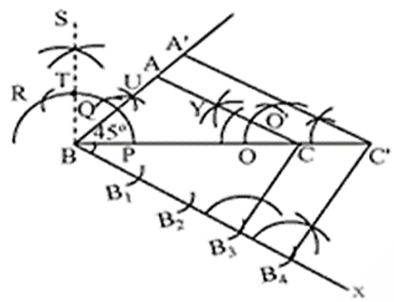
(3) Extend line segment CY and BU. Let they intersect each other at A. Δ ABC is the triangle having $\angle A = 105^o$, $\angle B = 45^o$ and BC = 7 cm.

(4) Draw any ray BX making an acute angle with BC on opposite side of vertex A.

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

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

(7) Through C' draw a line parallel to AC intersecting extended line segment BA at A'. $\Delta\ A'BC'$ is required triangle.



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

Solution:

The steps of construction are as follows:

(1) Draw a line segment $AB = 4\text{cm}$ and draw a ray SA making 90° with it.

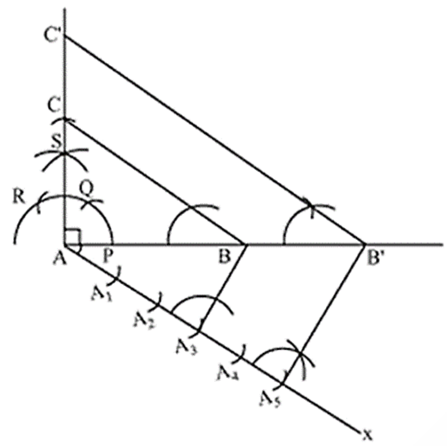
(2) Draw an arc of 3 cm radius while taking A as its centre to intersect SA at C. Join BC. Δ ABC is required triangle.

(3) Draw any ray AX making an acute angle with AB on the side opposite to vertex C.

(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.

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

(6) Through B', draw a line parallel to BC intersecting extended line segment AC at C'. $\Delta\ AB'C'$ is required triangle.



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EXERCISE 11.2

In each of the following, give also the justification of the construction:

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.

Solution:

The steps of construction are as follows:

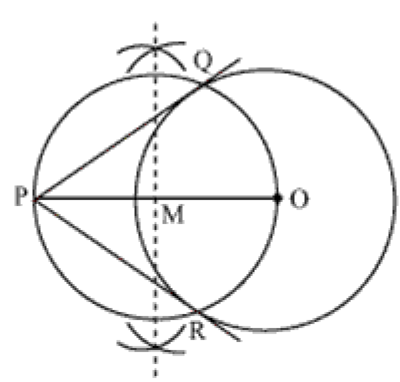
(1) Taking any point **O** of the given plane as centre. Draw a circle of **6 cm** radius. Locate a point **P**, **10 cm** away from **O**. Join **OP**.

(2) Bisect **OP**. Let **M** be the midpoint of **PO.**

(3) Taking **M** as centre and **MO** as radius, draw a circle.

(4) Let this circle intersect our first circle at point **Q** and **R.**

(5) Join **PQ** and **PR**. **PQ** and **PR** are the required tangents. The length of tangents **PQ** and **PR** are **8 cm** each.



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.

Solution:

The steps of construction are as follows:

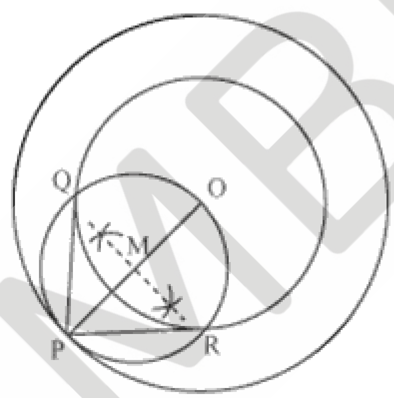
(1) Draw a circle of **4 cm** radius with centre as **O** on the given plane.

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

(3) Bisect **OP**. Let **M** be the midpoint of **PO.**

(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.**

(5) Join **PQ** and **PR. PQ** and **PR** are the required tangents.



Now, PQ and PR are of length 4.47 cm each.

In Δ PQO, since PQ is tangent, $\angle PQO = 90^{\circ}$.

$PO = 6$ cm

$QO = 4$ cm

Applying Pythagoras theorem in ΔPQO,

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

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

$\Rightarrow PQ^2 = 20$

$\therefore \ PQ = 2\sqrt{5} = 4.47$ cm

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.**

Solution:

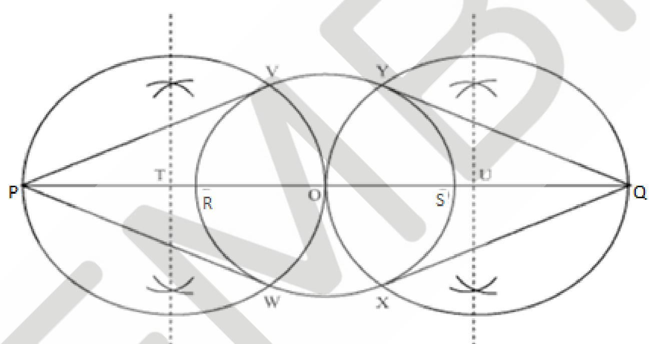
The steps of construction are as follows:

(1) Taking any point **O** on given plane as centre, draw a circle of **3 cm** radius.

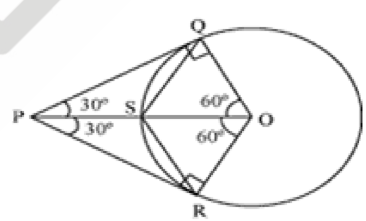
(2) Take one of its diameters, ***RS***, extended it on both sides. Locate two points on this diameter such that $\mathbf{OP = OQ = 7\ cm}$.

(3) Bisect **OP** and **OQ**. Let **T** and **U** be the midpoints of **OP** and **OQ** respectively.

(4) Taking **T** and **U** as its centre, with **TO** and **UO** as radius, draw two circles. These two circles will intersect our circle at point **V, W, X and Y** respectively. Join **PV, PW, QX** and **QY**. These are required tangents.



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



Consider the above figure. PQ and PR are the tangents to the given circle.

If they are inclined at 60°, then $\angle QPO = \angle OPR = 30^\circ$

Hence, $\angle POQ = \angle POR = 60^\circ$

Consider ΔQSO,

$\angle QOS = 60^\circ$

$OQ = OS$ (radius)

So, $\angle OQS = \angle OSQ = 60^o$

$\therefore \Delta$ QSO is an equilateral triangle

So, $QS = SO = QO =$ radius

$\angle PQS = 90^o - \angle OQS = 90^o - 60^o = 30^o$

$\angle QPS = 30^o$

$PS = SQ$ (Isosceles triangle)

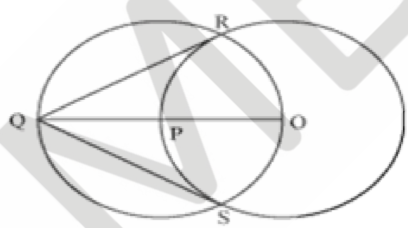
Hence, $PS = SQ = OS$ (radius)

Now, the steps of construction are as follows:

(1) Draw a circle of 5 cm radius and with centre O.

(2) Take a point P on circumference of this circle. Extend OP to Q such that $OP = PQ$.

(3) Midpoint of OQ is P. Draw a circle with radius OP with centre as P. Let it Intersect our circle at R and S. Join QR and QS QR and QS are required tangents.



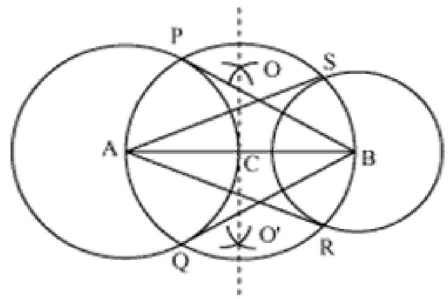
5. Draw a line segment AB of length 8 cm. Taking A as centre, draw a circle of radius 4 cm and taking B as centre, draw another circle of radius 3 cm. Construct tangents to each circle from the centre of the other circle.

Solution:

The steps of construction are as follows:

(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.

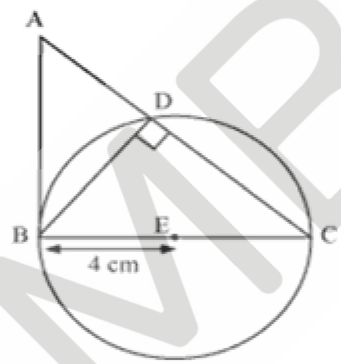
(2) Bisect the line AB. Let midpoint of AB is C. Taking C as centre draw a circle of radius AC which will intersect our circles at point P, Q, R and S. Join BP, BQ, AS and AR. These are our required tangents.



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

Solution:

In the following figure, it can be seen that if a circle is drawn through B, D and C, then BC will be its diameter as ∠BDC is 90^o. The centre E of this circle will be the midpoint of BC.



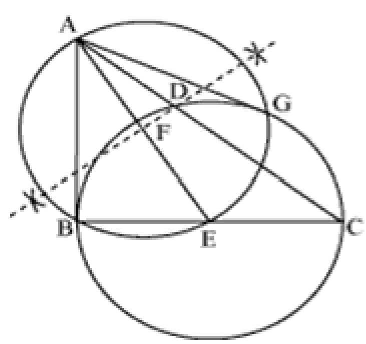
The steps of construction are as follows:

(1) Join AE and bisect it. Let F be the midpoint of AE.

(2) Now with F as centre and radius FE, draw a circle intersecting the first circle at point B and G.

(3) Join AG.

Thus, AB and AG are the required tangents.



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 circle.

Solution:

The steps of construction are as follows:

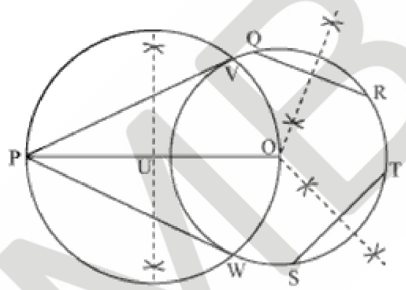
(1) Draw a circle with bangle.

(2) Take a point **P** outside this circle and take two non-parallel chords **QR** and **ST.**

(3) Draw perpendicular bisectors of these chords intersecting each other at point **O** which is centre of the given circle.

(4) Join **OP** and bisect it. Let **U** be the midpoint of **PO.** With **U** as centre and radius **OU**, draw a circle, intersecting our first circle at **V** and **W.** Join **PV** and **PW.**

Thus, PV and **PW** are the required tangents.



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