CHAPTER

9 CONSTRUCTIONS

Syllabus

- *Division of a line segment in a given ratio (Internally).*
- *Tangent to a circle from a point outside it.*
- *Construction of a triangle similar to a given triangle.*

Chapter Analysis

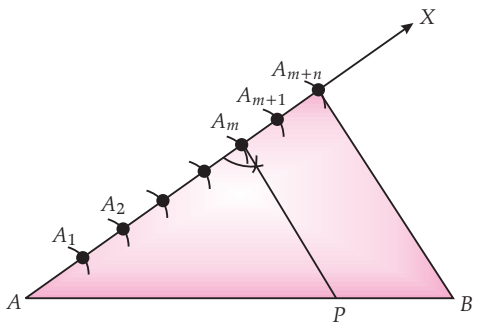
List of Topics	2016			2017			2018
	Delhi	Outside Delhi	Foreign	Delhi	Outside Delhi	Foreign	Delhi & Outside Delhi
Tangent to circle		1 Q (4 M)				1 Q (4 M)	
Construction of Triangle	1 Q (4 M)		1 Q (4 M)	1 Q (4 M)	1 Q (4 M)		1 Q (4 M)

TOPIC-1
Division of a Line Segment in a Given Ratio

Revision Notes

- The ratio of the sides of the triangle to be constructed with the corresponding sides of the given triangle is known as scale factor.
- To divide a line segment internally

  In a given ratio $m : n$, where both m and n are positive integers, we follow the following steps :



Step 1. Draw a line segment AB of given length by using a ruler.

Step 2. Draw any ray AX making an acute angle with AB.

Step 3. Along AX mark off $(m + n)$ points $A_1, = A_2, \ldots\ldots, A_m, A_{m+1}, \ldots\ldots, A_{m+n}$, such that $AA_1 = A_1A_2 = A_{m+n-1}A_{m+n}$.

Step 4. Join BA_{m+n}.

Step 5. Through the point A_m draw a line parallel to $A_{m+n}B$ by making an angle equal to $\angle AA_{m+n}B$ at A_m. *i.e.*, $\angle AA_mP$.

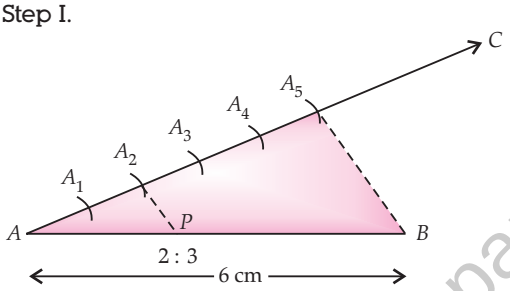
This line meets AB at point P.

The point P is the required point which divides AB internally in the ratio $m : n$.

How it is done on GREENBOARD ?

Q. Draw a line segment $AB = 6$ cm and divide it in the ratio of 2 : 3.

Sol. Step I.



Step II. Steps of construction :

(i) Draw a line segment $AB = 6$ cm.

(ii) At A draw an acute angle BAC.

(iii) Mark A_1, A_2, A_3, A_4, A_5 at equal distance.

(iv) Join A_5 to B.

(v) Draw a line A_2P parallel to A_5B.

(vi) P is the required point on AB which divides it in the ratio 2 : 3.

Objective Type Questions

(1 mark each)

[A] Multiple Choice Questions :

Q. 1. To divide a line segment AB in the ratio 5 : 7, first a ray AX is drawn so that $\angle BAX$ is an acute angle and then at equal distances points are marked on the ray AX such that the minimum number of these points is :

(a) 8 **(b)** 10

(c) 11 **(d)** 12

C + U **[NCERT Exemp.]**

Sol. Correct option : (d)

Explanation : Minimum number of the points marked = sum of ratios = 5 + 7 = 12.

Q. 2. To divide a line segment AB in ratio 4 : 7, a ray AX is drawn first such that $\angle BAX$ is an acute angle and then points $A_1, A_2, A_3, \ldots$ are located at equal distances on the ray AX and the point B is joined to :

(a) A_{12} **(b)** A_{11}

(c) A_{10} **(d)** A_9

C + U **[NCERT Exemp.]**

Sol. Correct option : (b)

Explanation : We have to divide the line segment into 7 + 4 = 11 equal parts and 11th part will be joined to B, here A_{12} will never appear.

Q. 3. To divide a line segment AB in the ratio 5 : 6 draw a ray AX such that $\angle BAX$ is an acute angle, then draw a ray BY parallel to AX, and the points, $A_1, A_2, A_3, \ldots$ and $B_1, B_2, B_3, \ldots$ are located at. Equal distances on ray AX and BY, respectively. Then the points joined are

(a) A_5 and B_6 **(b)** A_6 and B_5

(c) A_4 and B_5 **(d)** A_5 and B_4

C + U **[NCERT Exemp.]**

Sol. Correct option : (a)

Explanation : In the figure, segment AB of given length is divided into 2 parts of ratio 5 : 6 in following steps :

(i) Draw a line-segment AB of given length.

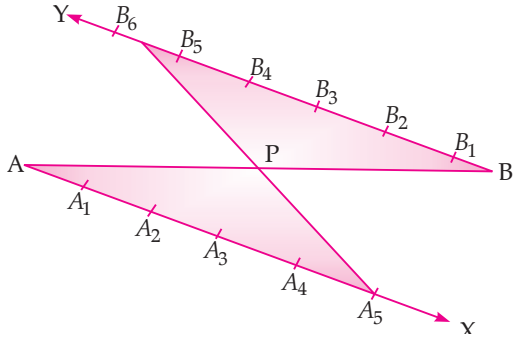
(ii) Draw an acute angle BAX as shown in figure either upside or down side.

(iii) Draw angle $\angle ABY = \angle BAX$ on other side of AX, that is, down side.

(iv) Divide AX into 5 equal parts by using compass.

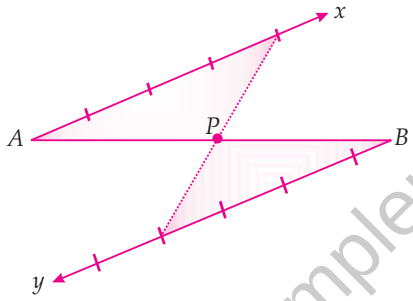
(v) Divide BX into same distance in 6 equal parts as AX was divided.

(vi) Now, join A_5 and B_6 which meet AB at P. P divides AB in ratio $AP : PB = 5 : 6$.



[B] Very Short Answer Type Questions :

Q. 1. In given figure, in what ratio does P divides AB internally ? U **[Board Term-2, 2012 Set (26)]**



Sol. P divides AB internally in the ratio $4 : 4 \Rightarrow 1 : 1$. **1**

[CBSE Marking Scheme, 2012]

Q. 2. To divide a line segment AB in the ratio 5 : 7, first AX is drawn, so that $\angle BAX$ is an acute angle and then at equal distance, points are marked on the ray AX, find the minimum number of these points. R **[Board Term-2, 2012 Set (13)]**

Sol. Try yourself, Similar to Q. No. 1 in MCQs.

Q. 3. To divide a line segment AB in the ratio 2 : 5, a ray AX is drawn such that $\angle BAX$ is acute. Then points are marked at equal intervals on AX. What is the minimum number of these points ?

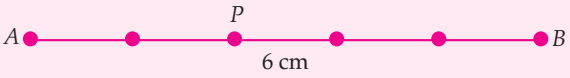
U **[Board Term-2, 2012 Set (1)]**

Sol. Try yourself, Similar to Q. No. 1 in MCQs.

Q. 4. To find a point P on the line segment $AB = 6$ cm, such that $\frac{AP}{AB} = \frac{2}{5}$, in which ratio the line segment AB is divided.

A **[Board Term-2, 2012 Set (5)]**

Sol. The line segment AB is divided in the ratio $AP : PB = 2 : (5 - 2) = 2 : 3$



[CBSE Marking Scheme, 2012] 1

Q. 5. A line Segment AB is divided at point P such that $\frac{PB}{AB} = \frac{3}{7}$, then find the radio $AP : PB$.

A **[Board Term-2, 2012 Set (44)]**

Sol. Here, $AB = 7$, $PB = 3$

$\therefore \quad AP = AB - PB = 7 - 3 = 4$

$\therefore \quad AP : PB = 4 : 3$

[CBSE Marking Scheme, 2012] 1

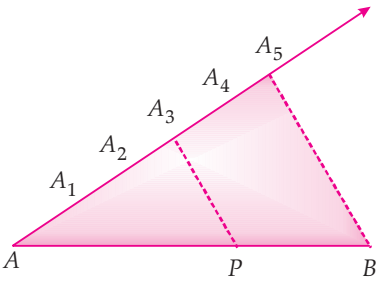
Q. 6. To divide the line segment AB in the ratio 2 : 3, a ray AX is drawn such that $\angle BAX$ is acute, AX is then marked at equal intervals. Find minimum number of these marks.

U **[Board Term-2, 2012 Set (12)]**

Sol. Minimum number of marks $= 2 + 3 = 5$ **1**

[CBSE Marking Scheme, 2012]

Q. 7. What is the ratio of division of the line segment AB by the point P from A ? U **[Board Term-2, 2011 (22)]**



Sol. The ratio of division of the line segment AB by the point P from A is $AP : AB = 3 : 5$. **1**

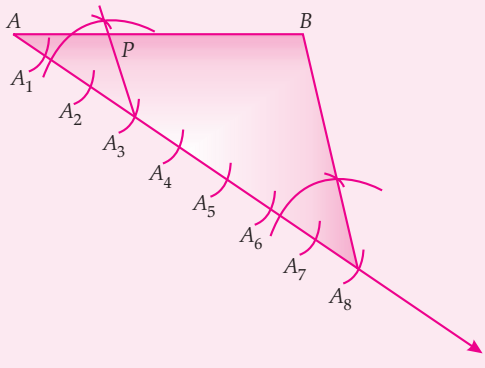
[CBSE Marking Scheme, 2011]

Short Answer Type Questions-I (2 marks each)

Q. 1. Draw a line segment of length 7 cm. Find a point *P* on it which divides it in the ratio 3 : 5.

U [Board Term-2, 2015]

Sol.



1

Steps of construction :

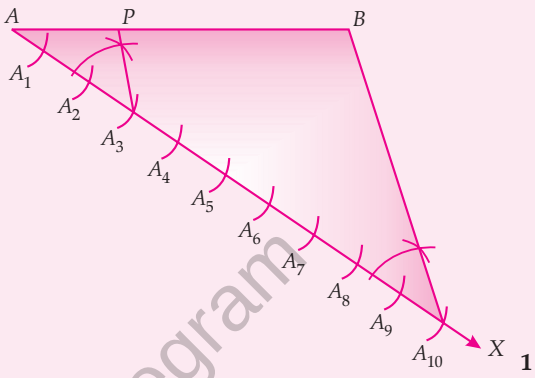
1. Draw a line segment $AB = 7$ cm.
2. Draw any ray AX making an acute angle down ward with AB.
3. Mark the points $A_1, A_2, A_3, ..., A_8$ on AX such that $AA_1 = A_1A_2 = A_2A_3 = ..., A_7A_8$.
4. Join BA_8.
5. Through the point A_3, draw a line parallel to BA_8. To meet AB on P.

Hence $AP : PB = 3 : 5$ **1**

[CBSE Marking Scheme, 2015]

Q. 2. Draw a line segment of length 5 cm and divide it in the ratio 3 : 7. U [Board Term-2, 2015]

Sol.



1

Steps of Construction :

1. Draw a line segment $AB = 5$ cm.
2. Draw any ray AX making an acute angle down ward with AB.
3. Mark the points $A_1, A_2, A_3, ... A_{10}$ on AX such that $AA_1 = A_1A_2 = ... = A_9A_{10}$.
4. Join BA_{10}.
5. Through the point A_3 draw a line parallel to BA_{10}. *To* meet AB at P

Hence $AP : PB = 3 : 7$. **1**

[CBSE Marking Scheme, 2015]

TOPIC-2
Tangents to a Circle from a Point Outside It

Revision Notes

➢ **To draw the tangent to a circle at a given point on it, when the centre of the circle is known.**

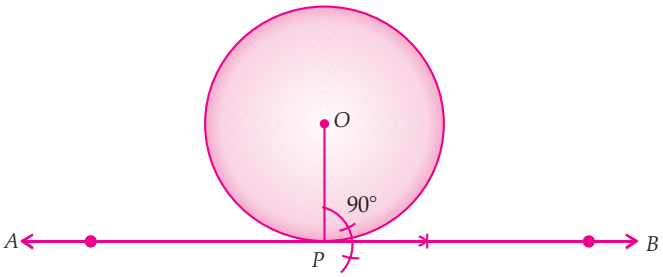
Given : A circle with centre O and a point P on it.

To construct : the tangent to the circle at the point *P*.

Steps of construction :

(i) Join *OP*.

(ii) Draw a line segment $AB \perp OP$ at the point *P*. *APB* is the required tangent at *P*.



➢ **To draw the tangent to a circle at a given point on it, when the centre is not known.**

Given : *P* is a point on the circle.

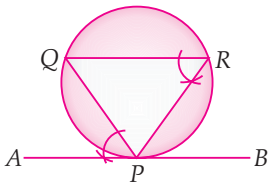
Construct : Draw a tangent from the point P.

Steps of construction :

(i) Draw any chord PQ and join P and Q to a point R.

(ii) Draw $\angle QPA$ equal to $\angle PRQ$ on opposite side of chord PQ.

The line segment BPA is the tangent to the circle at P.



➢ **To draw the tangent to a circle from an external point when its centre is known.**

Given : A circle with centre O and a point P outside it.

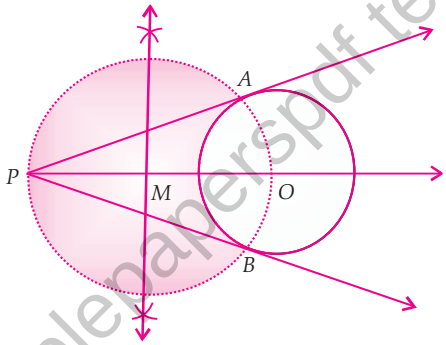
To construct : The tangents to the circle from P.

Steps of construction :

(i) Join OP and bisect it. Let M be the mid-point of OP.

(ii) Taking M as centre and MO as radius, draw a circle to intersect $C(O, r)$ in two points, say A and B.

(iii) Join PA and PB. These are the required tangents from P to the circle.



➢ **To draw tangents to a circle from a point outside it (when its centre is not known)**

Given : P is a point outside the circle.

To construct : To draw tangents from the point P.

Steps of construction :

(i) Draw a circle of given radius

(ii) Through P draw a secant PAB to meet the circle at A and B.

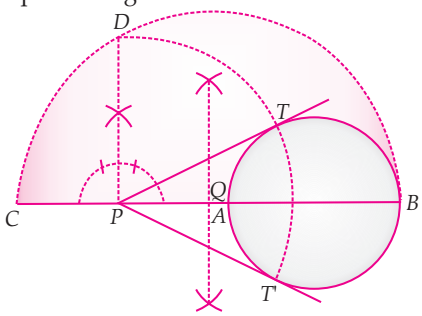
(iii) Produce AP to C such that $PC = PA$. Bisect CB at Q.

(iv) With CB as diameter and centre as Q, draw a semi-circle.

(v) Draw $PD \perp CB$, to meet semi-circle at the point D.

(vi) Intersect P as centre and PD as radius draw an arc to interest the circle at T and T'.
PT and PT' are the required tangents.

(vii) Join P to T and P to T'.
Hence, PT and PT' are the required tangents.



How it is done on GREENBOARD ?

Q. Draw a pair of tangents to a circle of any convenient radius, which are inclined to the line joining the centre of the circle and the point at which they intersect at an angle of 45°. A

OR

Draw a circle of radius 3.5 cm. Draw two tangents to the circle which are perpendicular to each other.

Sol. Steps of construction

Step I : Draw a circle of any convenient radius with O as centre.

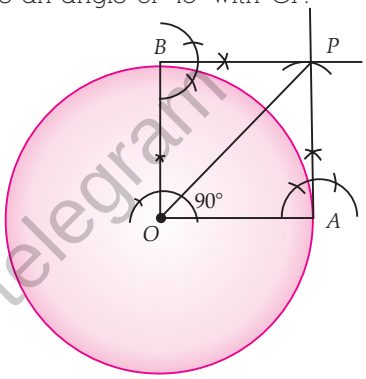
Step II : Take a point A on the circumference of the circle and join OA. Draw a perpendicular to OA at point A.

Step III : Draw a radius OB, making an angle of 90° with OA.

Step IV : Draw a perpendicular to OB at point B. Let both the perpendiculars intersect at point P.

Step V : Join OP.

PA and PB are the required tangents, which make an angle of 45° with OP.



Objective Type Questions (1 mark each)

(A) Multiple Choice Questions :

Q. 1. To draw a pair of tangents to a circle which are inclined to each other at an angle of 60°, it is required to draw tangents at end points of those two radii of the circle, the angle between them should be :

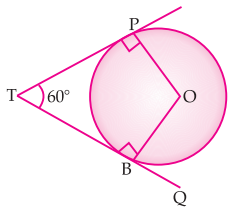
(a) 135° **(b) 90°**

(c) 60° **(d) 120°**

[AE] [NCERT Exemp.]

Sol. Correct option : (d)

Explanation :



We know that tangent and radius at contact point are perpendicular to each other. So, $\angle P$ and $\angle Q$ in quadrilateral $TPOQ$ formed by tangents and radii will be of 90° each. So, the sum of $\angle T + \angle O = 180°$ as $T = 60°$ [Given]

$\therefore \angle O = 180° - 60° = 120°$

Short Answer Type Questions-I (2 marks each)

Q. 1. Draw tangents to a circle of radius 6 cm from a point P at a distance of 10 cm from its centre.

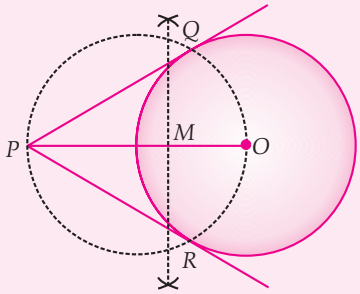
A [Board Term-2, 2015]

Sol. Given : A circle with centre O and a point P outside it.

Construction : two tangents from P to the circle.

Steps of construction :

1. Draw a line segment $PO = 10$ cm.
2. From the point O draw a circle of radius = 6 cm.
3. Draw a perpendicular bisector of PO. Let M be the mid-point of PO.
4. Taking M as centre and OM as radius draw a circle.
5. Let this circle intersect the given circle at the points Q and R.



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6. Join PQ and PR.

Hence, PQ and PR are the required tangents. **1**

[CBSE Marking Scheme, 2015]

Q. 2. Draw a circle of radius 1·5 cm. Take a point P outside it. Without using the centre draw two tangents to the circle from the point P.

A **[Board Term II, 2012 Set (56); 2011, Set B1]**

Sol. Steps of construction :

1. Draw a circle of radius 1·5 cm. Take a point P outside it.

2. Through P draw a secant PAB to meet the circle at A and B.

3. Produce AP to C such that $PC = PA$. Bisect CB at Q.

4. With CB as diameter and centre as Q, draw a semi-circle.

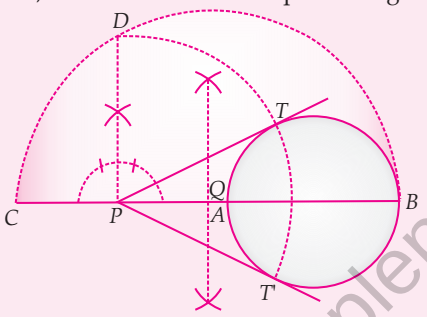
5. Draw $PD \perp CB$, to meet semi-circle at the point D.

6. Intersect P as centre and PD as radius draw an arc to interest the circle at T and T'. **1**

PT and PT' are the required tangents.

7. Join P to T and P to T'

Hence, PT and PT' are the required tangents.



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[CBSE Marking Scheme 2011, 12]

Q. 3. 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.

A **[Board Term-2, 2011, Set A1, B1]**

Sol. Steps of construction :

1. Draw a line segment BC = 8 cm.

2. Make a right angle at the point B *i.e.*, $\angle CBX = 90°$

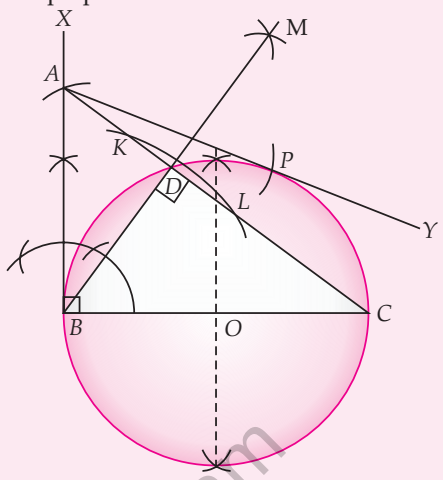
3. Draw a are of radius 6 cm as centre B which intersect BX at the point A.

4. Join AC $\therefore$ ABC is required right angle triangle.

5. Draw an arc taking centre B which intersects AC at the point K and L respectively taking K and L as centre draw two arcs of same radius which intersect at the point M.

6. Join BM $\therefore$ $\angle BDC = 90°$

7. Draw perpendicular bisector of BC.



1

8. Draw a circle taking radius equal to OB and centre O which is passes through B, D and C.

9. Draw an arc taking centre A and radius equal to AB *to* intersect the circle at point P $\therefore$ AP and AB are the tangents. **1**

[CBSE Marking Scheme, 2011]

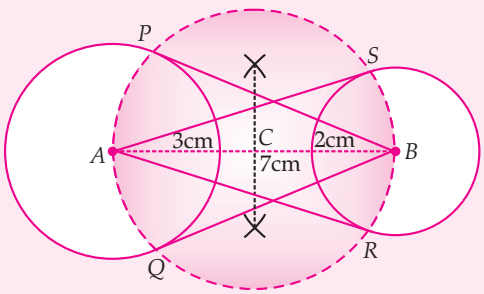
Q. 4. Draw a line segment AB of length 7 cm. Taking A as centre, draw a circle of radius 3 cm and taking B as centre, draw another circle of radius 2 cm. Construct tangents to each circle from the centre of the other circle.

A **[Delhi CBSE Term-2, 2015 (Set III)]**

Sol. Steps of Construction :

1. Draw a line segment AB of 7 cm.

2. Taking A and B as centres draw two circles radii of 3 cm and 2 cm respectively.



3. Bisect the line AB. Let mid-point of AB be C.

4. Taking C as centre draw a circle of radius AC which intersects the two circles at point P, Q, R and S.

5. Join BP, BQ, AS and AR.

BP, BQ and AR, AS are the required tangents. **2**

[CBSE Marking Scheme, 2015]

Short Answer Type Questions-II

(3 marks each)

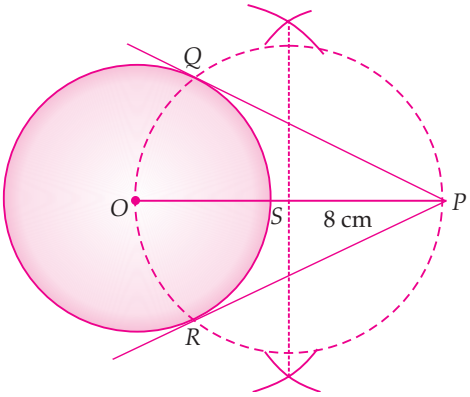
Q. 1. Construct a pair of tangents PQ and PR to a circle of radius 4 cm from a point P outside the circle 8 cm away from the centre. Measure PQ and PR.

A **[Board Term-2, 2014]**

Sol. Steps of construction :

1. Draw a line segment $OP = 8$ cm
2. Taking O as centre and radius 4 cm, draw a circle.
3. Taking OP as diameter draw another circle which intersects the first circle at Q and R.
4. Join P to Q and P to R.

On measuring, we get $PQ = PR = 5$ cm **1**



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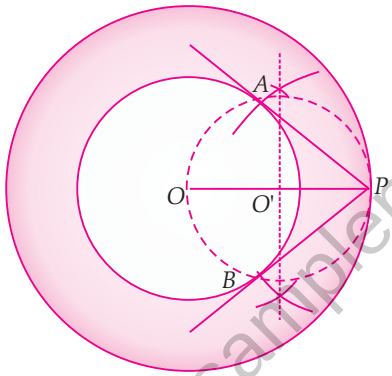
Q. 2. Construct a tangent to a circle of radius 4 cm from a point on the concentric circle of radius 6 cm. A **[Board Term-2, 2013]**

Sol. Steps of construction :



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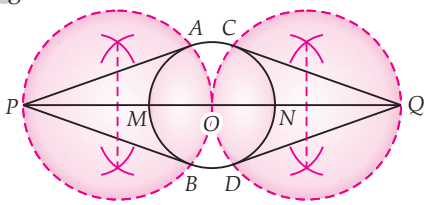
1. Draw a circle of radius 4 cm with centre O.
2. Draw another circle of radius 6 cm with same centre O.
3. Take a point P on second circle and join OP.
4. Draw perpendicular bisector of OP which intersect OP at O'.
5. Draw a circle with centre O' which intersects the inner circle at points A and B.
6. Join AP and BP.

$\therefore$ AP and BP are required tangents. **1**

Q. 3. Draw a circle of radius of 3 cm. Take two points P and Q one of its diameter extended on both sides, each at a distance of 7 cm on opposite sides of its centre. Draw tangents to the circle from these two points. A **[Foreign Set-III 2017]**

Sol. Steps of Construction :

1. Draw a circle with centre O and radius 3 cm.
2. Draw its diameter MON and extend it to both the sides to P and Q. Such that $OP = OQ = 7$ cm.
3. Taking diameters as OP and OQ draw two circles each of which intersects the first circle at the points A, B and C, D respectively.
4. Join PA, PB, QC and QO to get the required tangents. **1**



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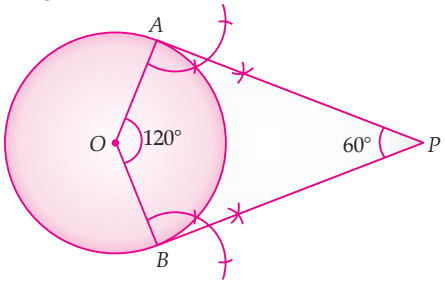
Long Answer Type Questions (4 marks each)

Q. 1. Draw a circle of radius 4 cm. Draw two tangents to the circle inclined at an angle of 60° to each other. A **[O.D. Set I, 2016] [Foreign Set I, II, III 2015]**

Sol. Steps of construction :

1. Draw a circle of radius 4 cm with O as centre.
2. Draw two radii OA and OB inclined to each other at an angle of 120°.

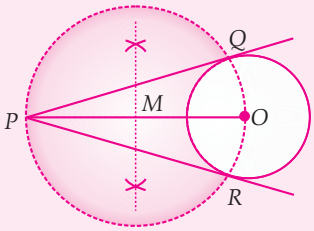


2

3. Draw AP ⊥ OA at A and BP ⊥ OB at B. Which meet at P.
4. PA and PB are the required tangents inclined to each other an angle of 60°. **2**

Q. 2. Draw a circle of radius 3 cm. From a point P, 7 cm away from its centre draw two tangents to the circle. Measure the length of each tangent. A **[Foreign Set I, 2015]**

Sol.



2

Steps of construction :

1. Draw a line segment $PO = 7$ cm.
2. From the point O, draw a circle of radius = 3 cm.

3. Draw a perpendicular bisector of PO. Let M be the mid-point of PO.

4. Taking M as centre and OM as radius draw a circle.

5. Let this circle intersects the given circle at the point Q and R.

6. Join PQ and PR.

On measuring we get

$PQ = PR = 6{\cdot}3$ cm **2**

[CBSE Marking Scheme, 2015]

Q. 3. Draw two concentric circles of radii 3 cm and 5 cm. Taking a point on the outer circle, construct the pair of tangents to the inner circle.

A **[Foreign Set I 2017]**

Sol. Try yourself, similar to Q.2 in SATQ-II.

Q. 4. 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.

A **[Foreign Set II 2017, Outside Delhi 2014]**

Sol. Steps of construction :

1. Construct a line segment $AB = 8$ cm. **1**

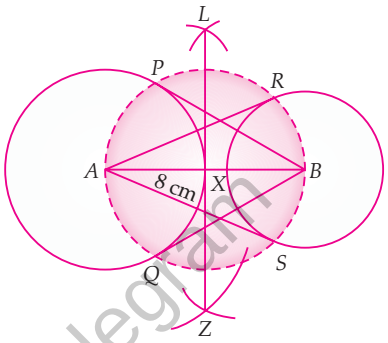
2. With A as centre and radius 4 cm draw a circle.

3. With B as centre and radius 3 cm draw another circle.

4. Taking AB as diameter draw another circle. Which intersects first two circles at P and Q, and R and S.**1**

5. Join B to P, B to Q, A to R and A to S.

Hence BP, BQ, AR and AS are the required tangents.



2

TOPIC-3
Construction of a Triangle Similar to a Given Triangle

Revision Notes

➢ **Construction of triangles similar to a given triangle :**

(a) Steps of constructions, when $m < n$:

Step I. Construct the given triangle ABC by using the given data.

Step II. Take any one of the three sides of the given triangle as base. Let AB be the base of the given triangle.

Step III. At one end, say A, of base AB. Construct an acute $\angle BAX$ below the base AB.

Step IV. Along AX mark off n points $A_1, A_2, A_3, \ldots\ldots, A_n$ such that $AA_1 = A_1A_2 = \ldots\ldots\ldots = A_{n-1}A_n$

Step V. Join A_nB.

Step VI. Draw A_mB' parallel to A_nB which meets AB at B'.

Step VII. From B' draw $B'C' \parallel CB$ meeting AC at C'.

Triangle $AB'C'$ is the required triangle each of whose sides is $\left(\frac{m}{n}\right)^{th}$ of the corresponding side of ΔABC.

(b) Steps of construction, when $m > n$:

Step I. Construct the given triangle by using the given data.

Step II. Take any one of the three sides of the given triangle and consider it as the base. Let AB be the base of the given triangle.

Step III. At one end, say A, of base AB. Construct an acute angle $\angle BAX$ below the base AB *i.e.*, on the opposite side of the vertex C.

Step IV. Along AX mark off m (larger of m and n) points $A_1, A_2, A_3, \ldots\ldots\ldots A_m$ such that $AA_1 = A_1A_2 = \ldots\ldots\ldots = A_{m-1}A_m$.

Step V. Join A_n to B' and draw a line through A_m parallel to A_nB, intersecting the extended line segment AB at B'.

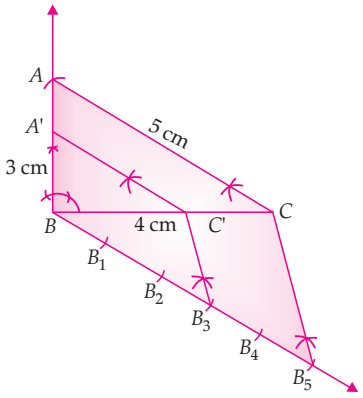
Step VI. Draw a line through B' parallel to BC intersecting the extended line segment AC at C'.

$\Delta AB'C'$ so obtained is the required triangle.

How it is done on GREENBOARD ?

Q. Construct a right triangle whose hypotenuse and one side measure 5 cm and 4 cm respectively. Then construct another triangle whose sides are $\frac{3}{5}$ times of the corresponding sides of this triangle.

Sol.



Steps of Construction :

Step I : (i) Draw a line segment BC = 4 cm.

(ii) Draw an angle of 90° at *B*.

(iii) Taking C as centre and radius equal to hypotenuse = 5 cm draw an arc to intersect at *A*. Join *A* to *C*.

Step II : Draw a line making an acute angle with side BC and divide it in five equal sections and mark B_1, B_2, B_3, B_4, B_5.

Step III : Join B_5 to C, and draw a parallel line B_3C' to B_5C which meets BC at C'.

Step IV : Draw a parallel line A'C' to AC

Hence ABC is the required triangle.

Objective Type Questions (1 mark each)

[A] Multiple Choice Questions :

Q. 1. To construct a triangle similar to a given ΔABC with its sides $\frac{3}{7}$ of the corresponding sides of ΔABC, first draw a ray BX such that $\angle CBX$ is an acute angle and X lies on the opposite side of A with respect to BC. Then located points B_1, B_2, B_3, ... on BX at equal distances and next step is to join :

(a) B_{10} **to** C **(b)** B_3 **to** C

(c) B_7 **to** C **(d)** B_4 **to** C

C + U **[NCERT Exemp.]**

Sol. Correct option : (c)

Explanation : Here, ratio is $\frac{3}{7} < 1$, so resultant figure will be smaller than original so, last 7th part is to be joined to *C*; So, that parallel line from third part of *BX* meet on *BC* without producing.

Q. 2. To construct a triangle similar to a given ΔABC with its side $\frac{8}{5}$ of the corresponding sides of ΔABC draw a ray BX such that $\angle CBX$ is an acute angle and X is on the opposite side of A with respect to BC. The minimum number of points to be located at equal distances on the ray BX :

(a) 5 **(b) 8**

(c) 13 **(d) 3**

C + U **[NCERT Exemp.]**

Sol. Correct option : (b)

Explanation : To construct a triangle similar to a given triangle *ABC* with its sides $\frac{8}{5}$ of the corresponding sides of ΔABC, the minimum number of parts in which *BX* is divided in 8 equal parts.

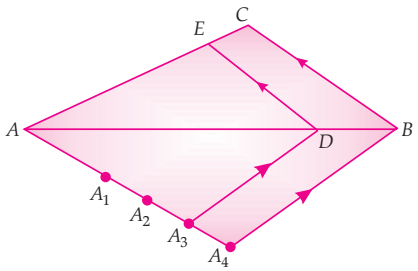
[B] Very Short Answer Type Questions :

Q. 1. When construction of a triangle similar to a given triangle in the scale factor $\frac{5}{3}$, then what is the nature of given triangle ? R **[Board Term-2, 2014]**

Sol. Given triangle is smaller than the constructed triangle. **1**

Q. 2. In figure, ΔADE is constructed similar to ΔABC, write down the scale factor.

R **[Board Term 2, 2012 Set (50)]**



Sol. Scale factor = $\frac{3}{4}$ **[CBSE Marking Scheme, 2012] 1**

Q. 3. When are the two triangles said to be similar ?

R **[Board Term-2, 2012 Set (26)]**

Sol. Two triangles are said to be similar when their corresponding sides are proportional or angles are equal. **[CBSE Marking Scheme, 2012] 1**

Q. 4. Triangle *PQR* is constructed similar to triangle *ABC* with scale factor $\frac{2}{3}$. Find triangle *PQR*.

U **[Board Term-2, 2011 Set (59)]**

Sol. Triangle *PQR* is smaller to triangle *ABC*. **1**

($\because$ Reduced scale factor figures are smaller in size)

[CBSE Marking Scheme, 2011]

Q. 5. Give three sides such that construction of a triangle is possible. R **[Board Term-2, 2011 Set (25)]**

Sol. To construct a triangle sum of two sides of a triangle must be greater than largest side. ½

Let the sides are 2.5 cm, 4.5 cm and 6.5 cm ½

[CBSE Marking Scheme, 2011]

Short Answer Type Questions-I

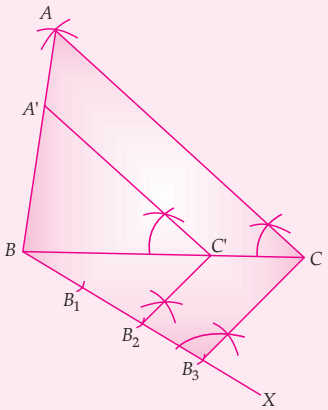
(2 marks each)

Q. 1. Construct a ΔABC in which $AB = 4$ cm, $BC = 5$ cm and $AC = 6$ cm. Then construct another triangle whose sides are $\frac{2}{3}$ times the corresponding sides of ΔABC. A **[Foreign Set I, 2014]** **[Board Term-2, 2011, 2012 Set (22); A1]**

Sol. Steps of construction :

1. Draw a line segment $BC = 5$ cm.
2. With B as centre and radius = $AB = 4$ cm, draw an arc.
3. With C as centre and radius = $AC = 6$ cm, draw another arc, intersecting the arc drawn in step 2 at the point A.
4. Join AB and AC to obtain ΔABC.
5. Below BC, make an acute angle $\angle CBX$.
6. Along BX mark off three points B_1, B_2, B_3 such that $BB_1 = B_1B_2 = B_2B_3$.
7. Join B_3C.
8. From B_2, draw $B_2C' \parallel B_3C$.
9. From C', draw $C'A' \parallel CA$, meeting BA at the point A'.

Then $A'BC'$ is the required triangle. **1**



[CBSE Marking Scheme 2011, 2012] 1

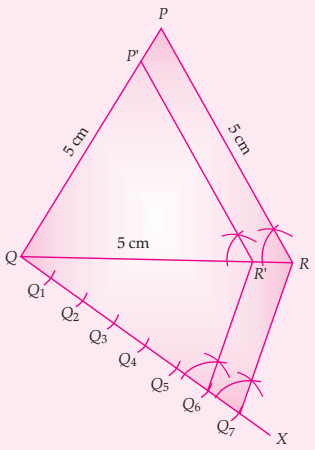
Q. 2. Construct a triangle similar to a given equilateral ΔPQR with side 5 cm such that each of its side is $\frac{6}{7}$ of the corresponding sides of ΔPQR.

A **[Foreign Set II, 2014]** **[Board Term-2, 2011, Set B1]**

Sol. Steps of construction :

1. Draw a line segment $QR = 5$ cm.
2. With Q as centre and radius = $PQ = 5$ cm, draw an arc.
3. With R as centre and radius = $PR = 5$ cm, draw another arc meeting the arc drawn in step 2 at the point P.
4. Join PQ and PR to obtain ΔPQR.
5. Below QR, construct an acute $\angle RQX$.
6. Along QX, mark off seven points Q_1, Q_2, ... Q_7 such that $QQ_1 = Q_1Q_2 = Q_2Q_3 = \ldots\ldots = Q_6Q_7$.
7. Join Q_7R.
8. Draw $Q_6R' \parallel Q_7R$.
9. From R' draw $R'P' \parallel RP$.

Hence, $P'QR'$ is the required triangle. **1**



[CBSE Marking Scheme 2011] 1

Short Answer Type Questions-II (3 marks each)

Q. 1. Construct a triangle with sides 6 cm, 8 cm and 10 cm. Construct another triangle whose sides are $\frac{3}{5}$ of the corresponding sides of original triangle.

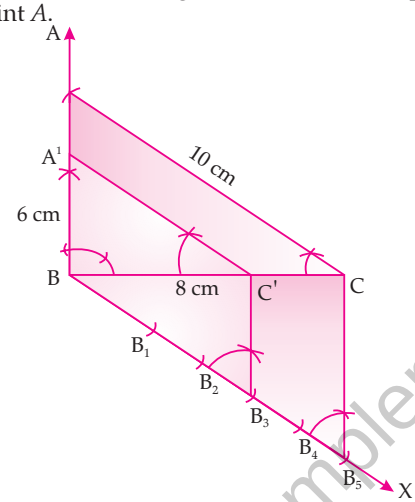
A [CBSE Comptt. Set I, II, III 2018]

Sol. Construction of ABC with sides 6 cm, 8 cm, 10 cm. **1**
Construction of similar triangle. **2**
[CBSE Marking Scheme, 2018]

Detailed Answer :

Steps of Construction :

1. Draw a line segment $BC = 8$ cm.
2. With B as a centre and radius $AB = 6$ cm, draw an arc.
3. With C as a centre and radius $AC = 10$ cm, draw an other arc meeting the arc drawn in step 2 at the point A.



2

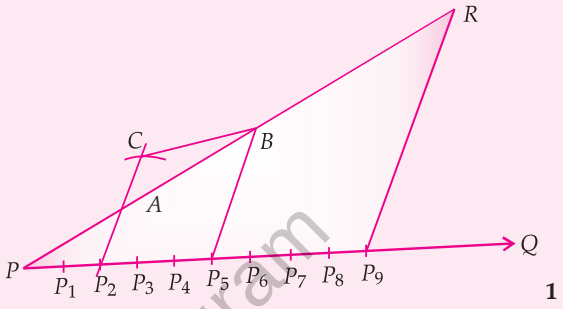
4. Join AB and AC to obtain ΔABC.
5. Below BC make an acute angle $\angle CBX$.
6. Along BX mark off five points B_1, B_2, B_3, B_4, B_5 such that
   $BB_1 = B_1B_2 = B_2B_3 = B_3B_4 = B_4B_5$.
7. Join B_5C
8. From B_3 draw $B_3C' \parallel B_5C$
9. From C', draw $C'A' \parallel CA$ meeting BA at the point A'.
   Hence $A'BC'$ in the required triangle. **1**

Q. 2. Construct a triangle whose perimeter is 13·5 cm and the ratio of the three sides is 2 : 3 : 4.

A [Board Term-2, 2012 Set (1); 2011, Set C1]

Sol. Steps of construction :

1. Draw a line segment PR of length 13·5 cm.
2. At the point P draw a ray PQ making an acute angle RPQ with PR.
3. On PQ mark (2 + 3 + 4) a points P_1, P_2, P_3, P_4, P_5, P_6, P_7, P_8, P_9 such that $PP_1 = P_1P_2 = P_2P_3 = P_3P_4 = P_4P_5 = P_5P_6 = P_6P_7 = P_7P_8 = P_8P_9$.
4. Join P_9R.
5. Through P_2 and P_5 draw lines P_2A and P_5B respectively parallel to P_9R intersecting PR at A and B respectively.
6. With A as centre and radius AP draw an arc. **2**
7. With B as centre and radius BR draw another arc to intersect first arc.
8. Join A to C and B to C.
   ABC is the required triangle.



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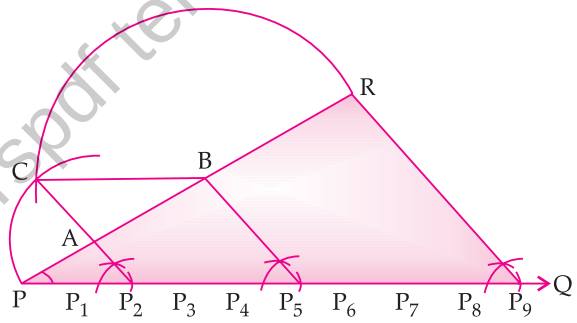
[CBSE Marking Scheme, 2012, 11]

Detailed Answer :



Q. 3. Construct a right-angled triangle whose base is 5 cm and sum of its hypotenuse and other side is 10 cm. Construct another triangle whose sides are 1·4 times the corresponding sides of the previously drawn triangle. Give the justification of the construction.

A [Board Term-2, 2012 Set (38); 2011, Set B1]

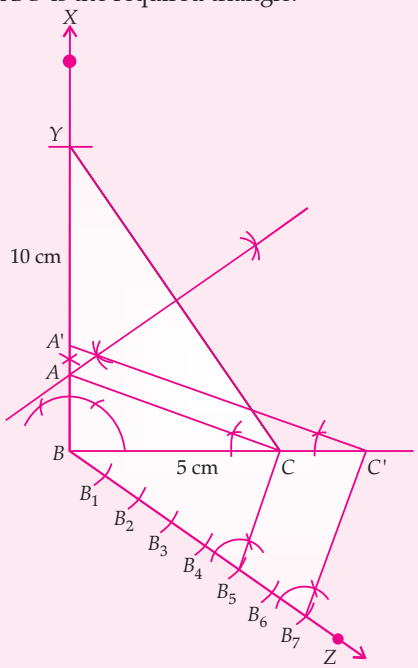
Sol. Let us assume that ΔABC is right-angled at B, with base $BC = 5$ cm and $AC + AB = 10$ cm.

$A\ \Delta A'BC'$ whose sides are $1.4 = \frac{7}{5}$ times of ΔABC,

Steps of construction :

1. Draw a line segment BC of length 5 cm.
2. At B, draw $\angle XBC = 90°$. Taking B as centre and radius as 10 cm, draw an arc that intersects the ray BX at Y.
3. Join CY and draw its perpendicular bisector to intersect BY at A. Join AC.
4. Draw a ray BZ making an acute angle with line segment BC.
5. Locate 7 points B_1, B_2, B_3, B_4, B_5, B_6 and B_7 on BZ such that $BB_1 = B_1B_2 = B_2B_3 = B_3B_4 = B_4B_5 = B_5B_6 = B_6B_7$.
6. Join CB_5 and draw a line $C'B_7$ parallel to CB_5 to intersect extended line segment BC at point C'.

7. Draw a line through C' parallel to AC intersecting the ray BX at A'.
$\Delta A'BC'$ is the required triangle. **1**



Justification : **1**
The construction can be justified by proving that :

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

$$\angle BB_5C = \angle BB_7C'$$
(Corresponding angles)

$$\therefore \quad \Delta BB_5C \sim \Delta BB_7C'$$
(AA similarity criterion)

$$\Rightarrow \quad \frac{BC}{BC'} = \frac{BB_5}{BB_7}$$

$$\frac{BC}{BC'} = \frac{5}{7} \quad ...(ii)$$

On comparing equations (i) and (ii), we obtain

$$\Rightarrow \quad \frac{AB}{A'B} = \frac{BC}{BC'}$$

$$= \frac{AC}{A'C'} = \frac{5}{7}$$

$$\Rightarrow \quad A'B = \frac{5}{7}AB,$$

$$BC' = \frac{5}{7}BC,$$

$$A'C' = \frac{7}{5}AC \quad \textbf{1}$$

[CBSE Marking Scheme, 2012, 11]

Q. 4. Construct a rhombus $ABCD$ in which $AB = 4$ cm and $\angle ABC = 60°$. Divide it into two triangles ABC and ADC. Construct the triangle $AB'C'$ similar to ΔABC with scale factor $\frac{2}{3}$. Draw a line segment $C'D'$ parallel to CD, where D' lies on AD. Is $AB'C'D'$ a rhombus ? Give reasons.

A **[Board Term II, 2012 Set (43); 2011, Set C1]**

Sol. The steps of construction :

1. The rhombus $ABCD$ is drawn in which $AB = 4$ cm and $\angle ABC = 60°$.

2. Join AC. $ABCD$ is divided into two triangles ABC and ADC.

3. Construct triangle $AB'C'$ similar to ABC with scale factor $\frac{2}{3}$.

4. Draw the line segment $C'D'$ parallel to CD.
It can be observed that :

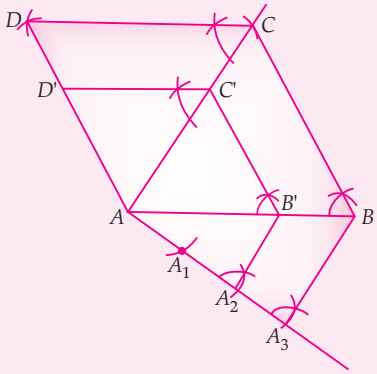
$$\frac{AB'}{AB} = \frac{2}{3} = \frac{AC'}{AC}$$

Also,
$$\frac{AC'}{AC} = \frac{C'D'}{CD}$$

$$= \frac{AD'}{AD} = \frac{2}{3}$$

Therefore, $AB' = B'C' = C'D' = AD' = \frac{2}{3}AB$.

Thus, $AB'C'D'$ is a rhombus. **2**



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[CBSE Marking Scheme, 2012, 11]

Long Answer Type Questions

(4 marks each)

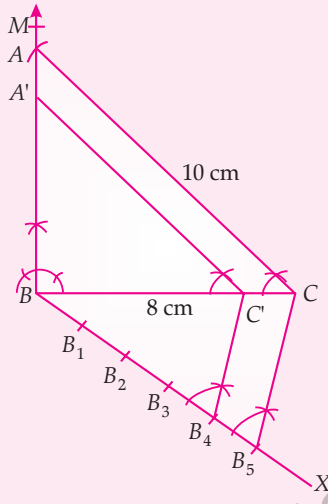
Q. 1. Construct a right triangle whose hypotenuse and one side measures 10 cm and 8 cm respectively. Then construct another triangle whose sides are $\frac{4}{5}$ times the corresponding sides of this triangle.

A **[Board Term-2, 2015]**

Sol. Steps of construction :

1. Draw a line segment $BC = 8$ cm.
2. Construct $AM \perp BC$.
3. Taking C as centre and radius as 10 cm, draw an arc that intersects the ray BM at A.
4. Join CA to obtain ΔABC.
5. Below BC, make an acute angle CBX.
6. Along BX mark off 5 points B_1, B_2, B_3, B_4, B_5 such that $BB_1 = B_1B_2 = B_2B_3 = \ldots\ldots = B_4B_5$.
7. Join B_5C.
8. From B_4, Draw $B_4C' \parallel B_5C$.
9. From the point C' draw $C'A' \parallel CA$ meeting BA at point A'.

Hence $A'BC'$ is the required triangle. **2**



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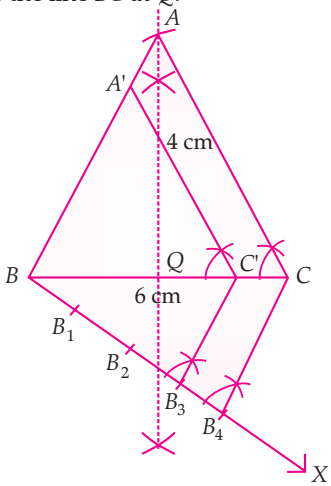
[CBSE Marking Scheme, 2015]

Q. 2. Construct an isosceles triangle whose base is 6 cm and altitude 4 cm. Then construct another triangle with sides are $\frac{3}{4}$ times the corresponding sides of the isosceles triangle.

A **[Delhi CBSE Board Term-2, 2015 (Set II)]**

Sol. Steps of Constructions :

1. Draw a line segment $BC = 6$ cm.
2. Draw a perpendicular bisector of BC which intersects the line BC at Q.



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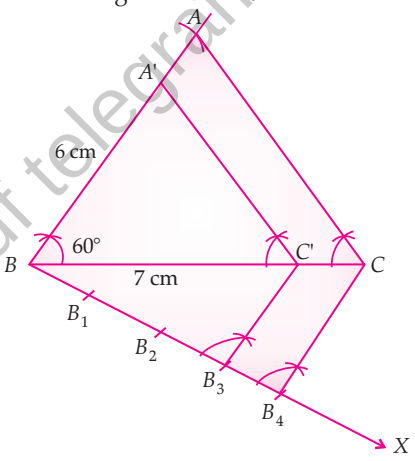
3. Mark A on the line such that $OA = 4$ cm.
4. Join A to B and C.
6. Draw a ray BX making an acute angle with BC.
7. Mark four points B_1, B_2, B_3 and B_4 on the ray BX. Such that $BB_1 = B_1B_2 = B_2B_3 = B_3B_4$.
8. Join B_4C. Draw a line parallel to B_4C through B_3 intersecting line segment BC at C'.
9. Draw $C'A' \,||\, CA$ from point C'

Hence $\Delta A'BC'$ is the required triangle. **2**

Q. 3. Construct a triangle ABC with $BC = 7$ cm, $\angle B = 60°$ and $AB = 6$ cm. Construct another triangle whose sides are $\frac{3}{4}$ times of the corresponding sides of ΔABC. A **[Delhi CBSE Board Term-2, 2015 (Set I)]**

Sol. Steps of construction :

1. Draw a line segment $BC = 7$ cm.



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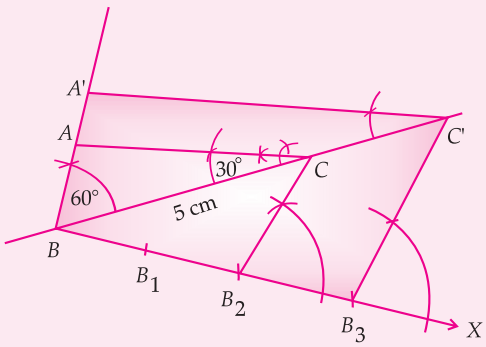
2. At point B draw a line BY making an angle of 60°.
3. With centre B mark an arc A of length 6 cm.
4. Join CA.
5. Draw a ray BX making an acute angle with BC.
6. Locate four points B_1, B_2, B_3 and B_4 on the line segment BX at equal distance.
7. Join B_4C. Draw a parallel line through B_3 to B_4C intersecting line segment BC at C'.
8. Through C' draw a line parallel to AC intersecting line segment AB at A'.

Hence $\Delta A'BC'$ is the required triangle. **2**

Q. 4. Draw triangle ABC such that $BC = 5$ cm, $\angle ABC = 60°$, $\angle ACB = 30°$. Now construct $\Delta A'BC'$ corresponds to ΔABC with $A'B : AB = 3 : 2$.

A **[Board Term-2, 2015]**

Sol.



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Steps of Construction :

1. Draw a line segment BC of length 5 cm.
2. Draw the angles of 60° and 30° on the points B and C respectively. which intersect each other at A.
3. ΔABC is the given triangle.
4. Draw a ray BX making an acute angle with BC.
5. Locate three points B_1, B_2, and B_3 on line segment BX. Such that $BB_1 = B_1B_2 = B_2B_3$.
6. Join B_2C.
7. Draw $B_3C' \parallel B_2C$ to intersect the extended line BC at C'.
8. Through C' draw a line parallel to AC intersecting extended line segment BA at A'.

$\Delta A'BC'$ is the required triangle. **2**

[CBSE Marking Scheme, 2015]

Q. 5. Draw an isosceles triangle ABC in which the base is 8 cm long and its altitude AD through A is 4 cm long. Then draw another triangle whose sides are $\frac{2}{3}$ of the corresponding sides of ΔABC.

A **[Outside Delhi Compt. Set-I 2017; Delhi Compt. Set I 2017]**

Sol. Try yourself, similar to Q.2 in LATQ.

Q. 6. Draw a triangle with sides 4 cm, 5 cm, and 6 cm than construct another triangle whose sides are $\frac{2}{3}$ of the corresponding sides of the first triangle.

A **[Delhi Compt. Set-II 2017]**

Sol. Try yourself, similar to Q.1 in SATQ-I.

Q. 7. Draw a right triangle in which sides (other than hypotenuse) are 8 cm and 6 cm. Then construct another triangle whose sides are $\frac{3}{4}$ times the (corresponding) sides of given triangle.

A **[Delhi Compt. Set-I 2017]**

Sol. Steps of Construction :

1. Draw a line segment $BC = 8$ cm.
2. Draw line segment BX making an angle of 90° at the point B of BC.
3. From B mark an arc on BX at a distance of 6 cm, Let it is A.
4. Join A to C.
5. Making an acute angle draw a line segment BY from B.
6. Mark B_1, B_2, B_3 , B_4 on BY such that $BB_1 = B_1B_2 = B_2B_3 = B_3B_4$.
7. Join B_4 to C.
8. Draw a line segment $B_3C' \parallel$ to B_4C to meet BC at C'.
9. Draw line segment $C'A' \parallel$ to CA to meet AB at A' $A'BC'$ is the required triangle. **2**

Q. 8. Draw a ΔABC in which $BC = 6$ cm, $AB = 5$ cm and $\angle ABC = 60°$. Then construct another triangle whose sides are $\frac{3}{4}$ of the corresponding sides of ΔABC.

A **[CBSE Delhi/OD Set-I 2018]**

[Delhi Compt. Set-I 2017]

Sol. Correct construction of ΔABC **2**

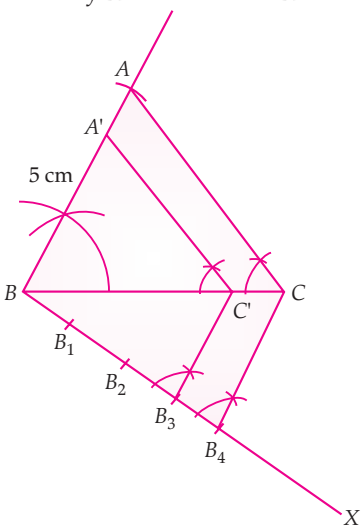
Correct construction of similar to ΔABC **2**

[CBSE Marking Scheme, 2018]

Detailed Answer :

(i) Construct a ΔABC in which $BC = 6$ cm, $AB = 5$ cm and $\angle ABC = 60°$.

(ii) Draw a ray BX such that $\angle CBX$ in acute angle.



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(iii) Locate 4 points B_1, B_2, B_3 and B_4 such that $BB_1 = B_1B_2 = B_2B_3 = B_3B_4$.

(vi) Join B_4C.

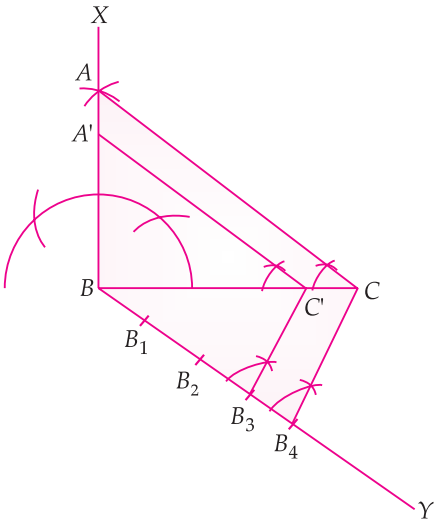
(v) Through B_3 draw a line parallel to B_4C which meet BC at C'.

(vi) Through C' draw a line parallel to AC which meet AB at A'.

(vii) $\Delta A'BC'$ is the required triangle. **2**

Q. 9. Construct a triangle ABC with side $BC = 7$ cm, $\angle B = 45°$, $\angle A = 105°$. Then construct another triangle whose sides are $\frac{3}{4}$ times of the corresponding sides of the ΔABC.

A **[Outside Delhi Set II, 2017]**



2

Sol.

In ΔABC,

$\angle A + \angle B + \angle C = 180°$ — angle sum property.

$105° + 45° + \angle C = 180°$

$\therefore \angle C = 30°$

Steps of construction:

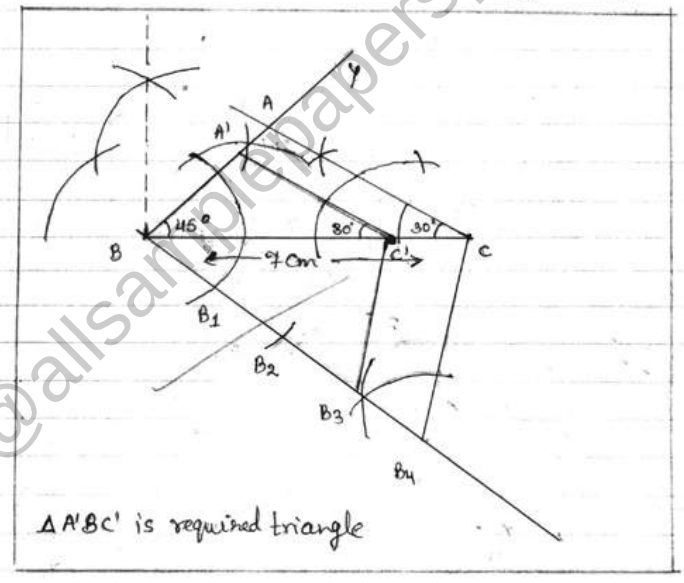
1) Draw $BC = 7$ cm $\angle CBY = 45°$ and $\angle BCZ = 30°$.
Let rays BY and CZ intersect at A. ΔABC is given Δ.

2) From B draw a ray BX below BC making acute angle with BC. Along it mark 4 points B_1, B_2, B_3, B_4 such that $BB_1 = B_1B_2 = \ldots = B_3B_4$.

3) Join B_4C. Make $\angle BB_4C$ at B_3 such that the ray intersects BC at C'. $\therefore \angle BB_4C = \angle BB_3C'$.
So, $B_4C \parallel B_3C'$.

4) From C' make $\angle BC'A' = BCA$ so that $C'A' \parallel CA$.
$\Delta A'BC'$ is the required triangle

Justification: $\angle B = \angle B$ and $\angle BC'A' = \angle BCA$ - construction
$\therefore \Delta A'BC' \sim \Delta ABC$ by AA so, $\frac{A'B}{AB} = \frac{A'C'}{AC} = \frac{BC'}{BC} = \frac{3}{4}$



[Topper Answer 2017] 4

Q. 10. Draw a ΔABC with sides 6 cm, 8 cm and 9 cm and then construct a triangle similar to ΔABC whose sides are $\frac{3}{5}$ of the corresponding sides of ΔABC.

A [CBSE SQP-2018]

Sol. Correct construction of ΔABC **1**
Correct construction of similar triangle. **3**
[CBSE Marking Scheme, 2018]

Detailed Answer :

Steps of Construction :

1. Draw a line segment $BC = 8$ cm.
2. With B as a centre and radius 6 cm, draw an arc.
3. With C as a centre and radius 9 cm, draw an other arc meeting the arc drawn in step 2 at the point A.
4. Join AB and AC to obtain ΔABC.
5. Below BC make an acute angle $\angle CBX$.

6. Along BX mark off five points B_1, B_2, B_3, B_4, B_5 such that

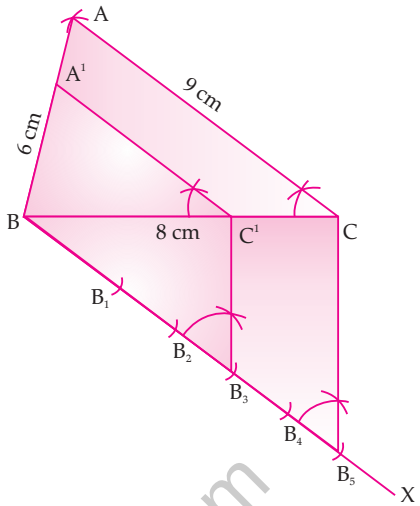
$BB_1 = B_1B_2 = B_2B_3 = B_3B_4 = B_4B_5$.

7. Join B_5C

8. From B_3 draw $B_3C' \parallel B_5C$

9. From C', draw $C'A' \parallel CA$ meeting BA at the point A'.

Hence $A'BC'$ in the required triangle. **4**



1

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