CBSE Class–10 Mathematics

NCERT solution

Chapter - 11

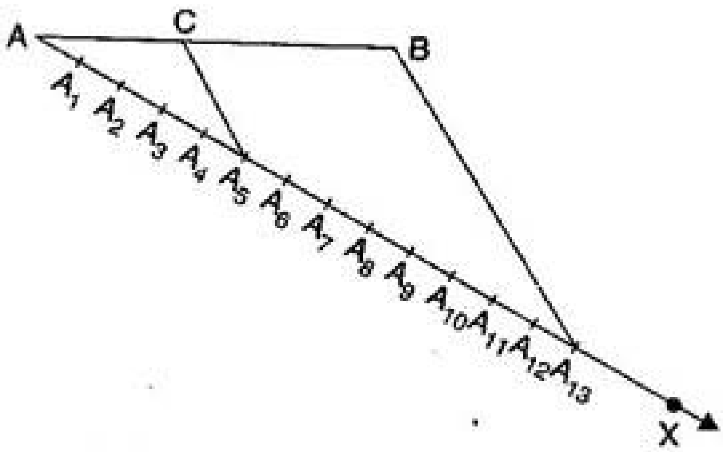
Constructions - Exercise 11.1

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.

Ans. Given: A line segment of length 7.6 cm.

To construct: To divide it in the ratio 5 : 8 and to measure the two parts.



Steps of construction:

(a) From a point A, draw any ray AX, making an acute angle with AB.

(b) Locate 13 (=5 + 8) points $A_1, A_2, A_3, A_4, A_5, A_6, A_7, A_8, A_9, A_{10}, A_{11}, A_{12} and\ A_{13}$ on AX such that

$AA_1 = A_1A_2 = A_2A_3 = A_3A_4 = A_4A_5 = A_5A_6 = A_6A_7 = A_7A_8 = A_8A_9 = A_9A_{10} = A_{10}A_{11} = A_{11}A_{12} = A_{12}A_{13}$

(c) Join BA_{13}.

(d) Through the point A_5, draw a line parallel to $A_{13}B$ intersecting AB at the point C.

Then, AC : CB = 5 : 8

On measurement we get, AC = 3.1 cm and CB = 4.5 cm

Justification:

$\because A_5C \parallel A_{13}B$ [By construction]

$\therefore \dfrac{AA_5}{A_5A_{13}} = \dfrac{AC}{CB}$

[By Basic Proportionality Theorem]

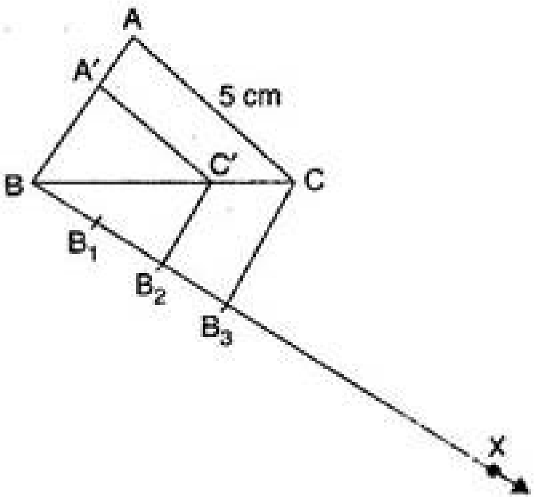
But $\dfrac{AA_5}{A_5A_{13}} = \dfrac{5}{8}$ [By construction]

Therefore, $\dfrac{AC}{CB} = \dfrac{5}{8}$

$\Rightarrow$ AC : CB = 5 : 8

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.

Ans. To construct: To 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.



Steps of construction:

(a) Draw a triangle ABC with sides AB = 4 cm, AC = 5 cm and BC = 6 cm.
(b) From point B, draw any ray BX, making an acute angle with BC on the side opposite to the

vertex A.

(c) Locate 3 points $B_1, B_2 and B_3$ on BX such that $BB_1 = B_1B_2 = B_2B_3$.

(d) Join B_3C and draw a line through the point B_2, draw a line parallel to B_3C intersecting BC at the point C'.

(e) Draw a line through C' parallel to the line CA to intersect BA at A'.

Then, A'BC' is the required triangle.

Justification:

$\because B_3C \parallel B_2C'$ [By construction]

$$\therefore \frac{BB_2}{B_2B_3} = \frac{BC'}{C'C}$$

[By Basic Proportionality Theorem]

But $\frac{BB_2}{B_2B_3} = \frac{2}{1}$ [By construction]

Therefore, $\frac{BC'}{C'C} = \frac{2}{1}$

$$\Rightarrow \frac{C'C}{BC'} = \frac{1}{2}$$

$$\Rightarrow \frac{C'C}{BC'} + 1 = \frac{1}{2} + 1$$

$$\Rightarrow \frac{C'C + BC'}{BC'} = \frac{1+2}{2}$$

$$\Rightarrow \frac{BC}{BC'} = \frac{3}{2}$$

$$\Rightarrow \frac{BC'}{BC} = \frac{2}{3} \quad \text{.........(i)}$$

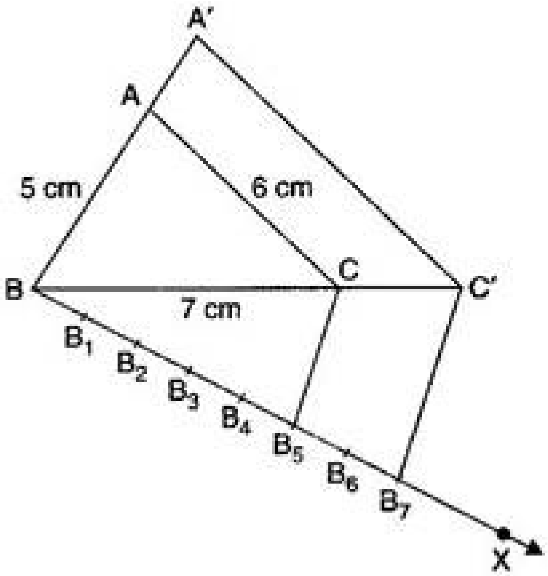
$\because$ CA || C'A' [By construction]

$\therefore$ $\triangle$BC'A' ~ $\triangle$BCA [AA similarity]

$\therefore \dfrac{AB'}{AB} = \dfrac{A'C'}{AC} = \dfrac{BC'}{BC} = \dfrac{2}{3}$ [From eq. (i)]

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

Ans. To construct: To construct a triangle of sides 5 cm, 6 cm and 7 cm and then a triangle similar to it whose sides are $\frac{7}{5}$ of the corresponding sides of the first triangle.



Steps of construction:

(a) Draw a triangle ABC with sides AB = 5 cm, AC = 6 cm and BC = 7 cm.

(b) From the point B, draw any ray BX, making an acute angle with BC on the side opposite to the vertex A.

(c) Locate 7 points $B_1, B_2, B_3, B_4, B_5, B_6 and\ B_7$ on BX such that

$BB_1 = B_1B_2 = B_2B_3 = B_3B_4 = B_4B_5 = B_5B_6 = B_6B_7$.

(d) Join B_5C and draw a line through the point B_7, draw a line parallel to B_5C intersecting BC at the point C'.

(e) Draw a line through C’ parallel to the line CA to intersect BA at A’.

Then, A’BC’ is the required triangle.

Justification:

∵ C’A’ || CA [By construction]

∴ Δ ABC ~ Δ A’BC’ [AA similarity]

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

[By Basic Proportionality Theorem]

∵ $B_7C' \parallel B_5C$ [By construction]

∴ $\Delta BB_7C' \sim \Delta BB_5C$ [AA similarity]

But $\frac{BB_5}{BB_7} = \frac{5}{7}$ [By construction]

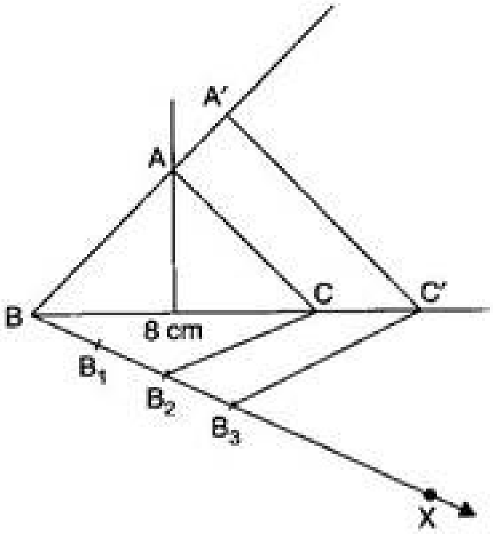
Therefore, $\frac{BC}{BC'} = \frac{5}{7}$

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

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

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.

Ans. To construct: To construct an isosceles triangle whose base is 8 cm and altitude 4 cm and then a triangle similar to it whose sides are $1\frac{1}{2}\left(\text{or } \frac{3}{2}\right)$ of the corresponding sides of the first triangle.



Steps of construction:

(a) Draw BC = 8 cm

(b) Draw perpendicular bisector of BC. Let it meets BC at D.

(c) Mark a point A on the perpendicular bisector such that AD = 4 cm.

(d) Join AB and AC. Thus ΔABC is the required isosceles triangle.

(e) From the point B, draw a ray BX, making an acute angle with BC on the side opposite to the vertex A.

(f) Locate 3 points $B_1, B_2 and\ B_3$ on BX such that $BB_1 = B_1B_2 = B_2B_3$.

(g) Join B_2C and draw a line through the point B_3, draw a line parallel to B_2C intersecting BC at the point C'.

(h) Draw a line through C' parallel to the line CA to intersect BA at A'.

Then, A'BC' is the required triangle.

Justification:

$\because$ C'A' || CA [By construction]

$\therefore$ ΔABC ~ ΔA'BC' [AA similarity]

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

[By Basic Proportionality Theorem]

$\because B_3C' \| B_2C$ [By construction]

$\therefore \Delta BB_3C' \sim \Delta BB_2C$ [AA similarity]

But $\dfrac{BB_3}{BB_2} = \dfrac{3}{2}$ [By construction]

Therefore,

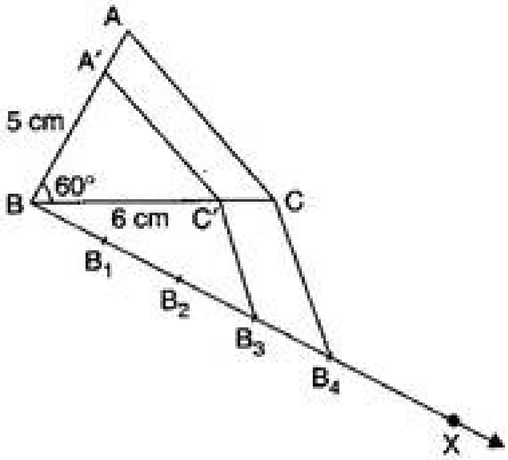
$$\Rightarrow \frac{BC'}{BC} = \frac{3}{2}$$

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

Hence, we get the new triangle similar to the given triangle whose sides are equal to $\frac{3}{2}$ i.e., $1\frac{1}{2}$ times of corresponding sides of triangle ABC.

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

Ans. To construct: To construct a triangle ABC with side BC = 6 cm, AB = 5 cm and $\angle$ ABC = 60° and then a triangle similar to it whose sides are $\dfrac{3}{4}$ of the corresponding sides of the first triangle ABC.



Steps of construction:

(a) Draw a triangle ABC with side BC = 6 cm, AB = 5 cm and $\angle$ ABC = 60°.
(b) From the point B, draw a ray BX, making an acute angle with BC on the side opposite to the vertex A.
(c) Locate 4 points $B_1, B_2, B_3 and\ B_4$ on BX such that $BB_1 = B_1B_2 = B_2B_3 = B_3B_4$.
(d) Join B_4C and draw a line through the point B_3, draw a line parallel to B_4C intersecting BC at the point C'.
(e) Draw a line through C' parallel to the line CA to intersect BA at A'.

Then, A'BC' is the required triangle.

Justification:

$\because B_4C \parallel B_3C'$ [By construction]

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

[By Basic Proportionality Theorem]

But $\frac{BB_3}{BB_4} = \frac{3}{4}$ [By construction]

Therefore, $\frac{BC'}{BC} = \frac{3}{4}$ ....(i)

$\because$ CA $\parallel$ C'A' [By construction]

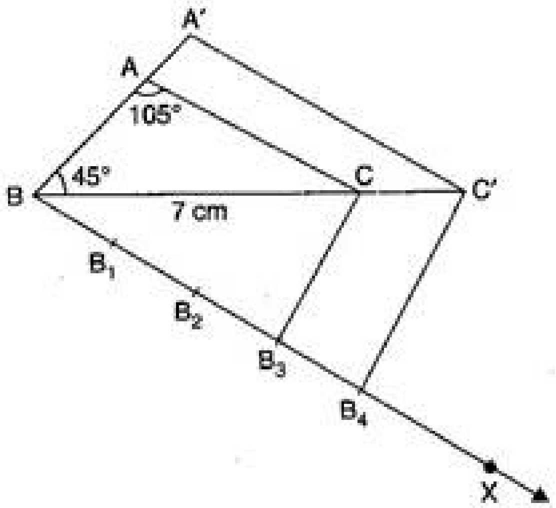
$\therefore$ Δ BC'A' $\sim$ Δ BCA [AA similarity]

$\therefore \frac{AB'}{AB} = \frac{A'C'}{AC} = \frac{BC'}{BC} = \frac{3}{4}$ [From eq. (i)]

Hence, we get the new triangle similar to the given triangle whose sides are equal to $\frac{3}{4}$ th of corresponding sides of triangle ABC.

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

Ans. To construct: To construct a triangle ABC with side BC = 7 cm, $\angle$ B = 45° and $\angle$ C = 105° and then a triangle similar to it whose sides are $\frac{4}{3}$ of the corresponding sides of the first triangle ABC.



Steps of construction:

(a) Draw a triangle ABC with side BC = 7 cm, $\angle$ B = 45° and $\angle$ C = 105°.
(b) From the point B, draw a ray BX, making an acute angle with BC on the side opposite to the vertex A.
(c) Locate 4 points $B_1, B_2, B_3 and\ B_4$ on BX such that $BB_1 = B_1B_2 = B_2B_3 = B_3B_4$.
(d) Join B_3C and draw a line through the point B_4, draw a line parallel to B_3C intersecting BC at the point C'.
(e) Draw a line through C' parallel to the line CA to intersect BA at A'.

Then, A'BC' is the required triangle.

Justification:

$\because B_4C' \parallel B_3C$ [By construction]

$\therefore \Delta BB_4C' \sim \Delta BB_3C$ [AA similarity]

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

[By Basic Proportionality Theorem]

But $\frac{BB_4}{BB_3} = \frac{4}{3}$ [By construction]

Therefore, $\frac{BC'}{BC} = \frac{4}{3}$ ....(i)

$\because$ CA $\|$ C'A' [By construction]

$\therefore$ ΔBC'A' $\sim$ ΔBCA [AA similarity]

$\therefore \frac{A'B}{AB} = \frac{A'C'}{AC} = \frac{BC'}{BC} = \frac{4}{3}$ [From eq. (i)]

Hence, we get the new triangle similar to the given triangle whose sides are equal to $\frac{4}{3}$ times of corresponding sides of triangle ABC.

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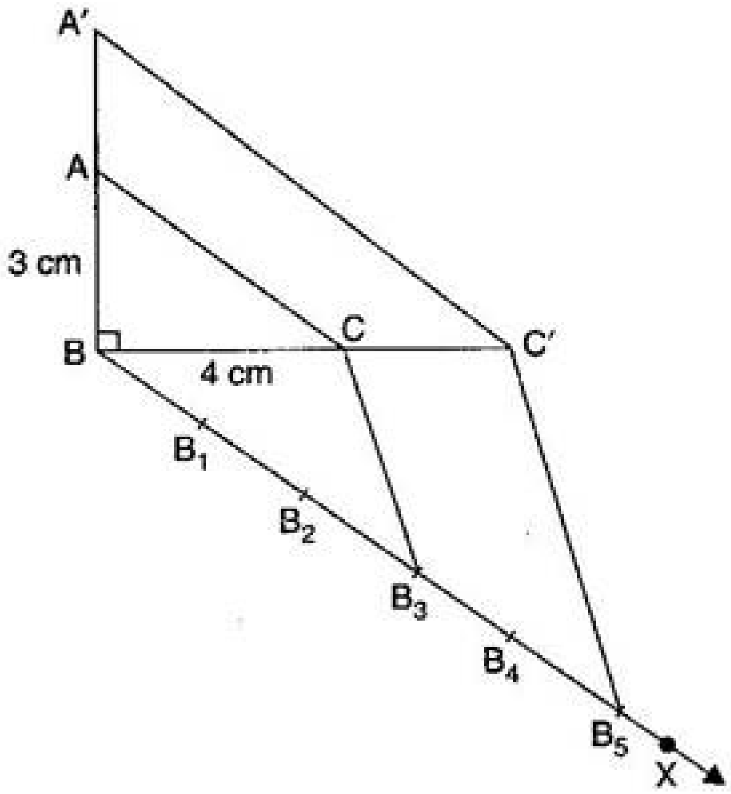
7. Draw a right triangle in which the sides (other than hypotenuse) are of lengths 4 cm and 3 cm. Then construct another triangle whose sides are $\frac{5}{3}$ times the corresponding sides of the given triangle.

Ans. To construct: To construct a right triangle in which sides (other than hypotenuse) are of lengths 4 cm and 3 cm and then a triangle similar to it whose sides are $\frac{5}{3}$ of the corresponding sides of the first triangle ABC.



Steps of construction:

(a) Draw a right triangle in which sides (other than hypotenuse) are of lengths 4 cm and 3 cm, right angled at B.
(b) From the point B, draw a ray BX, making an acute angle with BC on the side opposite to the vertex A.
(c) Locate 5 points $B_1, B_2, B_3, B_4 and\ B_5$ on BX such that
$BB_1 = B_1B_2 = B_2B_3 = B_3B_4 = B_4B_5$.
(d) Join B_3C and draw a line through the point B_5, draw a line parallel to B_3C intersecting BC at the point C'.
(e) Draw a line through C' parallel to the line CA to intersect BA at A'.

Then, A'BC' is the required triangle.

Justification:

$\because B_5C' \parallel B_3C$ [By construction]

$\therefore \Delta BB_5C' \sim \Delta BB_3C$ [AA similarity]

$\therefore \dfrac{BB_5}{BB_3} = \dfrac{BC'}{BC}$

[By Basic Proportionality Theorem]

But $\dfrac{BB_5}{BB_3} = \dfrac{5}{3}$ [By construction]

Therefore, $\dfrac{BC'}{BC} = \dfrac{5}{3}$ ....(i)

$\because$ CA $\|$ C'A' [By construction]

$\therefore$ ΔBC'A' $\sim$ ΔBCA [AA similarity]

$\therefore \dfrac{A'B}{AB} = \dfrac{A'C'}{AC} = \dfrac{BC'}{BC} = \dfrac{5}{3}$ [From eq. (i)]

Hence, we get the new triangle similar to the given triangle whose sides are equal to $\frac{5}{3}$ times of corresponding sides of triangle ABC.