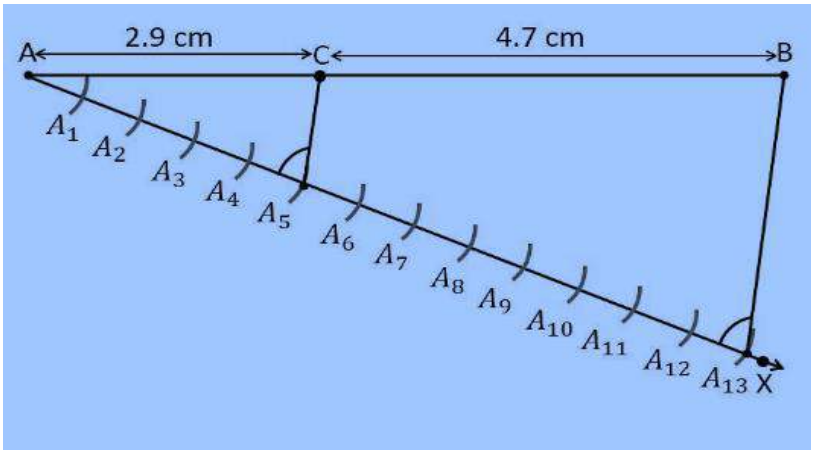
Exercise 11.1 Page: 220

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.

Construction Procedure:
A line segment with a measure of 7.6 cm length is divided in the ratio of 5:8 as follows.

1. Draw line segment AB with the length measure of 7.6 cm
2. Draw a ray AX that makes an acute angle with line segment AB.
3. Locate the points i.e.,13 (= 5+8) points, such as A_1, A_2, A_3, A_4 …….. A_{13}, on the ray AX such that it becomes $AA_1 = A_1A_2 = A_2A_3$ and so on.
4. Join the line segment and the ray, BA_{13}.
5. Through the point A_5, draw a line parallel to BA_{13} which makes an angle equal to $\angle AA_{13}B$
6. The point A_5 which intersects the line AB at point C.
7. C is the point divides line segment AB of 7.6 cm in the required ratio of 5:8.
8. Now, measure the lengths of the line AC and CB. It comes out to the measure of 2.9 cm and 4.7 cm respectively.

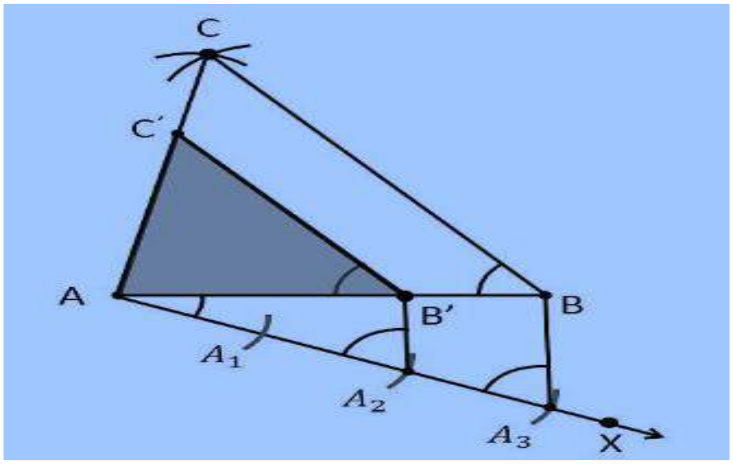


Justification:
The construction of the given problem can be justified by proving that
AC/CB = 5/ 8
By construction, we have $A_5C \parallel A_{13}B$. From Basic proportionality theorem for the triangle $AA_{13}B$, we get
$AC/CB = AA_5/A_5A_{13}$….. (1)
From the figure constructed, it is observed that AA_5 and A_5A_{13} contain 5 and 8 equal divisions of line segments respectively.
Therefore, it becomes
$AA_5/A_5A_{13} = 5/8$… (2)
Compare the equations (1) and (2), we obtain
AC/CB = 5/ 8
Hence, Justified.

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

Construction Procedure:

1. Draw a line segment AB which measures 4 cm, i.e., AB = 4 cm.
2. Take the point A as centre, and draw an arc of radius 5 cm.
3. Similarly, take the point B as its centre, and draw an arc of radius 6 cm .
4. The arcs drawn will intersect each other at point C.
5. Now, we obtained AC = 5 cm and BC = 6 cm and therefore ΔABC is the required triangle.
6. Draw a ray AX which makes an acute angle with the line segment AB on the opposite side of vertex C.
7. Locate 3 points such as A_1, A_2, A_3 (as 3 is greater between 2 and 3) on line AX such that it becomes $AA_1 = A_1A_2 = A_2A_3$.
8. Join the point BA_3 and draw a line through A_2which is parallel to the line BA_3 that intersect AB at point B'.
9. Through the point B', draw a line parallel to the line BC that intersect the line AC at C'.
10. Therefore, ΔAB'C' is the required triangle.



Justification:

The construction of the given problem can be justified by proving that

AB' = (2/3)AB

B'C' = (2/3)BC

AC'= (2/3)AC

From the construction, we get B'C' || BC

∴ ∠AB'C' = ∠ABC (Corresponding angles)

In ΔAB'C' and ΔABC,

∠ABC = ∠AB'C (Proved above)

∠BAC = ∠B'AC' (Common)

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

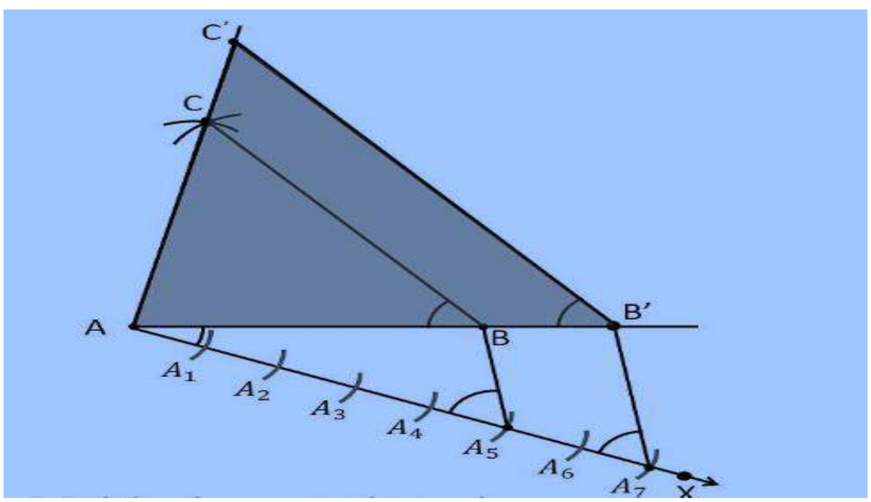
Therefore, AB'/AB = B'C'/BC= AC'/AC …. (1)

In ΔAAB' and ΔAAB,

$\angle A_2AB' = \angle A_3AB$ (Common)
From the corresponding angles, we get,
$\angle AA_2B' = \angle AA_3B$
Therefore, from the AA similarity criterion, we obtain
$\Delta AA_2B'$ and AA_3B
So, $AB'/AB = AA_2/AA_3$
Therefore, $AB'/AB = 2/3$ ……. (2)
From the equations (1) and (2), we get
$AB'/AB = B'C'/BC = AC'/AC = 2/3$
This can be written as
$AB' = (2/3)AB$
$B'C' = (2/3)BC$
$AC' = (2/3)AC$
Hence, justified.

3. Construct a triangle with sides 5 cm, 6 cm and 7 cm and then another triangle whose sides are 7/5 of the corresponding sides of the first triangle

Construction Procedure:
1. Draw a line segment AB =5 cm.
2. Take A and B as centre, and draw the arcs of radius 6 cm and 7 cm respectively.
3. These arcs will intersect each other at point C and therefore ΔABC is the required triangle with the length of sides as 5 cm, 6 cm, and 7 cm respectively.
4. Draw a ray AX which makes an acute angle with the line segment AB on the opposite side of vertex C.
5. Locate the 7 points such as A_1, A_2, A_3, A_4, A_5, A_6, A_7 (as 7 is greater between 5 and 7), on line AX such that it becomes $AA_1 = A_1A_2 = A_2A_3 = A_3A_4 = A_4A_5 = A_5A_6 = A_6A_7$
6. Join the points BA_5 and draw a line from A_7 to BA_5 which is parallel to the line BA_5 where it intersects the extended line segment AB at point B'.
7. Now, draw a line from B' the extended line segment AC at C' which is parallel to the line BC and it intersects to make a triangle.
8. Therefore, ΔAB'C' is the required triangle.



Justification:

The construction of the given problem can be justified by proving that

AB' = (7/5)AB

B'C' = (7/5)BC

AC'= (7/5)AC

From the construction, we get B'C' || BC

∴ ∠AB'C' = ∠ABC (Corresponding angles)

In ΔAB'C' and ΔABC,

∠ABC = ∠AB'C (Proved above)

∠BAC = ∠B'AC' (Common)

∴ ΔAB'C' ∼ ΔABC (From AA similarity criterion)

Therefore, AB'/AB = B'C'/BC= AC'/AC …. (1)

In $\Delta AA_7B'$ and ΔAA_5B,

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

From the corresponding angles, we get,

$\angle A\ A_7B' = \angle A\ A_5B$

Therefore, from the AA similarity criterion, we obtain

$\Delta A\ A_2B'$ and $A\ A_3B$

So, $AB'/AB = AA_5/AA_7$

Therefore, AB /AB' = 5/7 ……. (2)

From the equations (1) and (2), we get

AB'/AB = B'C'/BC = AC'/ AC = 7/5

This can be written as

AB' = (7/5)AB

B'C' = (7/5)BC

AC'= (7/5)AC

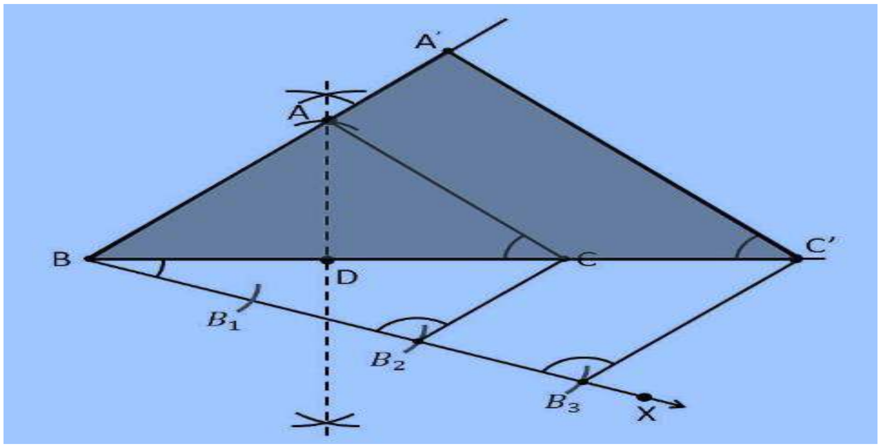
Hence, justified.

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

Construction Procedure:

1. Draw a line segment BC with the measure of 8 cm.
2. Now draw the perpendicular bisector of the line segment BC and intersect at the point D
3. Take the point D as centre and draw an arc with the radius of 4 cm which intersect the perpendicular bisector at the point A
4. Now join the lines AB and AC and the triangle is the required triangle.
5. Draw a ray BX which makes an acute angle with the line BC on the side opposite to the vertex A.
6. Locate the 3 points B_1, B_2 and B_3 on the ray BX such that $BB_1 = B_1B_2 = B_2B_3$

9. Join the points B_2C and draw a line from B_3 which is parallel to the line B_2C where it intersect the extended line segment BC at point C'.
10. Now, draw a line from C' the extended line segment AC at A' which is parallel to the line AC and it intersects to make a triangle.
11. Therefore, ΔA'BC' is the required triangle.



Justification:

The construction of the given problem can be justified by proving that

A'B = (3/2)AB

BC' = (3/2)BC

A'C'= (3/2)AC

From the construction, we get A'C' || AC

∴ ∠ A'C'B = ∠ACB (Corresponding angles)

In ΔA'BC' and ΔABC,

∠B = ∠B (common)

∠A'BC' = ∠ACB

∴ ΔA'BC' ∼ ΔABC (From AA similarity criterion)

Therefore, A'B/AB = BC'/BC= A'C'/AC

Since the corresponding sides of the similar triangle are in the same ratio, it becomes

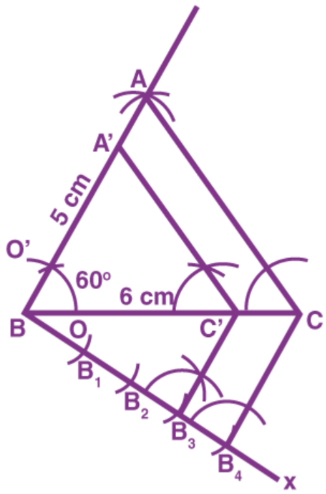
A'B/AB = BC'/BC= A'C'/AC = 3/2

Hence, justified.

5. Draw a triangle ABC with side BC = 6 cm, AB = 5 cm and ∠ABC = 60°. Then construct a triangle whose sides are 3/4 of the corresponding sides of the triangle ABC.

Construction Procedure:

1. Draw a ΔABC with base side BC = 6 cm, and AB = 5 cm and ∠ABC = 60°.
2. Draw a ray BX which makes an acute angle with BC on the opposite side of vertex A.
3. Locate 4 points (as 4 is greater in 3 and 4), such as B_1, B_2, B_3, B_4, on line segment BX.
4. Join the points B_4C and also draw a line through B_3, parallel to B_4C intersecting the line segment BC at C'.
5. Draw a line through C' parallel to the line AC which intersects the line AB at A'.
6. Therefore, ΔA'BC' is the required triangle



Justification:

The construction of the given problem can be justified by proving that
Since the scale factor is 3/4 , we need to prove
A'B = (3/4)AB
BC' = (3/4)BC
A'C'= (3/4)AC
From the construction, we get A'C' ∥ AC
In ΔA'BC' and ΔABC,
∴ ∠ A'C'B = ∠ACB (Corresponding angles)
∠B = ∠B (common)
∴ ΔA'BC' ~ ΔABC (From AA similarity criterion)
Since the corresponding sides of the similar triangle are in the same ratio, it becomes
Therefore, A'B/AB = BC'/BC= A'C'/AC
So, it becomes A'B/AB = BC'/BC= A'C'/AC = 3/4
Hence, justified.

6. Draw a triangle ABC with side BC = 7 cm, ∠ B = 45°, ∠ A = 105°. Then, construct a triangle whose sides are 4/3 times the corresponding sides of Δ ABC.

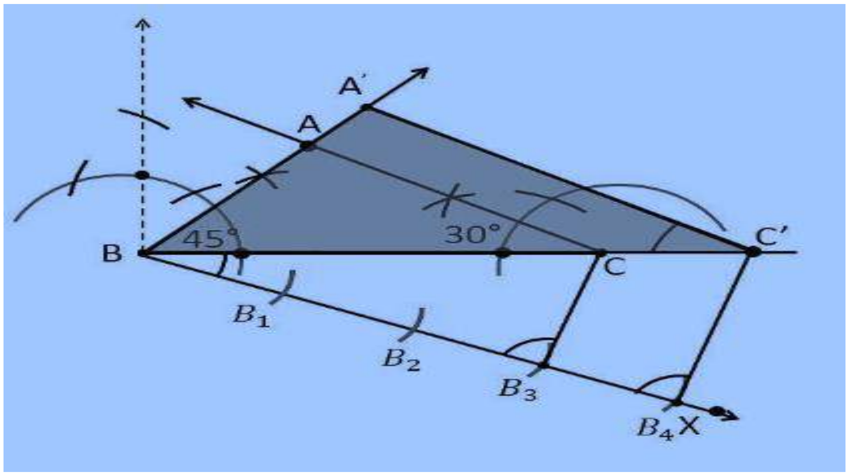
To find ∠C:

Given:
∠B = 45°, ∠A = 105°
We know that,
Sum of all interior angles in a triangle is 180°.
∠A+∠B +∠C = 180°
105°+45°+∠C = 180°
$\angle C = 180° - 150°$
$\angle C = 30°$
So, from the property of triangle, we get $\angle C = 30°$

Construction Procedure:

The required triangle can be drawn as follows.

1. Draw a ΔABC with side measures of base BC = 7 cm, ∠B = 45°, and ∠C = 30°.
2. Draw a ray BX makes an acute angle with BC on the opposite side of vertex A.
3. Locate 4 points (as 4 is greater in 4 and 3), such as B_1, B_2, B_3, B_4, on the ray BX.
4. Join the points B_3C.
5. Draw a line through B_4 parallel to B_3C which intersects the extended line BC at C'.
6. Through C', draw a line parallel to the line AC that intersects the extended line segment at C'.
7. Therefore, ΔA'BC' is the required triangle.



Justification:

The construction of the given problem can be justified by proving that

Since the scale factor is 4/3, we need to prove

A'B = (4/3)AB

BC' = (4/3)BC

A'C'= (4/3)AC

From the construction, we get A'C' ∥ AC

In ΔA'BC' and ΔABC,

∴ ∠A'C'B = ∠ACB (Corresponding angles)

∠B = ∠B (common)

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

Since the corresponding sides of the similar triangle are in the same ratio, it becomes

Therefore, A'B/AB = BC'/BC= A'C'/AC

So, it becomes A'B/AB = BC'/BC= A'C'/AC = 4/3

Hence, justified.

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 5/3 times the corresponding sides of the given triangle.

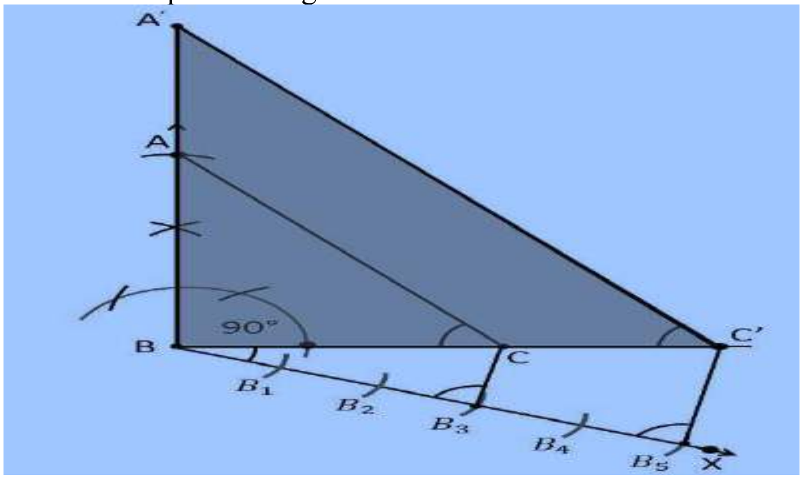
Given:

The sides other than hypotenuse are of lengths 4cm and 3cm. It defines that the sides are perpendicular to each other

Construction Procedure:

The required triangle can be drawn as follows.

1. Draw a line segment BC =3 cm.
2. Now measure and draw angle 90°
3. Take B as centre and draw an arc with the radius of 4 cm and intersects the ray at the point B.
4. Now, join the lines AC and the triangle ABC is the required triangle.
5. Draw a ray BX makes an acute angle with BC on the opposite side of vertex A.
6. Locate 5 such as B_1, B_2, B_3, B_4, on the ray BX such that such that $BB_1 = B_1B_2 = B_2B_3 = B_3B_4 = B_4B_5$
7. Join the points B_3C.
8. Draw a line through B_5 parallel to B_3C which intersects the extended line BC at C'.
9. Through C', draw a line parallel to the line AC that intersects the extended line AB at A'.
10. Therefore, ΔA'BC' is the required triangle.



Justification:

The construction of the given problem can be justified by proving that

Since the scale factor is 5/3, we need to prove

A'B = (5/3)AB

BC' = (5/3)BC

A'C'= (5/3)AC

From the construction, we get A'C' || AC

In ΔA'BC' and ΔABC,

∴ ∠ A'C'B = ∠ACB (Corresponding angles)

∠B = ∠B (common)

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

Since the corresponding sides of the similar triangle are in the same ratio, it becomes

Therefore, A'B/AB = BC'/BC= A'C'/AC

So, it becomes A'B/AB = BC'/BC= A'C'/AC = 5/3

Hence, justified.