

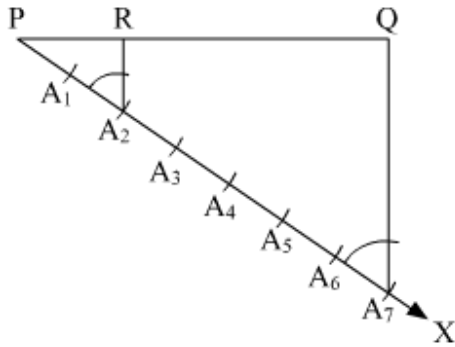
Constructions

- **Division of a line segment in a given ratio** vertical-align: middle;

Example:

Draw $\overline{PQ} = 9 \text{ cm}$ and divide it in the ratio 2:5. Justify your construction.

Solution:



Steps of construction

Draw $\overline{PQ} = 9 \text{ cm}$

Draw a ray \overrightarrow{PX} , making an acute angle with PQ.

Mark 7 (= 2 + 5) points $A_1, A_2, A_3 \dots A_7$ along PX such that

$PA_1 = A_1A_2 = A_2A_3 = A_3A_4 = A_4A_5 = A_5A_6 = A_6A_7$

Join QA_7

Through the point A_2 , draw a line parallel to A_7Q by making an angle equal to $\angle PA_7Q$ at A_2 , intersecting PQ at point R.

$PR:RQ = 2:5$

Justification:

We have $A_2R \parallel A_7Q$

$$\therefore \frac{PA_2}{A_2A_7} = \frac{PR}{RQ} \quad [\text{by basic proportionality theorem}]$$

$$\text{But, } \frac{PA_2}{A_2A_7} = \frac{2}{5} \quad [\text{by construction}]$$

$$\therefore \frac{PR}{RQ} = \frac{2}{5}$$

$$\Rightarrow PR : RQ = 2 : 5$$

- **Construction of a triangle similar to a given triangle as per the given scale factor**

Case I: Scale factor less than 1

Example:

Draw a $\triangle ABC$ with sides $BC = 8$ cm, $AC = 7$ cm, and $\angle B = 70^\circ$. Then, construct a similar triangle whose sides are $\frac{1}{5}$ th of the corresponding sides of $\triangle ABC$.

Justify your construction.

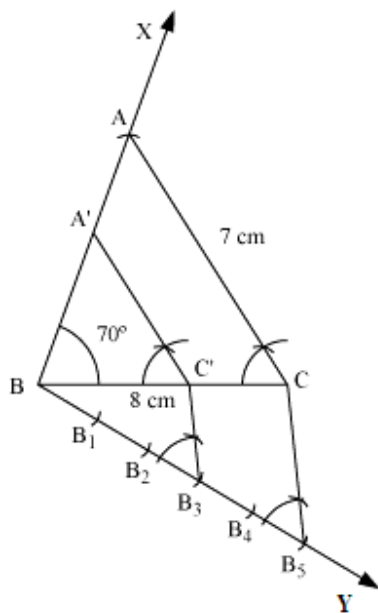
Solution:

Steps of construction:

Draw $BC = 8$ cm

At B , draw $\angle XBC = 70^\circ$

With C as centre and radius 7 cm, draw an arc intersecting BX at A .



Join AB , and $\triangle ABC$ is thus obtained.

Draw a ray $BY \rightarrow$, making an acute angle with BC .

Mark 5 points, B_1, B_2, B_3, B_4, B_5 , along BY such that

$BB_1 = B_1B_2 = B_2B_3 = B_3B_4 = B_4B_5$

Join CB_5

Through the point B_3 , draw a line parallel to B_5C by making an angle equal to $\angle BB_5C$, intersecting BC at C' .

Through the point C' , draw a line parallel to AC , intersecting BA at A' .

Thus, $\triangle A'BC'$ is the required triangle.

Justification:

By construction, we have

Now, in $\triangle ABC$,

Since, $AC \parallel A'C'$, so

$$\begin{aligned}\frac{BC'}{CC'} &= \frac{3}{2} \Rightarrow \frac{CC'}{BC'} = \frac{2}{3} \\ \therefore 1 + \frac{CC'}{BC'} &= 1 + \frac{2}{3} \\ \Rightarrow \frac{BC' + CC'}{BC'} &= \frac{5}{3} \\ \Rightarrow \frac{BC}{BC'} &= \frac{5}{3} \Rightarrow \frac{BC'}{BC} = \frac{3}{5}\end{aligned}$$

$\therefore \triangle A'BC' \sim \triangle ABC$

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

Case II: Scale factor greater than 1

Example:

Construct an isosceles triangle with base 5 cm and equal sides of 6 cm.

Then, construct another triangle whose sides are $\frac{3}{5}$ rd of the corresponding sides of the first triangle.

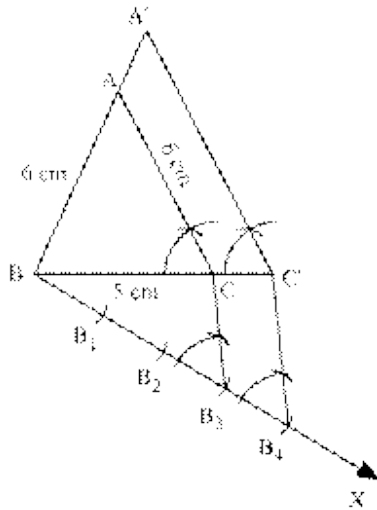
Solution:

Steps of construction:

Draw $BC = 5$ cm

With B and C as the centre and radius 6 cm, draw arcs on the same side of BC, intersecting at A.

Join AB and AC to get the required $\triangle ABC$.



Draw a ray \overrightarrow{BX} , making an acute angle with BC on the side opposite to the vertex A.

Mark 4 points B_1, B_2, B_3, B_4 , along BX such that $BB_1 = B_1B_2 = B_2B_3 = B_3B_4$

Join B_3C . Draw a line through B_4 parallel to B_3C , making an angle equal to $\angle BB_3C$, intersecting the extended line segment BC at C' .

Through point C' , draw a line parallel to CA, intersecting extended BA at A' .

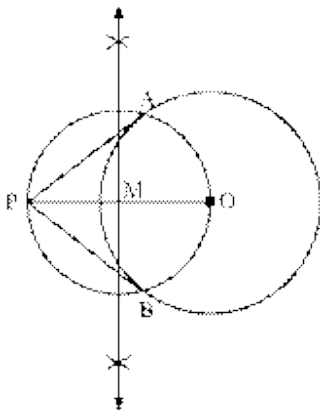
The resulting $\Delta A'BC'$ is the required triangle.

- **Construction of tangents to a circle**

Example:

Draw a circle of radius 3 cm. From a point 5 cm away from its centre, construct a pair of tangents to the circle and measure their lengths.

Solution:



Steps of construction:

- 1.
- 1.

1. Draw a circle with centre O and radius 3 cm. Take a point P such that $OP = 5$ cm, and then join OP.
2. Draw the perpendicular bisector of OP. Let M be the mid point of OP.
3. With M as the centre and OM as the radius, draw a circle. Let it intersect the previously drawn circle at A and B.
4. Join PA and PB. Therefore, PA and PB are the required tangents. It can be observed that $PA = PB = 4$ cm.