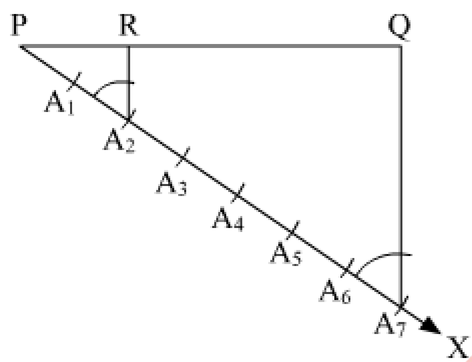
10th Standard Maths

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 $\overline{PQ} = 9$ cm
  Draw a ray $\overrightarrow{PX}$, making an acute angle with PQ.
  Mark 7 (= 2 + 5) points $A_1, A_2, A_3 \ldots A_7$ 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 ΔABC with sides BC = 8 cm, AC = 7 cm, and ÐB = 70°. Then, construct a similar triangle whose sides are 35th of the corresponding sides of ΔABC.

Justify your construction.

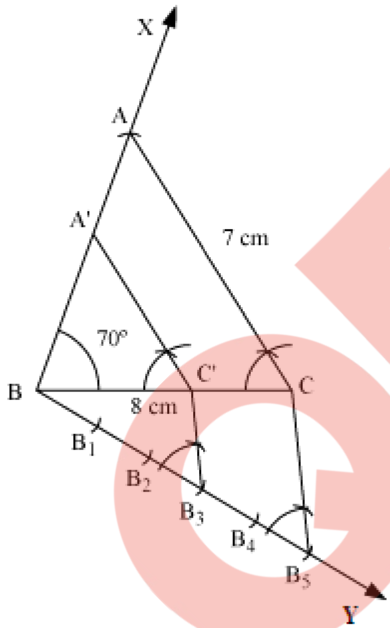
Solution:

Steps of construction:

Draw BC = 8 cm

At B, draw ∠XBC = 70°

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



Join AB, and DABC is thus obtained.

Draw a ray BY→ , 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, ΔA´BC´ is the required triangle.

Justification:

By construction, we have

Now, in ΔABC,

Since, AC || A'C' , so

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

$$\therefore 1+\frac{C'C}{BC'}=1+\frac{2}{3}$$

$$\Rightarrow\frac{BC'+C'C}{BC'}=\frac{5}{3}$$

$$\Rightarrow\frac{BC}{BC'}=\frac{5}{3}\Rightarrow\frac{BC'}{BC}=\frac{3}{5}$$

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

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

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 43rdof the corresponding sides of the first triangle.

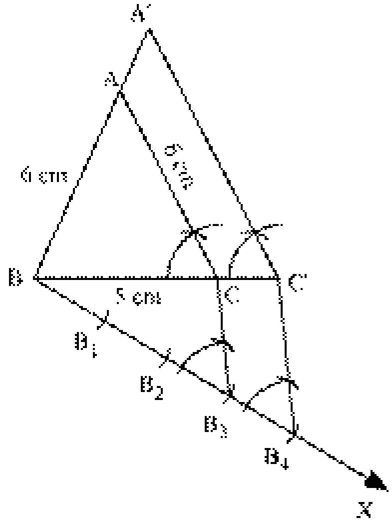
Solution:

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 ΔABC.



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´.

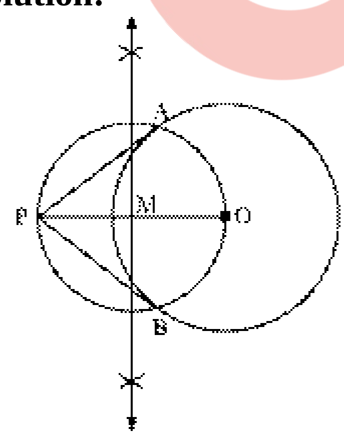
The resulting ΔA´BC´ is the required triangle.

- **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. Joint PA and PB. Therefore, PA and PB are the required tangents. It can be observed that PA = PB = 4 cm.