CHAPTER 11 : Constructions

- **To divide a line segment internally in a given ratio $m : n$, where both m and n are positive integers.**

  Steps of Construction :

  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.

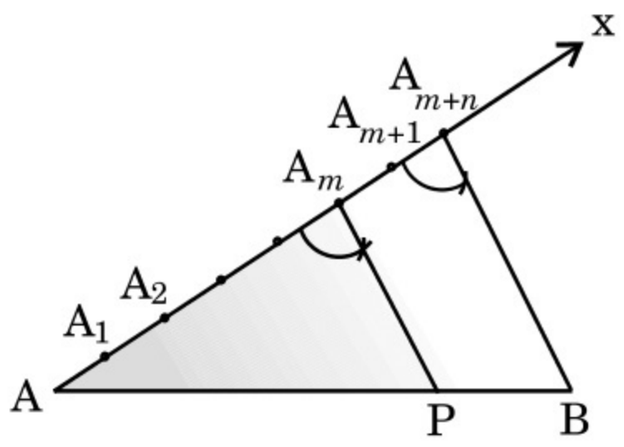
  Step 3 : Along AX mark off $(m + n)$ points $A_1, A_2, \ldots\ldots\ldots A_m, A_{m+1}. \ldots\ldots\ldots A_{m+n}$, such that $AA_1 = A_1A_2 = A_{m+n-1}\,A_{m+n}$.

  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.

  Suppose this line meets AB at point P.

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



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

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

  Step 1 : Construct the given triangle ABC by using the given data.

  Step 2 : Take any one of the three sides of the given triangle as base. Let AB be the base of the given triangle.

  Step 3 : At one end, say A, of base AB, Construct an acute $\angle BAX$ below the base AB.

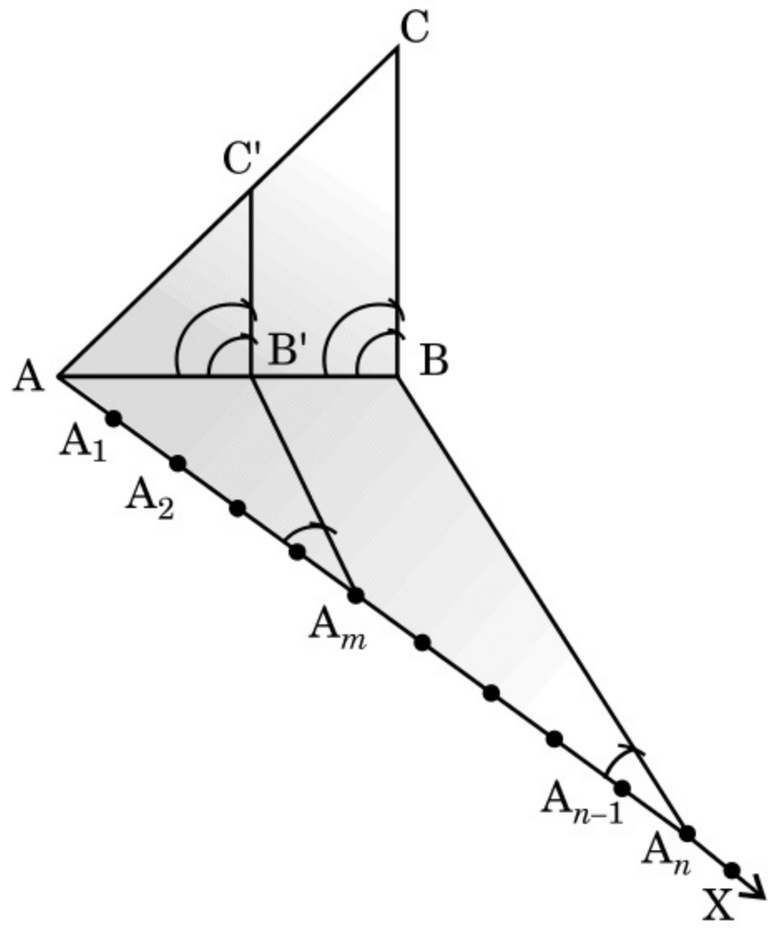
  Step 4 : Along AX mark off n points $A_1, A_2, A_3, \ldots\ldots\ldots A_n$ such that $AA_1 = A_1A_2 = \ldots\ldots\ldots\ldots = A_{n-1}A_n$.

  Step 5 : Join A_nB.

  Step 6 : Draw A_mB parallel to A_nB which meets AB at B'.

  Step 7 : From B' draw $B'C' \,||\, CB$ 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.



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

Step 1 : Construct the given triangle by using the given data.

Step 2 : 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.

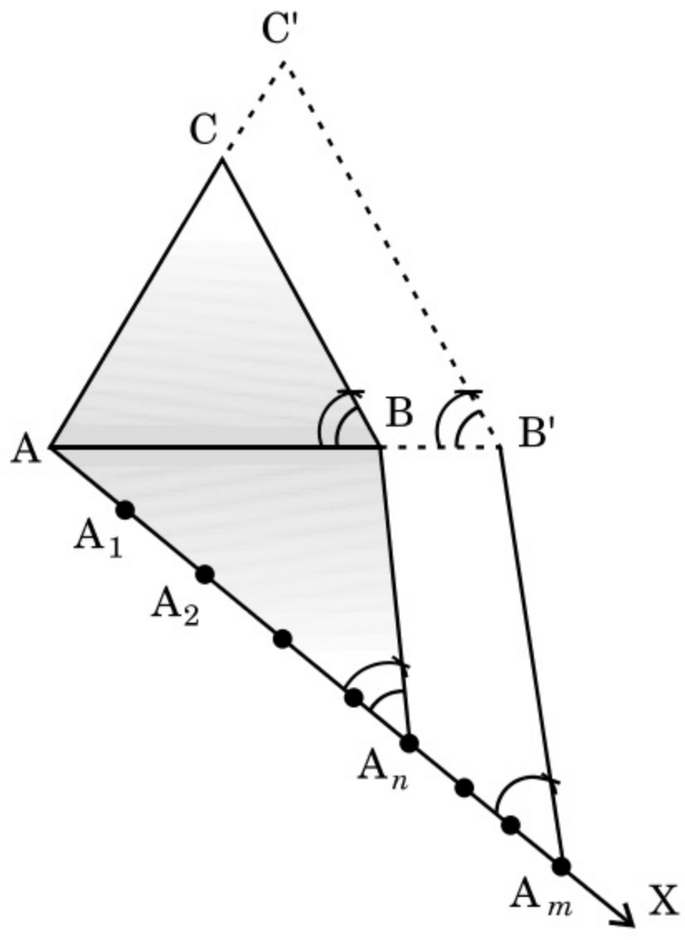
Step 3 : At one end, say A, of base AB, construct an acute $\angle BAX$ below base AB
i.e., on the opposite side of the vertex C.

Step 4 : 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 5 : Join A_nB to B and draw a line through A_m parallel to A_nB, intersecting the extended line segment AB at B',

Step 6 : Draw a line through B' parallel to BC intersecting the extended line segment AC at C'.

Step 7 : $\Delta AB'C'$ so obtained is the required triangles, each of whose sides is $\left(\frac{m}{n}\right)^{th}$ of the corresponding side of ΔABC.

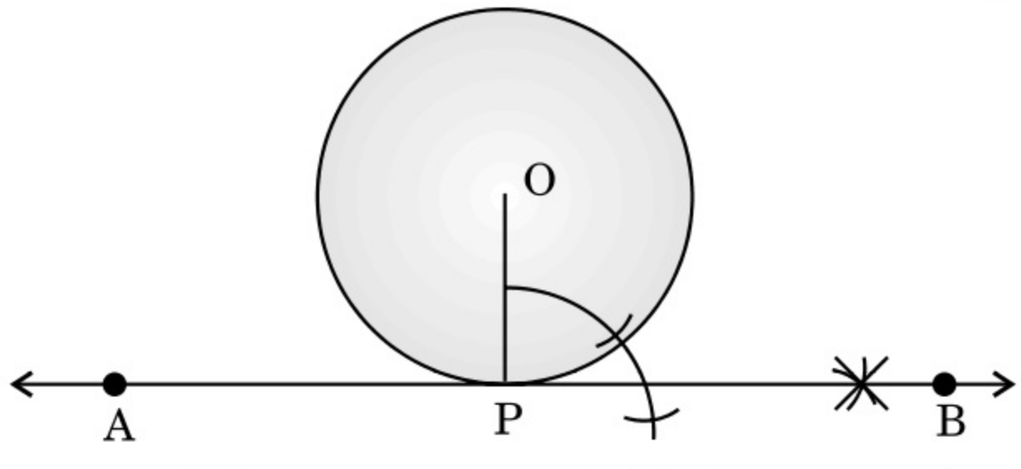


- **To draw the tangent to a circle at a given point on it, when the centre of the circle is known.**
  Given : A circle with centre O and a point P on it.
  Required : To draw the tangent to the circle at P.

Steps of construction :

(i) Join OP,

(ii) Draw a line AB perpendicular to OP at the point P, APB is the required tangent at P,



- **To draw the tangent to a circle from a point outside it (external point) when its centre is known.**
  Given : A circle with centre O and a point P outside it.
  Required : 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 $C(O, r)$.