CONSTRUCTIONS

Illustration 1 **Divide a line segment of length 10 cm internally in the ratio 3:2.**

Solution: We follow the following steps of construction.

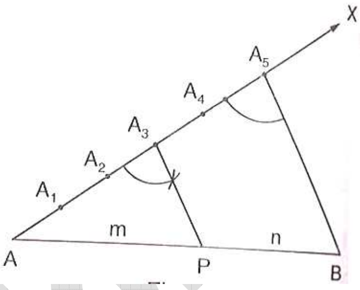
Steps of construction

Step I Draw a line segment AB = 10 cm by using a ruler.

Step II Draw any ray making an acute angle $\angle BAX$ With AB.

A_1, A_2, A_3, A_4 *and* A_5 *such that*

$AA_1 = A_1A_2 = A_2A_3 = A_3A_4 = A_4A_5$.



Step III Join BA_5

Step IV Through A_3 draw a line A_3P parallel to A_5B by making an angle equal to $\angle AA_5B$ *at* A_3 intersecting AB at a point P.

The point P so obtained is the required point, which divides AB internally in the ratio 3:2.

Illustration 2 **Divide a line segment of length 8 cm internally in the ratio 3 : 4.**

Solution: We follow the following steps:

Steps of construction

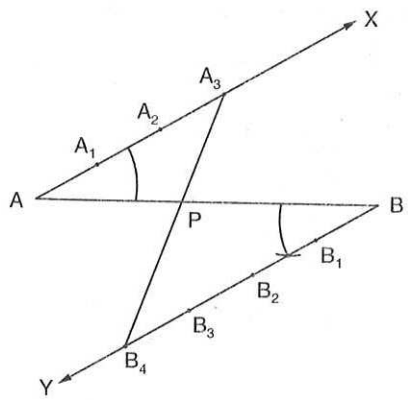
Step I Draw the line segment AB of length 8 cm.

Step II Draw any ray AX making an acute angle $\angle BAX$ with AB.

Step III Draw a ray BY parallel to AX by making $\angle ABY$ equal to $\angle BAX$.

Step IV Mark of three point A_1, A_2, A_3 *on AX and* 4 points B_1, B_2, B_3, B_4 *on BY* such that

$AA_1 = A_1A_2 = A_2A_3 = BB_1 = B_1B_2 = B_2B_3 = B_3B_4$.



Step V Join A_3, B_4. Suppose it intersects AB at a point P.

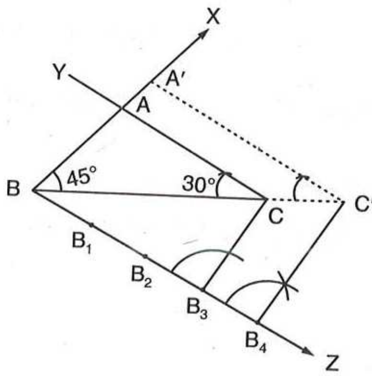
Then, P is the point dividing AB internally in the ratio 3:4.

Illustration 3 **Draw a triangle ABC with side BC = 7 cm, $\angle B = 45^0, \angle A = 105^0$ Then construct a triangle whose sides are (4/3) times the corresponding sides of ΔABC.**

Solution: In order to construct ΔABC, we follow the following steps :

Step I Draw BC = 7 cm.

Step II At B construct $\angle CBX = 45^0$ and at C construct $\angle BCY = 180^0 - (45^0 - 105^0) = 30^0$ suppose BX and CY intersect at A. ΔABC so obtained is the given triangle. To construct a triangle similar to ΔABC, we follow the following steps.



Step I Construct an acute angle $\angle CBZ$ at B on opposite side of vertex A of ΔABC.

Step II Mark off our (greater 4 of and 3 in $\frac{4}{3}$) points B_1, B_2, B_3, B_4 *on BZ* such that

$BB_1 = B_1B_2 = B_2B_3 = B_3B_4$

Step III Join B_3 (the third point) to C an d draw a line through B_4C' parallel to B_3C, intersecting the extended line segment BC at C'.

Step IV Draw a line through C' parallel to CA intersecting the extended line segment BA at A'. Triangle A'BC' so obtained is the required triangle such that

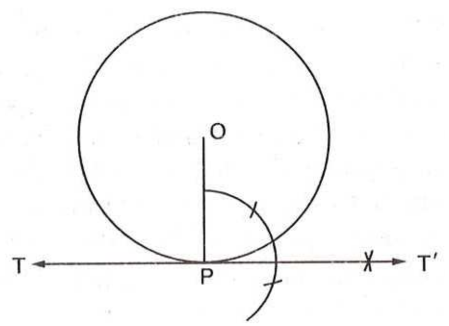
$$\frac{A'B}{AB} = \frac{BC'}{BC} = \frac{A'C'}{AC} = \frac{4}{3}$$

Type I Construction of A tangent to a circle when its centre is known

Steps of construction

Step I Take a point O on the plane of the paper and draw a circle of given radius.

Step II Take a point P on the circle.



Step III Join OP.

Step IV Construct $\angle OPT = 90^0$.

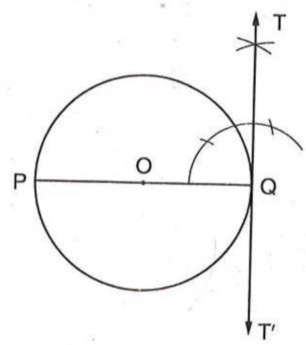
Step V Produce TP to T' to get TPT' as the required tangent.

Illustration 2 Draw a circle of radius 4 cm with centre O. Draw a diameter POQ. Through P or Q draw tangent to the circle.

Solution: We follow the following steps :

Steps of construction

Step I Taking O as centre and radius equal to 4 cm draw a circle.



Step II Draw diameter of POQ.

Step III Construct $\angle PQT = 90^0$.

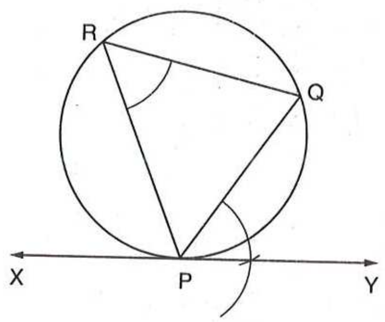
Step IV Produce TQ to T' to obtain the required tangent TQT'.

Type II Construction of a tangent to a circle at a given point when its centre is not known

Steps of construction

Step I Draw any chord PQ through the given point P on the circle.

Step II Join P and Q to a point R either in the major arc or in the minor arc.



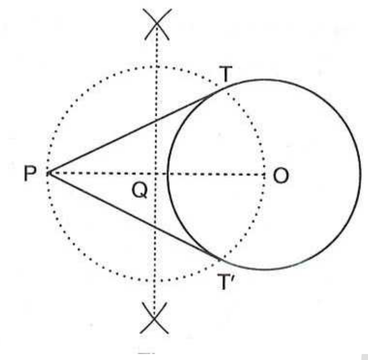
Step III Construct $\angle QPY$ *equal to* $\angle PRQ$ and on the opposite side of the chord PQ.

Step IV Produce YP to X to get YPX as the required tangent.

Type I Construction of tangents to a circle from an external point when its centre is known

Steps of construction

Step I Join the centre O of the circle to the given external point P i.e. Join OP



Step II Draw right bisector of OP, intersecting OP at Q.

Step III Taking Q as centre and OQ = PQ as radius, draw a circle to intersect the given circle at T and T'.

Step IV Join PT and PT' to get the required tangents as PT and PT'.

Type II On constructions of tangents to a circle from an external point when its centre is known.

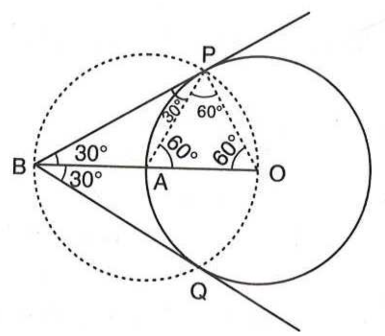
Illustration 1 **Draw a pair of tangents to a circle of radius 5 cm which are inclined to each other at an angle of 60^0.**

Solution: In order to draw the pair of tangents, we follow the following steps.

Steps of construction

Step I Take a point O on the plan e of the paper and draw a circle of radius OA = 5 cm.

Step II Produce OA to B such that OA = AB = 5 cm.



Step III Taking A as t he centre draw a circle of radius AO = AB = 5 cm. suppose it cuts the circle drawn in step I at P and Q.

Step IV Join Bp and BQ to get the desired tangents.

Justification: In OAP, we have

OA = OP = 5 cm (= Radius)

Also, AP = 5 cm (= Radius of circle with centre A)

$\therefore \quad \Delta OAP$ is equilateral $\Rightarrow \angle PAO = 60^0 \Rightarrow \angle BAP = 120^0$

$In\ \Delta BAP$, we have

BA = AP and $\angle BAP = 120^0$

$\therefore \quad \angle ABP = \angle APB = 30^0$

$\Rightarrow \quad \angle PBQ = 60^0$