CONSTRUCTIONS

CONSTRUCTION OF PERPENDICULAR BISECTOR OF A LINE SEGMENT

❖ EXAMPLES ❖

Ex.1 Draw a line segment PQ of length 8.4 cm. Draw the perpendicular bisector of this line segment.

Sol. We follow the following steps for constructing the perpendicular bisector of PQ.

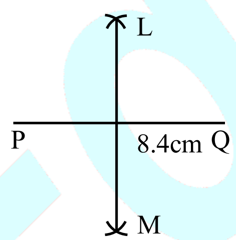
Steps of Construction

Step I : Draw a line segment PQ = 8.4 cm by using a ruler.

Step II : With P as centre and radius more than half of PQ, draw two arcs, one on each side of PQ.

Step III : With Q as centre and the same radius as in step II, draw arcs cutting the arcs drawn in the previous step at L and M respectively.

Step IV : Draw the line segment with L and M as end-points.



The line segment LM is the required perpendicular bisector of PQ.

CONSTRUCTION OF THE BISECTOR OF AN GIVEN ANGLE

❖ EXAMPLES ❖

Ex.2 Using a protractor, draw an angle of measure 78°. With this angle as given, draw an angle of measure 39°.

Sol. We follow the following steps to draw an angle of 39° from an angle of 78°.

Steps of Construction

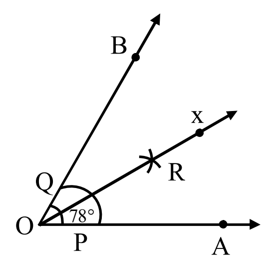
Step I : Draw a ray OA as shown in fig.

Step II : With the help of a protractor construct an angle AOB of measure 78°.

Step III : With centre O and a convenient radius drawn an arc cutting sides OA and OB at P and Q respectively.

Step IV : With centre P and radius more than $\frac{1}{2}$ (PQ), drawn an arc.

Step V : With centre Q and the same radius, as in the previous step, draw another arc intersecting the arc drawn in the previous step at R.



Step VI : Join OR and produce it to form ray OX.

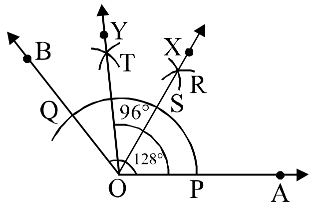
The angle ∠AOX so obtained is the required angle of measure 39°.

Verification : Measure ∠AOX and ∠BOX. You will find that

∠AOX = ∠BOX = 39°.

Ex.3 Using a protractor, draw an angle of measure 128º. With this angle as given, draw an angle of measure 96º.

Sol. In order to construct an angle of measure 96º from an angle of measure 128º, we follow the following steps :



Steps of Construction

Step I : Draw an angle ∠AOB of measure 128° by using a protractor.

Step II : With centre O and a convenient radius draw an arc cutting OA and OB at P and Q respectively.

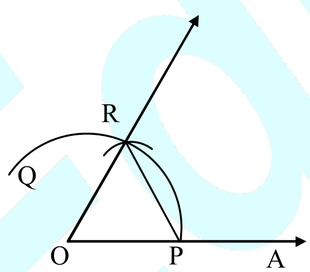
Steps III : With centre P and radius more than $\frac{1}{2}$(PQ), draw an arc.

Step IV : With centre Q and the same radius, as in step III, draw another arc intersecting the previously drawn arc at R.

Steps V : Join OR and produce it to form ray OX. The ∠AOX so obtained is of measure $\left(\frac{128^\circ}{2}\right)$ i.e. 64°.

Step VI : With centre S (the point where ray OX cuts the arc (PQ) and radius more than $\frac{1}{2}$(QS), draw an arc.

Step VII : With centre Q and the same radius, as in step VI, draw another arc intersecting the arc drawn in step VI at T.



Step VIII : Join OT and produce it form OY.

Clearly, $\angle XOY = \frac{1}{2}\angle XOB = \frac{1}{2}(64^\circ) = 32^\circ$.

$\therefore \angle AOT = \angle AOX + \angle XOY = 64^\circ + 32^\circ = 96^\circ$

Then, ∠AOY is the desired angle.

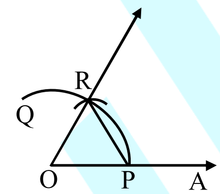
Verification : Measure ∠AOX, ∠XOY and ∠AOY. You will find ∠AOY = 96°.

➢ CONSTRUCTION OF SOME STANDARD ANGLES

In this section, we will learn how to construct angles of 60°, 30°, 90°, 45° and 120° with the help of ruler and compasses only.

(i) Construction of an Angle of 60°

In order to construct an angle of 60° with the help of ruler and compasses only, we follow the following steps :



Steps of Construction

Step I : Draw a ray OA.

Step II : With centre O and any radius draw an arc PQ with the help of compasses, cutting the ray OA at P.

Step III : With centre P and the same radius draw an arc cutting the arc PQ at R.

Step IV : Join OR and produce it to obtain ray OB.

The angle ∠AOB so obtained is the angle of measure 60°.

Justification : In above figure, join PR.

In ΔOPR, we have

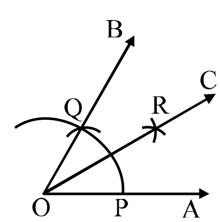
OP = OR = PR

⇒ ΔOPR is an equilateral triangle.

⇒ ∠POR = 60°

⇒ ∠AOB = 60° [∵ ∠POR = ∠AOB]

(ii) Construction of An Angle of 30°



Steps of Construction

Step I : Draw ∠AOB = 60° by using the steps mentioned above.

Step II : With centre O and any convenient radius draw an arc cutting OA and OB at P and Q respectively.

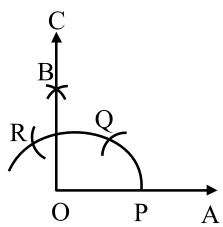
Step III : With centre P and radius more than $\frac{1}{2}$ (PQ), draw an arc in the interior of $\angle$AOB.

Step IV : With centre Q and the same radius, as in step III, draw another arc intersecting the arc in step III at R.

Step V : Join OR and product it to any point C.

Step VI : The angle $\angle$AOC is the angle of measure 30º.

(iii) Construction of An Angle of 90º



Steps of Construction

Step I : Draw a ray OA.

Step II : With O as centre and any convenient radius, draw an arc, cutting OA at P.

Step III : With P as centre and the same radius, an arc cutting the arc drawn in step II at Q.

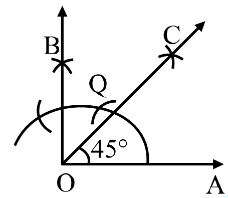
Step IV : With Q as centre and the same radius as in steps II and III, draw an arc, cutting the arc drawn in step II at R.

Step V : With Q as centre and the same radius, draw an arc.

Step VI : With R as centre and the same radius, draw an arc, cutting the arc drawn in step V at B.

Step VII : Draw OB and produce it to C. $\angle$AOC is the angle of measure 90º.

(iv) Construction of An Angle of 45º



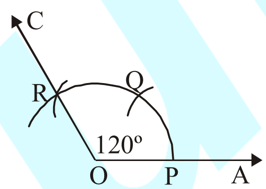
Steps of Construction

Step I : Draw $\angle$AOB = 90º by following the steps given above.

Step II : Draw OC, the bisector of $\angle$AOB.

The angle $\angle$AOC so obtained is the required angle of measure 45º.

(v) Construction of An Angle of 120º



Steps of Construction

Step I : Draw a ray OA.

Step II : With O as centre and any convenient radius, draw an arc cutting OA at P.

Step III : With P as centre and the same radius draw an arc, cutting the first arc at Q.

Step IV : With Q as centre and the same radius, draw an arc, cutting the arc drawn in step II at R.

Step V : Join OR and produce it to any point C. $\angle$AOC so obtained is the angle of measure 120º

➢ CONSTRUCTIONS OF TRIANGLES

(i) Construction of an equilateral triangle :

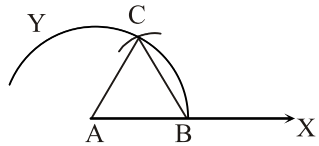
Steps of construction

Step I : Draw a ray AX with initial point A.

Step II : With centre A and radius equal to length of a side of the triangle draw an arc BY, cutting the ray AX at B.

Step III : With centre B and the same radius draw an arc cutting the arc BY at C.

Step IV : Join AC and BC to obtain the required triangle.

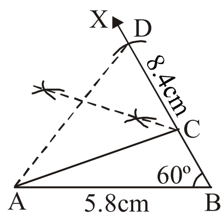


(ii) Construction of a triangle when its base, sum of the other two sides and one base angle are given

❖ EXAMPLES ❖

Ex.4 Construct a triangle ABC in which AB = 5.8cm, BC + CA = 8.4 cm and ∠B = 60º.

Sol.



Steps of Construction

Step I : Draw AB = 5.8 cm

Step II : Draw ∠ABX = 60º

Step III : From point B, on ray BX, cut off line segment

BD = BC + CA = 8.4 cm.

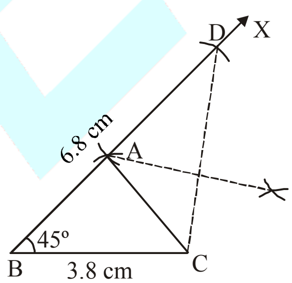
Step IV : Join AD

Step V : Draw the perpendicular bisector of AD meeting BD at C.

Step VI : Join AC to obtain the required triangle ABC.

Ex.5 Construct a triangle ABC, in which BC = 3.8cm, ∠B = 45º and AB + AC = 6.8 cm.

Sol.



Steps of Construction

Step I : Draw BC = 3.8 cm.

Step II : Draw ∠CBX = 45º

Step III : Form B on ray BX, cut-off line segment BD equal to AB + AC i.e. 6.8 cm.

Step IV : Join CD.

Step V : Draw the perpendicular bisector of CD meeting BD at A.

Step VI : Join CA to obtain the required triangle ABC.

(iii) Construction of a triangle when its base, difference of the other two sides and one base angle are given

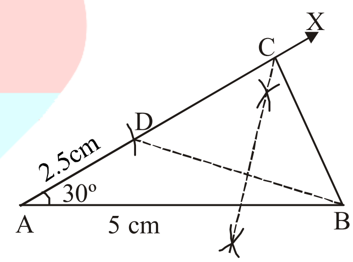
Case (1) : ∠A = 30º, AC – BC = 2.5

Case (2) : ∠A = 30º, BC – AC = 2.5

❖ EXAMPLES ❖

Ex.6 Construct a triangle ABC in which base AB = 5 cm, ∠A = 30º and AC – BC = 2.5 cm.

Sol.



Steps of Construction

Step I : Draw base AB = 5 cm

Step II : Draw ∠BAX = 30º

Step III : From point A, on ray AX, cut off line segment

AD = 2.5 cm (= AC – BC).

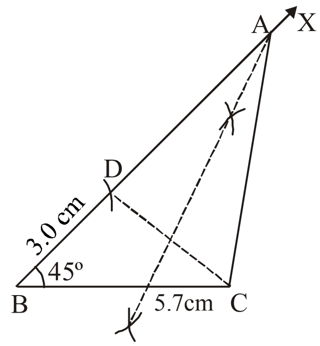
Step IV : Join BD.

Step V : Draw the perpendicular bisector of BD which cuts AX at C.

Step VI : Join BC to obtain the required triangle ABC.

Ex.7 Construct a triangle ABC in which BC = 5.7cm, ∠B = 45º, AB – AC = 3 cm.

Sol.



Steps of Construction

Step I : Draw base BC = 5.7 cm.

Step II : Draw ∠CBX = 45°

Step III : From B, on ray BX, cut off line segment
BD = 3 cm (= AB – AC).

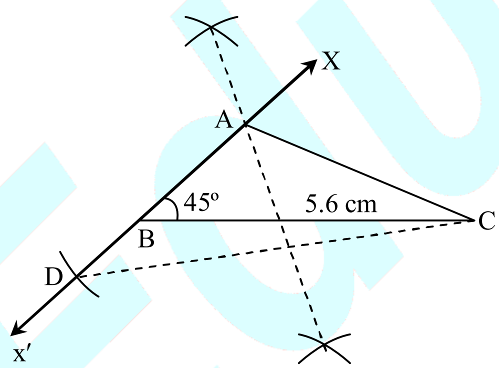
Step IV : Join CD.

Step V : Draw the perpendicular bisector of CD which cuts BX at A.

Step VI : Join CA to obtain the required triangle ABC.

Ex.8 Construct a ΔABC in which BC = 5.6 cm, AC – AB = 1.6 cm and ∠B = 45°. Justify your construction.

Sol.



Steps of construction

Step I : Draw BC = 5.6 cm

Step II : At B, construct ∠CBX = 45°

Step III : Produce XB to X′ to form line XBX′.

Step IV : From ray BX′, cut-off line segment BD = 1.6 cm

Step V : Join CD

Step VI : Draw perpendicular bisector of CD which cuts BX at A

Step VII : Join CA to obtain required triangle BAC.

Justification : Since A lies on the perpendicular bisector of CD. Then

∴ AC = AD = AB + DB = AB + 1.6

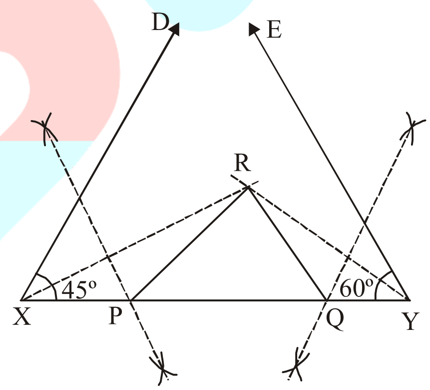
Hence, ΔABC is the required triangle.

(iv) Construction of a triangle of given perimeter and two base angles :

❖ EXAMPLES ❖

Ex.9 Construct a triangle PQR whose perimeter is equal to 14 cm, ∠P = 45° and ∠Q = 60°.

Sol.



Steps of Construction

Step I : Draw a line segment XY = 14 cm

Step II : Construct ∠YXD = ∠P = 45° and ∠XYE = ∠Q = 60°

Step III : Draw the bisectors of angles ∠YXD and ∠XYE mark their point of intersection as R.

Step IV : Draw right bisectors of RX and RY meeting XY at P and Q respectively.

Step V : Join PR and QR to obtain the required triangle PQR.