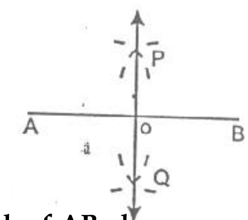
CHAPTER – 11
CONSTRUCTIONS

11.1 BASIC CONSTRUCTIONS

TO CONSTRUCT THE BISECTOR OF A LINE SEGMENT

Ex.1 **Draw a line segment of length 7.8 cm draw the perpendicular bisector of this line segment.**



Sol. **Given the given the segment be AB = 7.8 cm.**

STEPS :

(i) Draw the line segment AB = 7.8 cm.

(ii) With point A as centre and a suitable radius, more than half the length of AB, draw arcs on both the sides of AB.

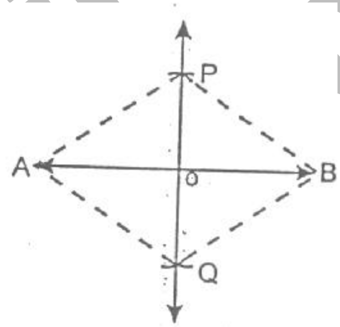
(iii) With point B as centre and with the same radius draw arcs on both the sides of AB. Let these arc cut at points P & Q as shown on in the figure.

(iv) Draw a line through the points P and Q. The line so obtained is the required perpendicular bisector of given line segment AB.

Line PQ is perpendicular bisector of AB.

(A) PQ bisects AB i.e., OA = OB.

(B) PQ is perpendicular to AB i.e., ĎPAO = ĎPOB = 90^0.



Proof : In ΔAPQ and ΔBPQ :

	AP = BP	[By construction]
	AQ = BQ	[By construction]
	PQ = PQ	[Common]
⇒	ΔAPQ = ∠BPQ	[By SSS]
⇒	∠APQ = ∠BPQ	[By cpctc]

Now, in Δ APO & ΔBPO

	AP = BP	[By construction]
	OP = OP	[Common side]
∠APO = ∠BPO		[Proved above]
⇒	ΔAPO ≅ ΔBPO	[By SAS]

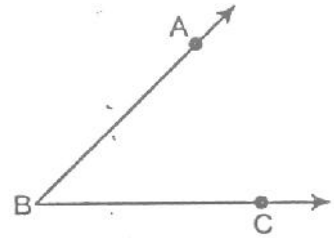
And, ∠POA = ∠POB

$= \frac{180^0}{2} = 90^0$ [∵ ∠POA + ∠POB = 180^0]

⇒ PQ is perpendicular bisector of AB.

TO CONSTRCUT THE BISECTOR OF A GIVEN ANGLE

Let ABC be the given angle to be bisected.



STEPS :

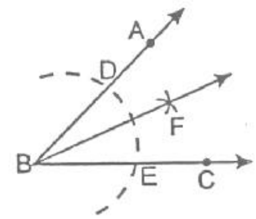
(i) With B as centre and a suitable radius, draw an arc which cuts ray BA at point D and ray BC at point E.

(ii) Taking D and E as centres and with equal radii draw arcs which intersect each other at point F. In this step, each equal radius must be more than half the length DE.

(iii) Join B and F and produce to get the ray BF.

Ray BF is the required bisector of the given angle ABC.

Proof : Join DF and EF.



In Δ BDF and Δ BEF :

	BD = BE	[Radii of the same arc]
	DF = EF	[Radii of the equal arcs]
	BF = BF	[Common]
⇒	ΔBDF ≅ ΔBEF	[By SSS]
⇒	∠DBF = ∠EBF	[By cpctc]

i.e., ∠ABF = ∠CBF

⇒ BF bisects ∠ABC. **Hence Proved.**

TO CONSTRUCT THE REQUIRED ANGLE

(a) To Construct the Required Angle of 60^0 :

STEPS :

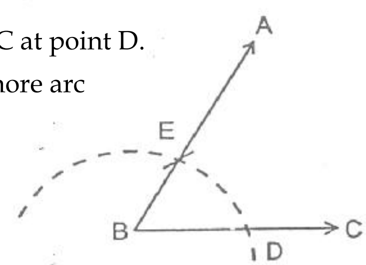
(i) Draw a line BC of any suitable length.

(ii) With B as centre and any suitable radius, draw an arc which cuts BC at point D.

(iii) With D as centre and radius same, as taken in step (ii), draw one more arc which cuts previous arc at point E.

(iv) Join BE and produce upto any point A.

Then, $\angle ABC = 60^0$



(b) To Construct an Angle of 120^0 :

STEPS

(i) Draw a line BC of any suitable length.

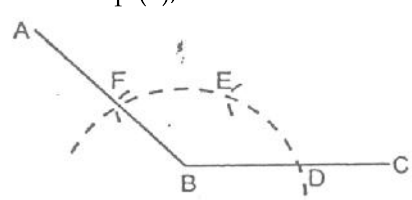
(ii) Taking B as centre and with any suitable radius, draw an arc which cuts BC at point D.

(iii) Taking D as centre, draw an arc of the same radius, as taken in step (ii), which cuts the first arc at point E.

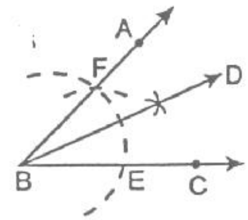
(iv) Taking E as centre and radius same, as taken in step (ii), draw one more arc which cuts the first arc at point F.

(v) Join BF and produce upto any suitable point A.

Then, $\angle ABC = 120^0$



(c) To Construct and Angle of 30^0 :



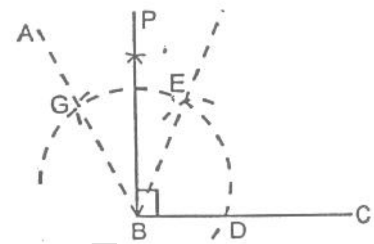
STEPS :

(i) Construct angle ABC = 60^0 by compass.

(ii) Draw BD, the bisector of angle ABC.

The, $\angle DBC = 30^0$

(d) To Construct an Angle of 90^0 :



STEPS

(i) Construct angle ABC = 120.0 by using compass.

(ii) Draw PB, the bisector of angle EBG.

Then, $\angle PBC = 90^0$

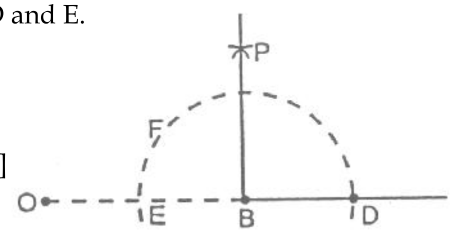
Alternative Method :

(i) Draw a line segment BC of any suitable length.

(ii) Produce CB upto a arbitrary point O.

(iii) Taking B as centre, draw as arc which cuts OC at points D and E.

(iv) Taking D and E as centres and with equal radii draw arcs with cut each other at point P.

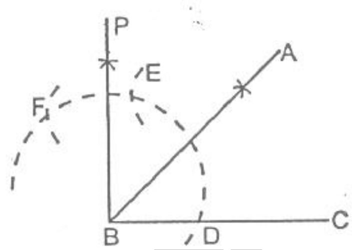


[The radii in this step must be of length more than half of DE.]

(v) Join BP and produce.

Then, $\angle PBC = 90^0$

(d) To Construct an Angle of 45^0



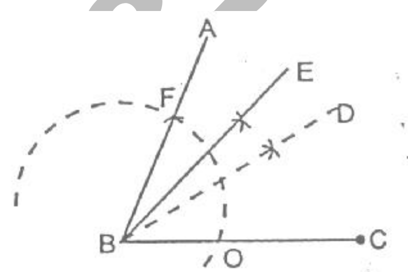
STEPS

(i) Draw $\angle PBC = 90^0$

(ii) Draw AB which bisects angle PBC,

Then, $\angle ABC = 45^0$

Alternative Method :



STEPS :

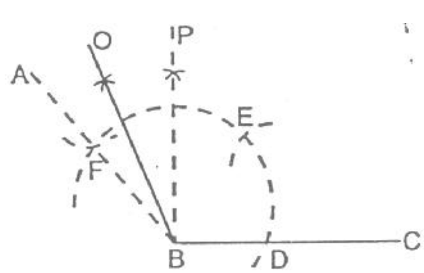
(i) Construct $\angle ABC = 60^0$

(ii) Draw BD, the bisector of angle ABC.

(iii) Draw BE, the bisector of angle ABD.

Then, $\angle EBC = 45^0$

(e) To Construct an Angle of 105^0 :



STEPS :

(i) Construct $\angle ABC = 120^0$ and $\angle PBC = 90^0$

(ii) Draw BO, the bisector of $\angle ABP$.

Then, $\angle OBC = 105^0$

(f) To Construct an Angle of 150^0.

STEPS :

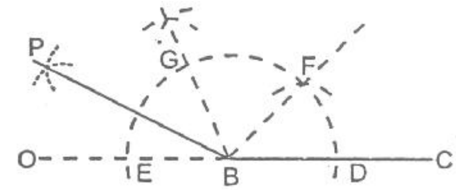
(i) Draw line segment BC of any suitable length. Produce CB upto any point O.

(ii) With B as centre, draw an arc (with any suitable radius) which buts OC at points D and E.

(iii) With D as centre, draw an arc of the same radius, as taken in step 2, which cuts the first arc at point F.

(iv) With F as centre, draw one more arc of the same radius, staken in step 2, which cuts the first arc at point G.

(v) Draw PB, the bisector of angle EBG.



Now $\angle FBD = \angle GBF = \angle EBG = 60^0$

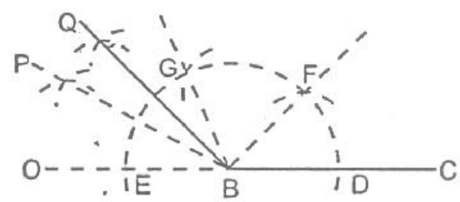
Then, $\angle PBC = 150^0$

(g) To Construct an Angle of 135^0.

STEPS :

(i) Construct $\angle PBC = 150^0$ and $\angle GBC = 120^0$

(ii) Construct BQ, the bisector of angle PBG.



Then, $\angle QBC = 135^0$