Exercise 11.1

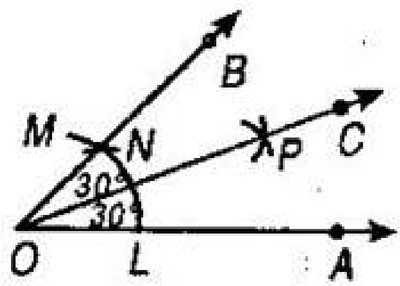
**Q3.** Construct the angles of the following measurements:

**(i)** $30^\circ$

**(ii)** $22\frac{1}{2}^\circ$

**(iii)** $15^\circ$

**Ans. (i) Steps of construction:** $30^\circ$




**(a)** Draw a ray OA.

**(b)** With O as centre and a suitable radius, draw an arc LM that cuts OA at L.

**(c)** With L as centre and radius OL, draw an arc to cut LM at N.

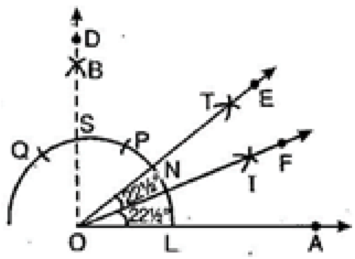
**(d)** Join O and N draw ray OB. Then $\angle AOB = 60^\circ$.

**(e)** With L as centre and radius greater than $\frac{1}{2}$ LN, draw an arc.

**(f)** Now with N as centre and same radius as in step 5, draw another arc cutting the arc drawn in step 5 at P.

**(g)** Join O and P and draw ray OC. Thus OC bisects $\angle AOB$ and therefore $\angle AOC = \angle BOC = 30^\circ$

**(ii) Steps of construction:** $22\frac{1}{2}°$




**(a)** Draw a ray OA.

**(b)** With O as centre and convenient radius, draw an arc LM cutting OA at L.

**(c)** Now with L as centre and radius OL, draw an arc cutting the arc LM at P.

**(d)** Then taking P as centre and radius OL, draw an arc cutting arc PM at the point Q.

**(e)** Join OP to draw the ray OB. Also join O and Q to draw the OC. We observe that:

$\angle$ AOB = $\angle$ BOC = $60°$

**(f)** Now we have to bisect $\angle$ BOC. For this, with P as centre and radius greater than $\frac{1}{2}$ PQ draw an arc.

**(g)** Now with Q as centre and the same radius as in step 6, draw another arc cutting the arc drawn in step 6 at R.

**(h)** Join O and R and draw ray OD. Then $\angle$ AOD is the required angle of $90°$.

**(i)** With L as centre and radius greater than $\frac{1}{2}$ LS, draw an arc.

**(j)** Now with S as centre and the same radius as in step 2, draw another arc cutting the arc draw in step 2 at T.

**(k)** Join O and T and draw ray OE. Thus OE bisects $\angle$AOD and therefore $\angle$AOE = $\angle$DOE = $45^\circ$.

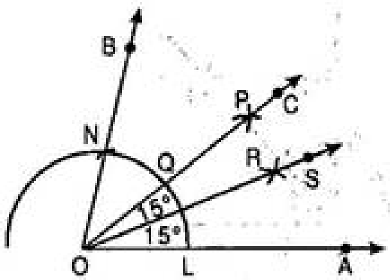
**(l)** Let ray OE intersect the arc of circle at N.

**(m)** Now with L as centre and radius greater than $\frac{1}{2}$ LN, draw an arc.

**(n)** With N as centre and same radius as in above step and draw another arc cutting arc drawn in above step at I.

**(o)** Join O and I and draw ray OF. Thus OF bisects $\angle$AOE and therefore $\angle$AOF = $\angle$EOF = $22\frac{1}{2}^\circ$.

**(iii) Steps of construction:** $15°$




**(a)** Draw a ray OA.

**(b)** With O as centre and a suitable radius, draw an arc LM that cuts OA at L.

**(c)** With L as centre and radius OL, draw an arc to cut LM at N.

**(d)** Join O and N draw ray OB. Then $\angle AOB = 60°$.

**(e)** With L as centre and radius greater than $\frac{1}{2}$ LN, draw an arc.

**(f)** Now with N as centre and same radius as in step 5, draw another arc cutting the arc drawn in step 5 at P.

**(g)** Join O and P and draw ray OC. Thus OC bisects $\angle AOB$ and therefore $\angle AOC = \angle BOC = 30°$.

**(h)** Let ray OC intersects the arc of circle at point Q.

**(i)** Now with L as centre and radius greater than $\frac{1}{2}$ LQ; draw an arc.

**(j)** With Q as centre and same radius as in above step, draw another arc cutting the arc shown in above step at R.

**(k)** Join O and R and draw ray OS. Thus OS bisects $\angle AOC$ and therefore $\angle COS = \angle AOS = 15^\circ$

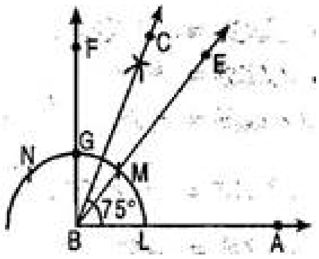
**Q4.** Construct the following angles and verify by measuring them by a protractor:

**(i)** $75^\circ$

**(ii)** $105^\circ$

**(iii)** $135^\circ$

**Ans. (i) Step of construction of** $75^\circ$




(a) Draw $\angle ABE = 60^\circ$ and $\angle ABF = 90^\circ$. [ Follow the same steps as done in Question 1 and Question 3 (i)]

(b) Let ray BF intersects the arc of circle at G.

(c) Now with M as centre and radius greater than $\frac{1}{2}$ MG draw an arc.

(d) With G as centre and with same radius as in step (c), draw an arc which intersects the previous arc at point H.

(e) Draw a ray BC passing through H which bisects $\angle EBF$.

Thus $\angle ABC = 75^\circ$ is the required angle.

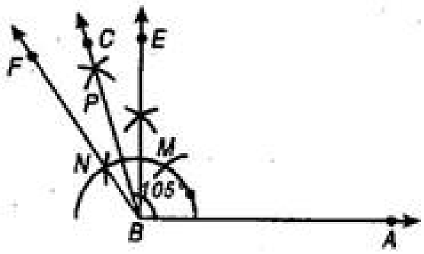
**Justification**:

$\angle$ EBF = $\angle$ ABF – $\angle$ ABE = $90^\circ - 60^\circ = 30^\circ$

Now $\angle$ EBF = $\angle$ CBF = $\frac{1}{2}\angle$ EBF = $\frac{1}{2} \times 30^\circ = 15^\circ$ [ $\because$ BC is the bisector of $\angle$ EBF]

$\therefore$ $\angle$ABC = $\angle$ ABE + $\angle$ EBC = $60^\circ + 15^\circ = 75^\circ$

**(ii) Steps of construction of** $105^\circ$




(a) Draw $\angle$ ABE = $90^\circ$ and $\angle$ ABF = $120^\circ$.

(b) Let ray BE intersects the arc of circle at M and ray BF intersects the arc of circle N.

(c) With point M as centre and radius greater than $\frac{1}{2}$ MN, draw an arc.

(d) With N as centre and with same radius as in step (c), draw another arc which intersects the previous arc at P.

(e) Draw a ray BC passing through P which bisects $\angle$ EBF.

Thus $\angle$ ABC = $105^\circ$ is the required angle.

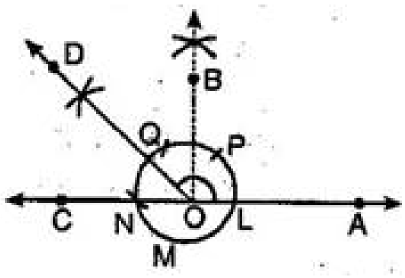
**Justification**:

$\angle$ EBF = $\angle$ ABF – $\angle$ ABE= $120^\circ - 90^\circ = 30^\circ$

Now $\angle$ EBC = $\angle$ CBF = $\frac{1}{2}\angle$ EBF = $\frac{1}{2} \times 30^\circ = 15^\circ$ [ $\because$ BC is the bisector of $\angle$ EBF]

$\therefore$ $\angle$ABC = $\angle$ ABE + $\angle$ EBC = $90^\circ + 15^\circ = 105^\circ$

**(iii) Steps of construction of $135^{\circ}$**




(a) Draw a ray OA.

(b) With O as centre and convenient radius, draw an arc LM (having length more than the semicircle) cutting OA at L.

(c) Now with L as centre and radius = OL; draw an arc cutting the arc LM at P.

(d) Then taking P as centre and radius OL, draw an arc cutting arc PM at Q.

(e) Now bisect $\angle$ POQ by ray OB, we get $\angle$ AOB $= 90^{\circ}$.

(f) Now taking Q as centre and radius OL, draw an arc cutting QM at N.

(g) Join O and N to draw the ray OC.

Thus we get $\angle$ AOC = $180^{\circ}$. $\Rightarrow \angle$ BOC = $\angle$ AOB $= 90^{\circ}$

(h) Now bisect $\angle$ BOC by ray OD.

Then $\angle$ AOD is the required angle of $135^{\circ}$.

$\angle$ AOD = $\angle$ AOB + $\angle$ BOD = $90^{\circ} + 45^{\circ} = 135^{\circ}$

**Q5.** Construct an equilateral triangle, given its side and justify the construction.

**Ans. Steps of construction**:

**(a)** Draw a line segment BC of length 6 cm.

**(b)** At B draw $\angle XBC = 60^\circ$.

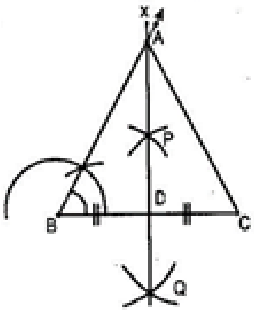
**(c)** Draw perpendicular bisector PQ of line segment BC.

**(d)** Let A and D be the points where PQ intersects the ray BX and side BC respectively.

**(e)** Join AC.

Thus ABC is the required equilateral triangle.

**Justification**:




In right triangle ADB and right triangle ADC,

AD = AD [Common]

$\angle ADB = \angle ADC = 90^\circ$ [By construction]

BD = CD [By construction]

$\therefore \Delta ADB \cong \Delta ADC$ [By SAS congruency]

$\therefore \angle B = \angle C = 60^\circ$ [By CPCT]

$\therefore \angle A = 180^\circ - (\angle B + \angle C)$

$= 180^\circ - (60^\circ + 60^\circ) = 180^\circ - 120^\circ = 60^\circ$

$\because \angle A = \angle B = \angle C = 60^\circ$

$\therefore$ **$\Delta$ ABC is an equilateral triangle.**

*********** END **********