Exercise 11.1

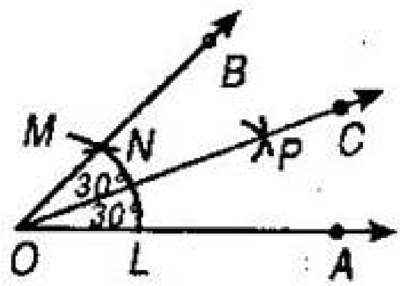
Q3. Construct the angles of the following measurements:

(i) 30°

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

(iii) 15°

Ans. (i) Steps of construction: 30°



(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.

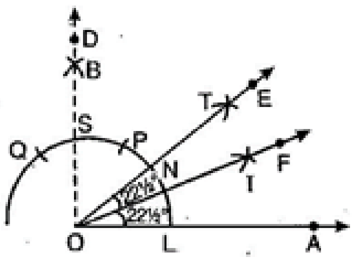
(d) Join O and N draw ray OB. Then $\angle AOB = 60^\circ$.

(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°.

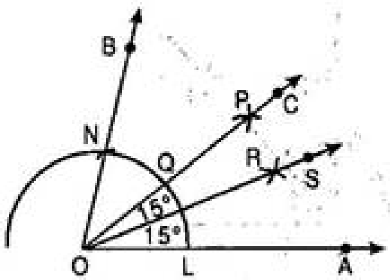
(l) Let ray OE intersect the arc of circle at N.

(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 $\angle AOB = 60^\circ$.

(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 $\angle AOC = \angle BOC = 30^\circ$.

(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°

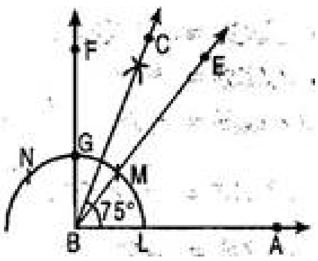
Q4. Construct the following angles and verify by measuring them by a protractor:

(i) 75°

(ii) 105°

(iii) 135°

Ans. (i) Step of construction of 75°



(a) Draw $\angle$ABE = 60° and $\angle$ABF = 90°. [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° is the required angle.

Justification:

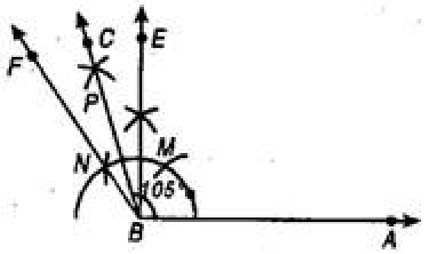
$\angle$ EBF = $\angle$ ABF – $\angle$ ABE = $90^\circ - 60^\circ = 30^\circ$

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°



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

(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° is the required angle.

Justification:

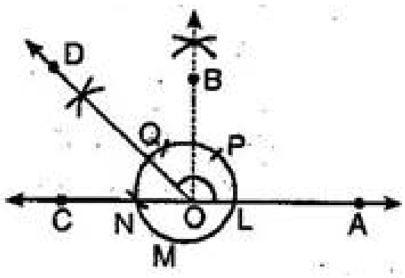
$\angle$ EBF = $\angle$ ABF – $\angle$ ABE= $120^\circ - 90^\circ = 30^\circ$

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°



(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°. $\Rightarrow \angle$ BOC = $\angle$ AOB $= 90^\circ$

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

Then $\angle$ AOD is the required angle of 135°.

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

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 $\angle XBC = 60^\circ$.

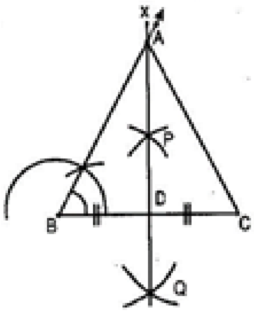
(c) Draw perpendicular bisector PQ of line segment BC.

(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 **********