1. Construct an angle of 90^{o} at the initial point of a given ray and justify the construction.

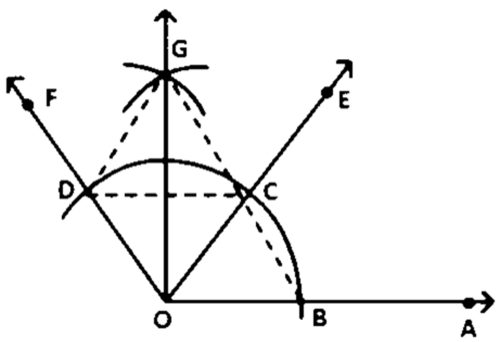
Sol. Given a ray OA.

Required: To construct an angle of 90^{o} at 'O' and justify the construction.

Steps of Construction:

1.Taking O as centre and some radius, draw an arc of a circle, which intersects OA, say at a point B.

2. Taking B as centre and with the same radius as before, draw an arc intersecting the previously drawn arc, say at a point C.



3. Taking C as centre and with the same radius as before, draw an arc intersecting the arc drawn in step 1, say at D.

4. Draw the ray OE passing through C. Then $\angle EOA = 60^{\text{o}}$

Draw the ray OF passing through D. The $\angle FOE = 60^{\text{o}}$

5. Next, taking C and D as centres and with the radius more than CD, draw arcs to intersect each other, say at G.

6. Draw the ray 0G. This ray OG is the bisector of the angle $\angle FOE$, i.e., $\angle FOG = \angle EOG =; \angle FOE = (60^{\text{o}}) = 30^{\text{o}}$

Thus, $\angle GOA = \angle GOE + \angle EOA = 30^{\text{o}} + 60^{\text{o}} = 90^{\text{o}}$

Justification:

(i) Join BC.

Then, OC = OB = BC (By construction)

$\therefore \Delta COB$ is an equilateral triangle.

$\therefore \angle COB = 60^{\text{o}}$

$\therefore \angle EOA = 60^{\text{o}}$

(ii) Join CD.

Then, OD = OC = CD (By construction) ΔDOC is an equilateral triangle.

$\therefore \angle DOC = 60^{o}$

$\therefore \angle FOE = 60^{o}$.

(iii) Join CG and DG.

In ΔODG and ΔOCG,

OD = OC I Radii of the same arc

DG = CG I Arcs of equal radii

OG = OG I Common: $\Delta ODG \cong \Delta OCG$ ISSS Rule

$\therefore \angle DOG = \angle COG$ ICPCT

$\therefore \angle FOG = \angle EOG = \frac{1}{2}\angle FOE = \frac{1}{2}(60^{o}) = 30^{o}$

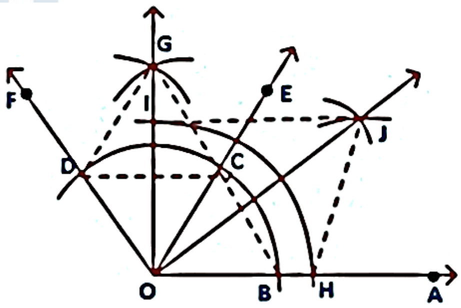
Thus, $\angle GOA = \angle GOE + \angle EOA = 30^{o} + 60^{o} = 90^{o}$.

2. Construct an angle of 45^{o} at the initial point of a given ray and justify the construction.

Sol. Given: A ray OA. Required: To construct an angle of 45^{o} at 0 and justify the construction.

Steps of Construction:

1. Taking 'O' as centre and some radius, draw an arc of a circle, which intersects OA, say at a point B.
2. Taking B as centre and with the same radius as before, draw an arc intersecting the previously drawn arc, say at a point C.
3. Taking C as centre and with the same radius as before, draw an arc intersecting the arc drawn in step 1, say at D.



4. Draw the ray OE passing through C. Then $\angle EOA = 60^{o}$.
5. Draw the ray OF passing through D. Then $\angle FOE = 60^{o}$.
6. Next, taking C and D as centres and with radius more than 1CD, draw arcs to intersect each other, say at G.
7. Draw the ray OG. This ray OG is the bisector of the angle FOE,

i.e., $\angle FOG = \angle EOG = \frac{1}{2}\angle FOE = \frac{1}{2}(60^{o}) = 30^{o}$.

Thus, $\angle GOA = \angle GOE + \angle EOA = 30^{o} + 60^{o} = 90^{o}$

8. Now, taking 0 as centre and any radius, draw an arc to intersect the rays OA and OG, say at H and I respectively.
9. Next, taking H and I as centres and with the radius more than $\frac{1}{2}$ HI, draw arcs to intersect each other, say at J.
10. Draw the ray OJ. This ray OJ is the required bisector of the angle GOA.

Thus, $\angle GOJ = \angle AOJ = \frac{1}{2}\angle GOA = \frac{1}{2}(90^o) = 45^o$

Justification:

(i)Join BC.

Then, OC = OB = BC triangle. (By construction)

$\therefore\ \angle COB$ is an equilateral triangle.

$\therefore\ \angle COB = 60^o$

$\therefore\ \angle EOA = 60^o$

(ii) Join CD.

Then, OD = OC = CD (By construction)

DOC is an equilateral triangle

$\therefore\ \angle DOC = 60^o$

$\therefore \angle FOE = 60^o$

(iii) Join CG and DG.

In ΔODG and ΔOCG,

OD = OC I Radii of the same arc

DG = CG I Arcs of equal radii

OG = OG I Common

$\therefore \Delta ODG = \Delta OCG$ |SSS

Rule: $\angle DOG = \angle COG$ $|CPCT$

$\therefore\ \angle FOG = \angle EOG = \frac{1}{2}\angle FOE = \frac{1}{2}(60^o) = 30^o$

Thus, $\angle GOA = \angle GOE + \angle EOA = 30^o + 60^o = 90^o$.

- Join HJ and IJ.

In ΔOIJ and ΔOHJ,

OI = OH | Radii of the same arc

IJ = HJ | Arcs of equal radii

OJ = OJ | Common $\therefore \Delta OIJ = \Delta OHJ$

Rule $\therefore$ $\angle IOJ = \angle HOJ$

$\therefore\ \angle AOJ = \angle GOJ = \frac{1}{2}\ \angle GOA = \frac{1}{2}\ (90^o) = 45^o$

3. Construct the angles of the following measurements:

(i) 30^o

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

(iii) 15^o

Sol.

(i) Steps of Construction

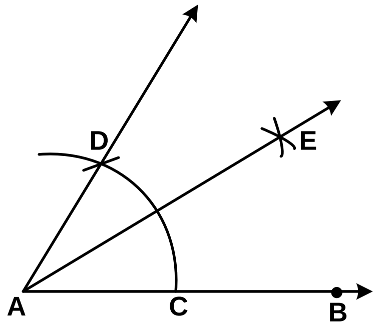
(i) Draw a ray AB at the point A.

(ii) Taking A as centre and a convenient radius, draw an arc which intersect AB at C.

(iii) Taking C as centre and with the same radius, draw an arc which intersect the previous arc at D.

(iv) Taking C and D as centre, draw arcs with equal radius (more than half of CD), which intersect at E.

(v) Draw the ray $AE. \angle EAB$ is the required angle of 30^{o}.



(ii) Steps of Construction

(i) Draw a ray AB at the point A.

(ii) Taking A as centre and a convenient radius, draw an arc which intersect AB at C.

(iii) Taking C as centre and with the same radius, draw an arc which intersect the previous arc at M.

(iv) Similarly, taking M as centre and with the same radius, draw an arc which intersect at N.

(v) Taking M and N as centre, draw arcs with equal radius (more than half of MN), which intersect at P.

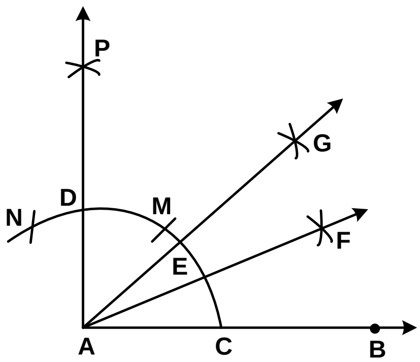
(vi) Draw a ray AP which intersects the main arc at D.

(vii) Taking C and D as centre, draw arcs with equal radius (more than half of CD), which intersect at G.

(viii) Draw a ray AG which intersects the main arc at E.

(ix) Taking C and E as centre, draw arcs with equal radius (more than half of CE), which intersect at F.

(x) Draw an arc AF. Z.FAB is the required angle of $22\frac{1}{2}^{o}$.



(iii) Steps of Construction

(i) Draw a ray AB at the point A.

(ii) Taking A as centre and a convenient radius, draw an arc which intersect AB at C.

(iii) Taking C as centre and with the same radius, draw an arc which intersect the previous arc at D.

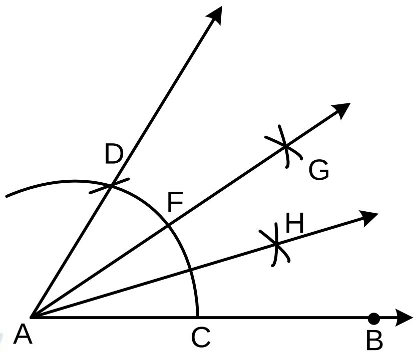
(iv) Taking C and D as centre, draw arcs with equal radius (more than half of CD), which intersect at G.

(v) Draw a ray AG which intersects the main arc at F.

(vi) Taking C and F as centre, draw arcs with equal radius (more than half of CF), which intersect at H.

(vii) Draw a ray AH.

(viii) $\angle HAB$ is the required angle of 15^{o}.

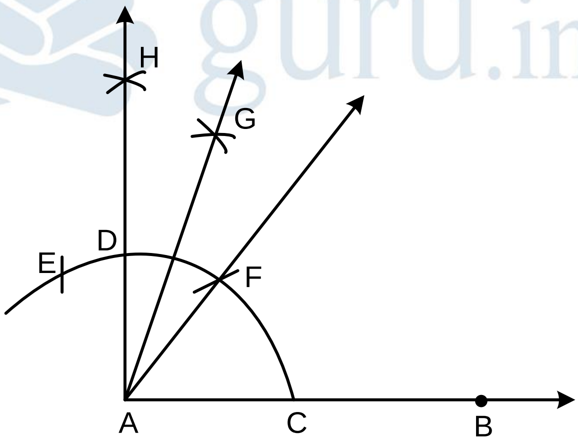


4. Construct the following angles and verify by measuring them by a protractor:

(i) 75^{o} (ii) 105^{o} (iii) 135^{o}

Sol. (i) Steps of Construction

(i) Draw a Ray AB at the point A.

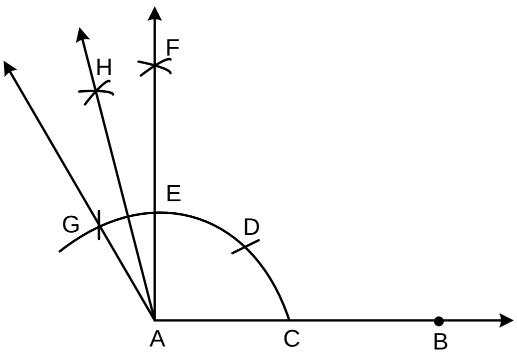


(ii) Taking A as centre and a convenient radius, draw an arc which intersect AB at C.

(iii) Taking C as centre and with the same radius, draw an arc which intersect the previous arc at F.

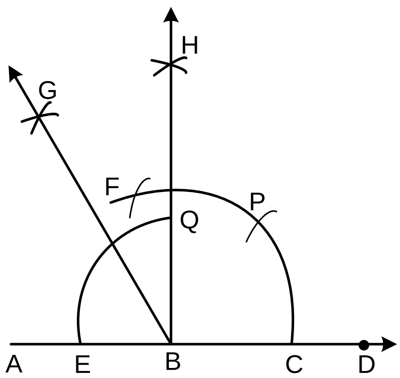
(iv) Similarly, taking E as centre and with the same radius, draw an arc which intersect at E.
(v) Taking E and F as centre, draw arcs with equal radius (more than half of EF), which intersect at H.
(vi) Draw a ray AH which intersects the main arc at D.
(vii) Taking F and D as centre, draw arcs with equal radius (more than half of FD), which intersect at G.
(viii) Draw a ray AG, so $\angle GAB$ is the required angle of 75^{o}.

(ii) Steps of Construction
(i) Draw a ray AB at the point A.



(ii) Taking A as centre and a convenient radius, draw an arc which intersect AB at C.
(iii) Taking C as centre and with the same radius, draw an arc which intersect the previous arc at D.
(iv) Similarly, taking E as centre and with the equal radius, draw an arc which intersect at G.
(v) Taking D and G as centre, draw arcs with same radius (more than half of DG), which intersect at F.
(vi) Draw a ray AF which intersects the main arc at E.
(vii) Taking E and G as centre, draw arcs with equal radius (more than half of EG), which intersect at H.
(viii) Draw a ray AH, $\angle HAB$ is the required angle of 105^{o}.

(iii) Steps of Construction
(i) Draw a ray AD at the point A.

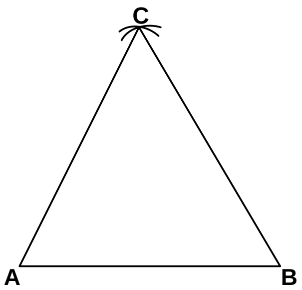


(ii) Taking B as centre and a convenient radius, draw an arc which intersect AD at C.
(iii) Taking C as centre and with the same radius, draw an arc which intersect the previous arc at P.
(iv) Similarly, taking P as centre and with the equal radius, draw an arc which intersect at F.
(v) Taking P and F as centre, draw arcs with same radius (more than half of PF), which intersect at H.
(vi) Draw a ray BH from the point B.
(vii) Taking B as center, draw an arc taking some radius, which intersects AB at E and BH at Q.
(viii) Taking E and Q as centre, draw arcs with equal radius (more than half of EQ), which intersect at G.
(ix) Draw a ray $BG, \angle GBD$ is the required angle of 135°,

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

Steps of Construction

(i) Draw a line segment AB of given measurement.



(ii) Taking A and B as centre, draw arcs with same radius (equal to AB), which intersect at C.
(iii) Join A to C and B to C.
(iv) ΔABC is the required equilateral triangle.

Justification

In ΔABC,

$AB = BC$ [$\because$ By construction]

$AC = BC$ [$\because$ By construction]

Hence, $AB = BC = AC$

$\Rightarrow$ Triangle ABC is an equilateral triangle.

6. Construct a triangle ABC in which $BC = 7\,cm$, $\angle B = 75^{o}$ and $AB + AC = 13\,cm$.

Sol. **Steps of construction**

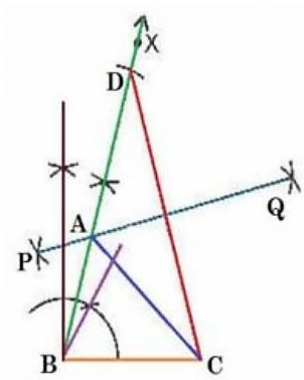
(i) Draw a line segment BC = 7 cm.
(ii) Using ruler and compass, draw an angle $\angle CBX = 75^{o}$.
(iii) Taking B as centre and 13 cm as radius, mark an arc on BX, which intersects at D.
(iv) Join CD and draw a perpendicular bisector (PQ) of CD, which intersects BD at A.
(v) Join AC.
(vi) Triangle ABC is the required triangle.

Justification

Point A lies on the perpendicular bisector of DC. So, AD = AC Here, $AB = BD - AD$

$\Rightarrow AB = BD - AC \qquad [\because AD = AC]$

$\Rightarrow AB + AC = BD$



7. Construct a triangle ABC in which $BC = 8cm$, $\angle B = 45^o$ and $AB - AC = 3.5\ cm$.

Sol.

Steps of construction

(i) Draw a line segment BC = 8 cm.

(ii) At point B, using ruler and compass, draw an angle $\angle CBX = 45^o$.

(iii) Taking B as centre and radius 3.5 cm, mark an arc, which intersects AX at D.

(iv) Join CD and draw a perpendicular bisector (MN) of CD, which intersects at BD produced at A.

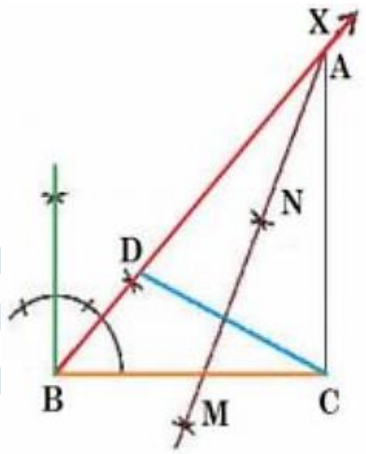
(v) Join AC.

(vi) Triangle ABC is the required triangle.

justification

Point A lies on the perpendicular bisector of DC. So, AD = AC Here, BD = AB - AD

$\Rightarrow BD = AB - AC \qquad [\because AD = AC]$



8. Construct a triangle PQR in which $QR = 6cm$, $\angle Q = 60^o$ and $PR - PQ = 2cm$.

Sol. **Steps of construction**

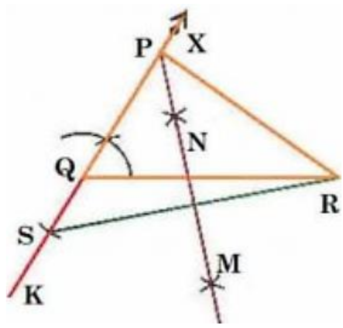
(i) Draw a line segment QR = 6 cm.

(ii) At point Q, using ruler and compass, draw an angle $\angle RQX = 60^o$. Produce XQ to K.

(iii) Taking Q as centre and 2 cm as radius, draw an arc which intersects QK at S.

(iv) Join SR and draw the perpendicular bisector (MN) of SR, which intersects QX at point P.

(v) Join PR. Triangle PQR is the required triangle.



Justification

Point P lies on the perpendicular bisector of SR. So, PS = PR

Here, QS = PS – PQ

$\Rightarrow QS = PR - AC$ $\quad [\because PS = PR]$

9. Construct a triangle XYZ in which $\angle Y = 30^o$, $\angle Z = 90^o$ and $XY + YZ + ZX = 11\,cm$.

Sol. Steps of construction

(i) Draw a line segment AB = 11 cm.

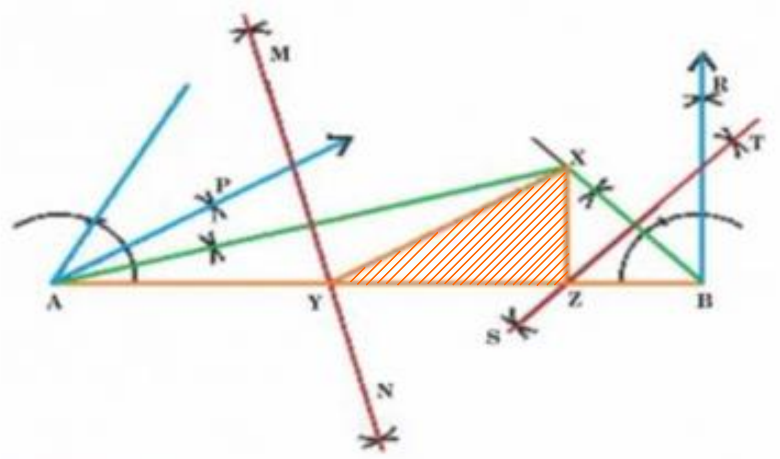
(ii) At A, using ruler and compass, draw an angle $\angle BAX = 15^o$ and at point B, draw an angle $\angle ABX = 45^o$.

(iii) Draw the perpendicular bisector (MN) of AX, which intersects AB at Y.

(iv) Draw the perpendicular bisector (ST) of BX, which intersects AB at Z.

(v) Join X to Y and X to L

(vi) Triangle XYZ is the required triangle.



Justification

Point Y lies on the perpendicular bisector of AX. So, AY = XY

Point Z lies on the perpendicular bisector of BX. So, BZ = ZX

So, $BZ = ZX$

Here, $AB = AY + YZ + ZB$

$\Rightarrow AB = XY + YZ + ZX$

$[\because AY = XY$ or $YZ + ZX]$

$\angle XYZ$ is the exterior angle of triangle AXY.

Therefore, $\angle XYZ = \angle YXA + \angle YAX = 15^o + 15^o = 30^o$

Similarly, $\angle XZY$ is the exterior angle of triangle BXZ.

Hence, $\angle XZY = \angle ZXB + \angle ZBX = 45^o + 45^o = 90^o$

10. Construct a right triangle whose base is 12cm and sum of its hypotenuse and other side is 18 cm.

Sol. **Steps of construction**

(i) Draw a line segment AB = 12 cm.

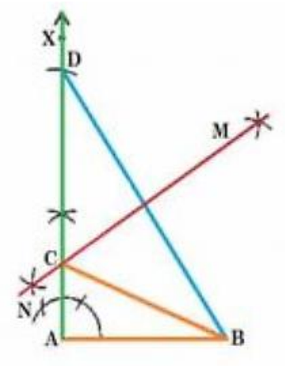
(ii) At point A, using ruler and compass, draw an angle $\angle BAX = 90^o$.

(iii) Taking A as centre and 18 cm as radius, draw an arc which intersects AX at D.

(iv) Join B to D. Draw a perpendicular bisector (MN) of BD which intersects AD at C.

(v) Join B to C. Triangle ABC is the required triangle.

Justification



Point C lies on the perpendicular bisector of BD.

So, $BC = CD$

Here, $AD = AC + CD$

$\Rightarrow AD = AC + BC$ $[\because BC = CD]$