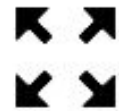


(Chapter – 11)(Constructions)
(Class - 9)
Exercise 11.1



Question 1:

Construct an angle of 90° at the initial point of a given ray and justify the construction.

Answer 1:

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 E.
- (iv) Similarly, taking E as centre and with the same radius, draw an arc which intersect at F.
- (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 AG. $\angle PAQ$ is the required angle of 90° .

Justification: Join AE, CE, EF, FG and GE.

$AC = CE = AE$ [\because By Construction]

$\Rightarrow \triangle ACE$ is an equilateral triangle.

$\Rightarrow \angle CAE = 60^\circ$... (1)

Similarly, $\angle AEF = 60^\circ$... (2)

Hence, $\angle CAE = \angle AEF$ [\because From (1) and (2)]

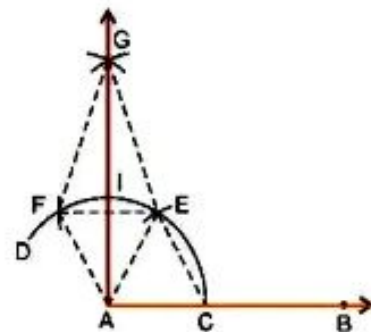
$\angle CAE$ and $\angle AEF$ alternate angles, therefore

$FE \parallel AC$

Here, $FG = EG$ [\because By Construction]

\Rightarrow Point G lies on the perpendicular bisector of EF. $\Rightarrow \angle GIE = 90^\circ$

Hence, $\angle GAB = \angle GIE = 90^\circ$ [\because Corresponding angles]



Question 2:

Construct an angle of 45° at the initial point of a given ray and justify the construction.

Answer 2:

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 D as centre and with the same radius, draw an arc which intersect at E.
- (v) Taking D and E as centre, draw arcs with equal radius (more than half of DE), which intersect at F.
- (vi) From the point A, draw a ray AF, which intersects arc DE at G.
- (vii) Taking C and G as centre, draw arcs with equal radius (more than half of CG), which intersect at H.
- (viii) From the point A, draw a ray AH.
- (ix) $\angle HAB$ is the required angle of 45° .

Justification: Join GH and CH.

In $\triangle AGH$ and $\triangle ACH$,

$GH = CH$ [\because Arcs of equal radii]

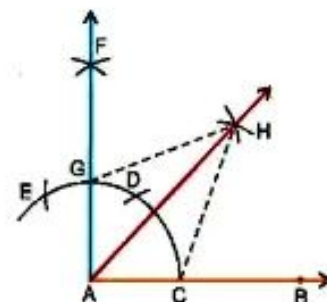
$AG = AC$ [\because Radii of same circle]

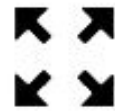
$AH = AH$ [\because Common]

So, $\triangle AGH \cong \triangle ACH$ [\because SSS Congruency rule]

$\angle GAH = \angle CAH$ [\because CPCT]

Hence, $\angle GAH = \angle CAH = 45^\circ$





Question 3:

Construct the angles of the following measurements:

(i) 30°

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

(iii) 15°

Answer 3:

(i) Steps of Construction

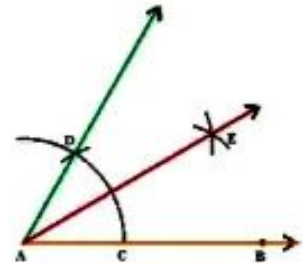
(i) Draw a ray AB at the point A.

(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° .



(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.

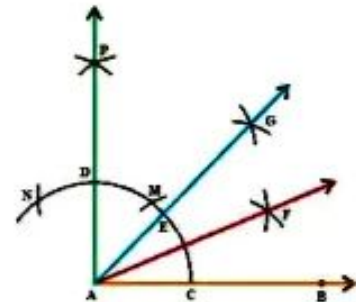
(vi) Draw a ray AP which intersects the main arc at D.

(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. $\angle FAB$ is the required angle of $22\frac{1}{2}^\circ$.



(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.

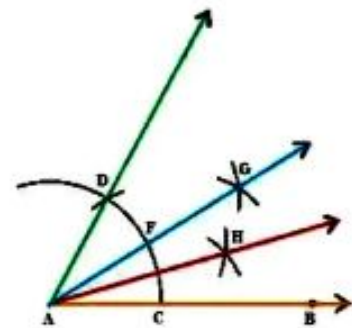
(iv) Taking C and D as centre, draw arcs with equal radius (more than half of CD), which intersect at G.

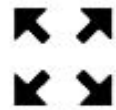
(v) Draw a ray AG which intersects the main arc at F.

(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° .





Question 4:

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

(i) 75°

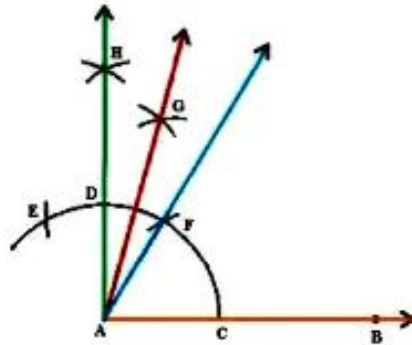
(ii) 105°

(iii) 135°

Answer 4:

(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.

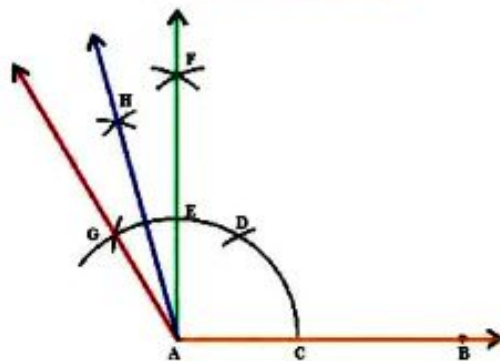
(vi) Draw a ray AH which intersects the main arc at D.

(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. $\angle GAB$ is the required angle of 75° .

(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.

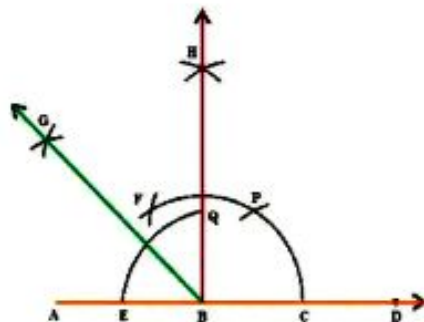
(vii) Taking E and G as centre, draw arcs with equal radius (more than half of EG), which intersect at H.

(viii) Draw a ray AH. $\angle HAB$ is the required angle of 105° .



(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° .

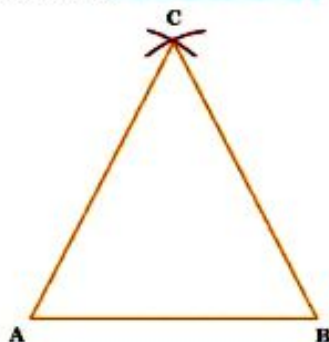
Question 5:

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

Answer 5:

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) $\triangle ABC$ is the required equilateral triangle.

Justification

In $\triangle ABC$,

$AB = BC$ [\because By construction]

$AC = BC$ [\because By construction]

Hence, $AB = BC = AC$

\Rightarrow Triangle ABC is an equilateral triangle.



Question 1:

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

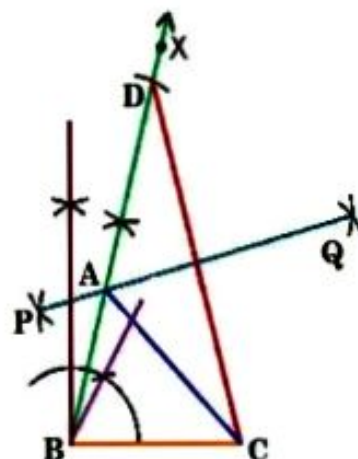
Answer 1:

Steps of construction

- (i) Draw a line segment $BC = 7\text{cm}$.
- (ii) Using ruler and compass, draw an angle $\angle CBX = 75^\circ$.
- (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, $AB = BD - AD$
 $\Rightarrow AB = BD - AC$ $[\because AD = AC]$
 $\Rightarrow AB + AC = BD$



Question 2:

Construct a triangle ABC in which $BC = 8\text{cm}$, $\angle B = 45^\circ$ and $AB - AC = 3.5\text{cm}$.

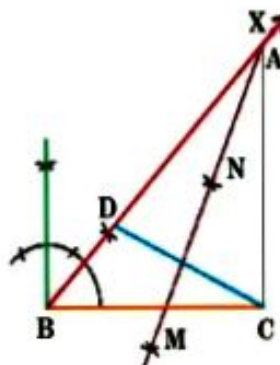
Answer 2:

Steps of construction

- (i) Draw a line segment $BC = 8\text{cm}$.
- (ii) At point B, using ruler and compass, draw an angle $\angle CBX = 45^\circ$.
- (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, $BD = AB - AD$
 $\Rightarrow BD = AB - AC$ $[\because AD = AC]$



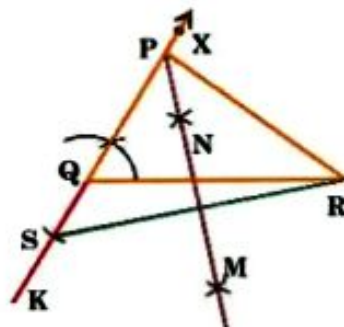
Question 3:

Construct a triangle PQR in which $QR = 6\text{cm}$, $\angle Q = 60^\circ$ and $PR - PQ = 2\text{cm}$.

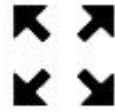
Answer 3:

Steps of construction

- (i) Draw a line segment $QR = 6\text{cm}$.
- (ii) At point Q, using ruler and compass, draw an angle $\angle RQX = 60^\circ$. 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.



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Justification

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

Here, QS = PS - PQ

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

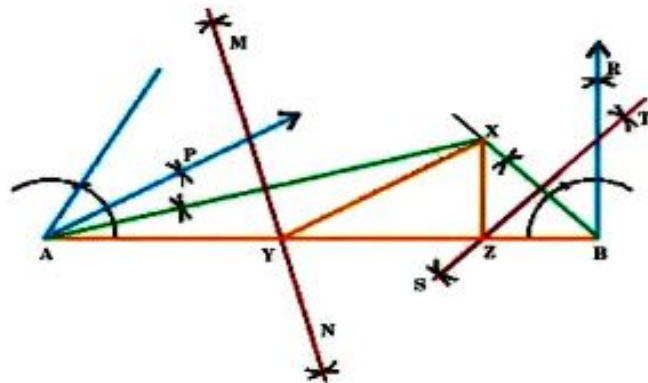
Question 4:

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

Answer 4:

Steps of construction

- (i) Draw a line segment AB = 11 cm.
- (ii) At A, using ruler and compass, draw an angle $\angle BAX = 15^\circ$ and at point B, draw an angle $\angle ABX = 45^\circ$.
- (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 Z.
- (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

Here, AB = AY + YZ + ZB

$\Rightarrow AB = XY + YZ + ZX$

[$\because AY = XY$ और $BZ = ZX$]

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

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

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

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

Question 5:

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

Answer 5:

Steps of construction

- (i) Draw a line segment AB = 12 cm.
- (ii) At point A, using ruler and compass, draw an angle $\angle BAX = 90^\circ$.
- (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

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

