

Mathematics

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(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

- Draw a ray AB at the point A.
- Taking A as centre and a convenient radius, draw an arc which intersect AB at C.
- Taking C as centre and with the same radius, draw an arc which intersect the previous arc at E.
- Similarly, taking E as centre and with the same radius, draw an arc which intersect at F.
- Taking E and F as centre, draw arcs with equal radius (more than half of EF), which intersect at H.
- 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)]

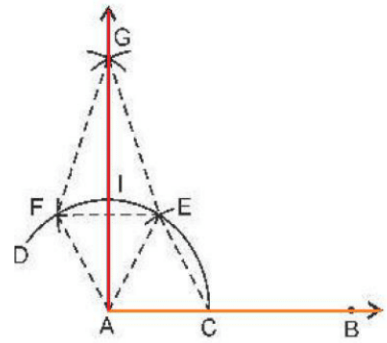
$\angle CAE$ and $\angle AEF$ alternate angles, therefore

$FE \parallel AC$

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

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

Justification: Join GH and CH.

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

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

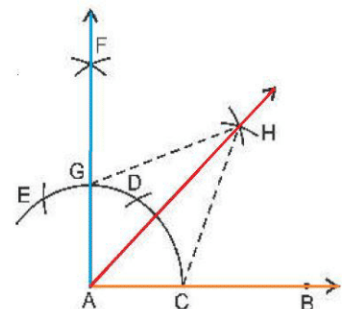
$AG = AC$ [\because Radii of same circle]

$AH = AH$ [\because Common]

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

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

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



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Question 3:

Construct the angles of the following measurements:

(i) 30°

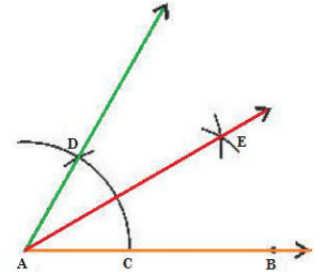
(ii) $22\frac{1}{2}^\circ$

(iii) 15°

Answer 3:

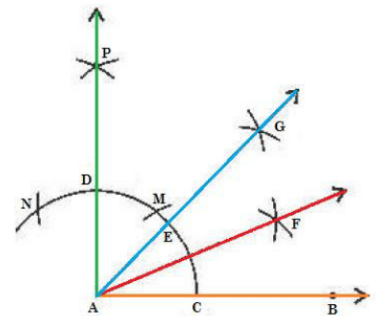
(i) Steps of Construction

- (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° .



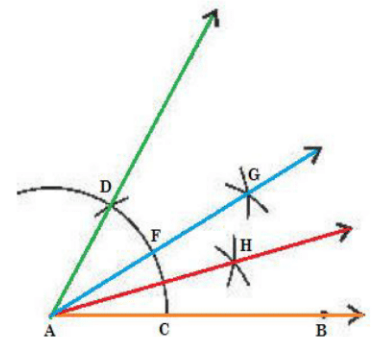
(ii) Steps of Construction

- (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° .



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Question 4:

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

(i) 75°

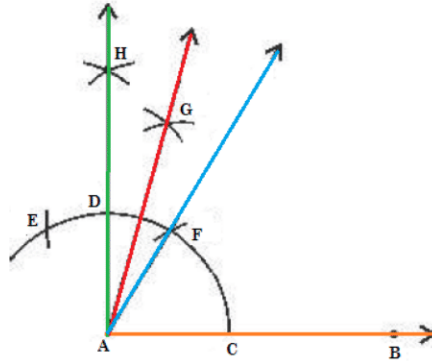
(ii) 105°

(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.

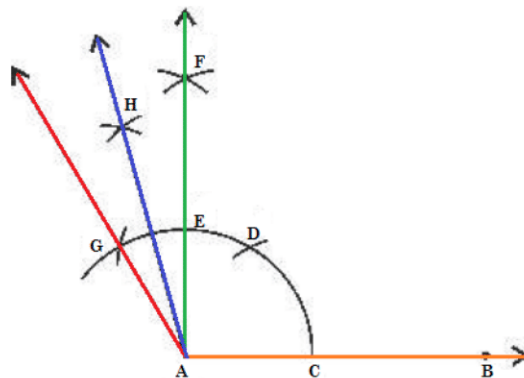
(vi) Draw a ray AH which intersects the main arc at D.

(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° .

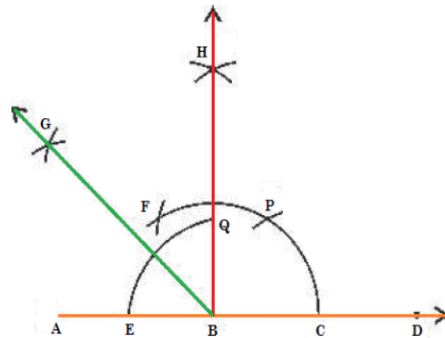
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(iii) Steps of Construction

(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.

(viii) Draw a ray BG. $\angle GBD$ is the required angle of 135° .

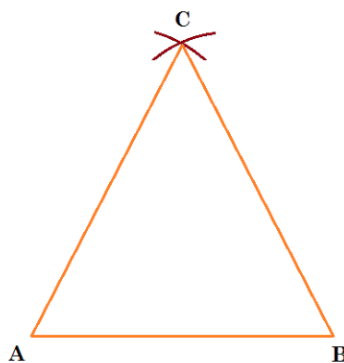
Question 5:

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.

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