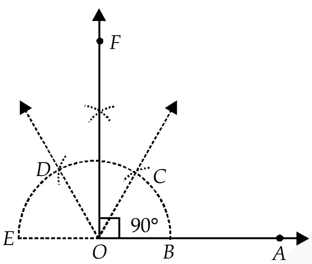
Constructions

CHAPTER 11

NCERT FOCUS SOLUTIONS

EXERCISE - 11.1

1. Steps of Construction :



Step I : Draw a ray OA.

Step II : Taking O as centre and suitable radius, draw a semicircle, cutting $\overrightarrow{OA}$ at B.

Step III : Keeping the radius same, and starting from B, mark points C, D and E on the semicircle such that $\overset{\frown}{BC} = \overset{\frown}{CD} = \overset{\frown}{DE}$.

Step IV : Draw $\overrightarrow{OC}$ and $\overrightarrow{OD}$.

Step V : Draw $\overrightarrow{OF}$, the bisector of $\angle COD$.

Then, $\angle AOF = 90°$

Justification :

Since, O is the centre of the semicircle and $\overset{\frown}{BC} = \overset{\frown}{CD} = \overset{\frown}{DE}$

$\Rightarrow \quad \angle BOC = \angle DOC = \angle DOE$

[$\because$ Equal arcs subtend equal angles at the centre]

Now, as $\angle BOC + \angle COD + \angle DOE = 180°$

$\therefore \quad \angle BOC + \angle BOC + \angle BOC = 180°$

$\Rightarrow \quad 3\angle BOC = 180°$

$\Rightarrow \quad \angle BOC = 60°$

Similarly, $\angle COD = 60°$ and $\angle DOE = 60°$

$\because \quad OF$ is the bisector of $\angle COD$

$\therefore \quad \angle COF = \frac{1}{2}\angle COD = \frac{1}{2}(60°) = 30°$

Now, $\angle BOC + \angle COF = 60° + 30°$

$\Rightarrow \quad \angle BOF = 90°$ or $\angle AOF = 90°$

2. Steps of Construction :

Step I : Draw a ray OA.

Step II : Taking O as centre and suitable radius, draw a semicircle cutting $\overrightarrow{OA}$ at B.

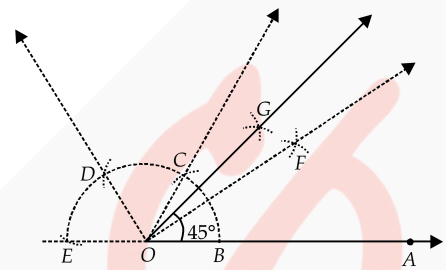
Step III : Keeping the radius same and starting from B, mark points C, D and E on the semicircle such that $\overset{\frown}{BC} = \overset{\frown}{CD} = \overset{\frown}{DE}$.

Step IV : Draw $\overrightarrow{OC}$ and $\overrightarrow{OD}$.

Step V : Draw $\overrightarrow{OF}$, the angle bisector of $\angle BOC$.

Step VI : Draw $\overrightarrow{OG}$, the angle bisector of $\angle FOC$.

Then, $\angle BOG = 45°$ or $\angle AOG = 45°$



Justification :

Since, O is the centre of the semicircle and $\overset{\frown}{BC} = \overset{\frown}{CD} = \overset{\frown}{DE}$

$\therefore \quad \angle BOC = \angle COD = \angle DOE$

[$\because$ Equal arcs subtend equal angles at the centre]

Now, as $\angle BOC + \angle COD + \angle DOE = 180°$

$\therefore \quad \angle BOC = 60°$

$\because \quad \overrightarrow{OF}$ is the bisector of $\angle BOC$.

$\therefore \quad \angle BOF = \frac{1}{2}\angle BOC = \frac{1}{2}(60°) = 30°$ ...(i)

Also, $\overrightarrow{OG}$ is the bisector of $\angle COF$.

$\therefore \quad \angle FOG = \frac{1}{2}\angle COF = \frac{1}{2}(30°) = 15°$ ...(ii)

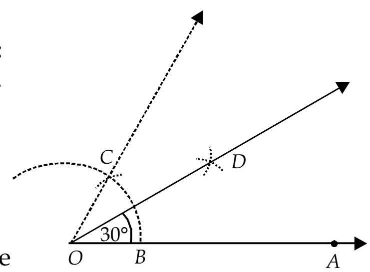
Adding (i) and (ii), we get

$\angle BOF + \angle FOG = 30° + 15° = 45°$

$\Rightarrow \quad \angle BOG = 45°$

3. (i) Angle of 30°

Steps of Construction :



Step I : Draw a ray OA.

Step II : With O ascentre and suitable radius, draw an arc cutting $\overrightarrow{OA}$ at B.

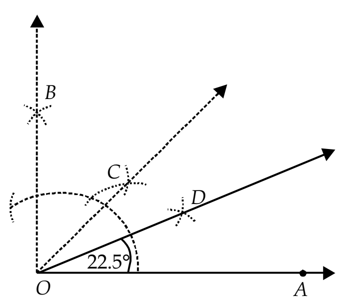
Step III : With B as centre and the same radius as above, draw an arc cutting the previous arc at C.

Step IV : Join $\overrightarrow{OC}$ which gives $\angle BOC = 60°$.

Step V : Draw $\overrightarrow{OD}$, bisector of $\angle BOC$. Then, $\angle AOD = 30°$.

(ii) Angle of $22\frac{1}{2}°$

Steps of Construction :



Step I : Draw a ray OA.

Step II : With O as centre and suitable radius, draw an arc cutting $\overrightarrow{OA}$ at B.

Step III : Keeping the radius same and starting from B mark points C and D on the arc of step II such that $\overset{\frown}{BC} = \overset{\frown}{CD}$.

Step IV : Draw $\overrightarrow{OC}$ and $\overrightarrow{OD}$.

Step V : Draw $\overrightarrow{OE}$, the bisector of $\angle COD$. Then, $\angle AOE = 90°$

Step VI : Draw $\overrightarrow{OF}$, the bisector of $\angle AOE$. Then,

$\angle AOF = \frac{1}{2}\angle AOE = \frac{1}{2}(90°) = 45°$.

Step VII : Draw $\overrightarrow{OG}$, the bisect or of $\angle AOF$, then

$\angle AOG = \frac{1}{2}\angle AOF = \frac{1}{2}(45°) = \left(22\frac{1}{2}\right)^{\circ}$.

(iii) Angle of 15°

Steps of Construction :

Step I : Draw a ray OA.

Step II : With O as centre and suitable radius, draw an arc cutting $\overrightarrow{OA}$ at B.

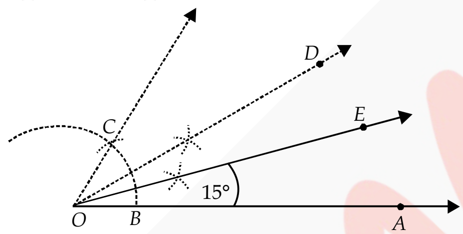
Step III : With B as centre and keeping the radius same, mark a point C on the previous arc and draw $\overrightarrow{OC}$.

Step IV : Draw $\overrightarrow{OD}$, the bisector of $\angle BOC$. Then,

$\angle AOD = \frac{1}{2}\angle BOC = \frac{1}{2}(60°) = 30°$

Step V : Draw $\overrightarrow{OF}$, the bisector of $\angle AOD$. Then,

$\angle AOE = \frac{1}{2}\angle AOD = \frac{1}{2}(30°) = 15°$.



4. (i) Angle of 75°.

Steps of Construction :

Step I : Draw a ray OA.

Step II : With O as centre and suitable radius, draw an arc which cuts $\overrightarrow{OA}$ at B.

Step III : Keeping the radius same and starting from B, mark points C and D on the arc of step II such that $\overset{\frown}{BC} = \overset{\frown}{CD}$. Mark a point C on the previous arc.

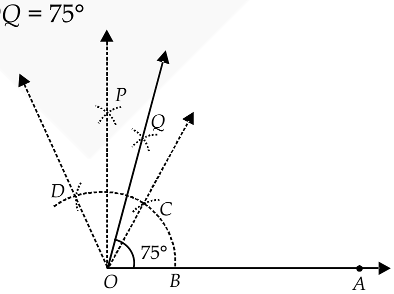
Step IV : Draw $\overrightarrow{OC}$ and $\overrightarrow{OD}$.

Step V : Draw $\overrightarrow{OP}$, the bisector of $\angle COD$. Then, $\angle COP = \frac{1}{2}(60°) = 30°$.

Step VI : Draw $\overrightarrow{OQ}$, the bisector of $\angle COP$. Then, $\angle COQ = 15°$.

Thus, $\angle BOQ = \angle BOC + \angle COQ = 60° + 15° = 75°$

or $\angle AOQ = 75°$



(ii) Angle of 105°

Steps of Construction :

Step I : Draw a ray OA.

Step II : With O as centre and suitable radius, draw an arc which cuts $\overrightarrow{OA}$ at B.

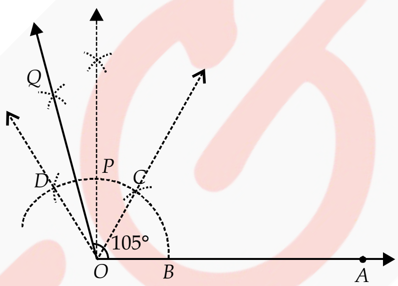
Step III : Keeping the radius same and starting from B, mark points C and D on the arc of step II, such that $\overset{\frown}{BC} = \overset{\frown}{CD}$. Mark a point C on the arc of step II.

Step IV : Draw $\overrightarrow{OC}$ and $\overrightarrow{OD}$.

Step V : Draw $\overrightarrow{OP}$, the bisector of $\angle COD$.

Step VI : Draw $\overrightarrow{OQ}$, the bisector of $\angle POD$.

Then, $\angle AOQ = \angle AOP + \angle POQ = 90° + 15° = 105°$.



(iii) Angle of 135°

Steps of Construction :

Step I : Draw a ray OP.

Step II : With O as centre O and suitable radius, draw an arc which cuts $\overrightarrow{OP}$ at A.

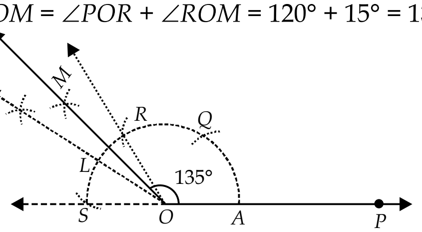
Step III : Keeping the radius same and starting from A, mark points Q, R and S on the arc of step II such that $\overset{\frown}{AQ} = \overset{\frown}{QR} = \overset{\frown}{RS}$.

Step IV : Draw $\overrightarrow{OR}$ and $\overrightarrow{OS}$.

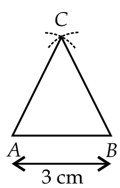
Step V : Draw $\overrightarrow{OL}$, the bisector of $\angle ROS$.

Step VI : Draw $\overrightarrow{OM}$, the bisector of $\angle ROL$.

Then, $\angle POM = \angle POR + \angle ROM = 120° + 15° = 135°$



5. Let us construct an equilateral triangle, each of whose side = 3 cm (say).



Steps of Construction :

Step I : Draw the line segment $AB = 3$ cm

Step II : Taking A as centre and radius equal to 3 cm, draw an arc.

Step III : Taking B as centre and radius equal to 3 cm, draw an arc cutting the previous arc at C.

Step IV : Join AC and BC.

Then, ΔABC is the required equilateral triangle.

Justification :

Clearly, $AC = BC = 3$ cm [Equal radii of arcs]

Thus, $AC = AB = BC = 3$ cm

$\therefore$ ΔABC is an equilateral triangle.

EXERCISE - 11.2

1. Steps of Construction :

Step I : Draw the base $BC = 7$ cm.

Step II : At point B, construct $\angle CBX = 75°$.

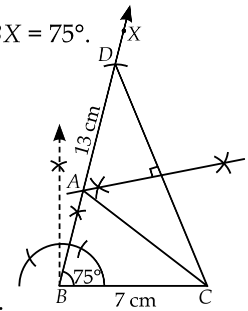
Step III : From $\overrightarrow{BX}$, cut-off $BD = 13$ cm ($= AB + AC$).

Step IV : Join DC.

Step V : Draw perpendicular bisector of CD, which meets BD at A.

Step VI : Join AC.

Then, ABC is the required triangle.



2. Steps of Construction :

Step I : Draw the base $BC = 8$ cm.

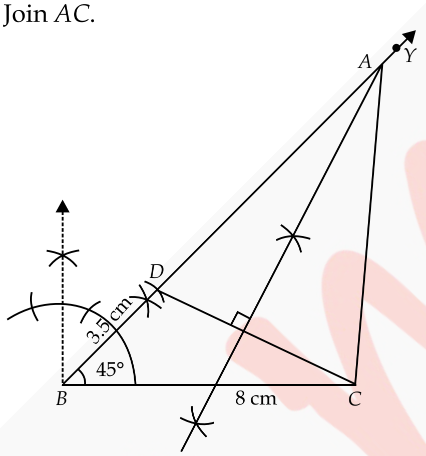
Step II : At point B, construct $\angle CBY = 45°$.

Step III : From $\overrightarrow{BY}$, cut-off $BD = 3.5$ cm ($= AB - AC$)

Step IV : Join DC.

Step V : Draw perpendicular bisector of DC, which intersects $\overrightarrow{BY}$ at A.

Step VI : Join AC.



Then, ABC is the required triangle.

3. Steps of Construction :

Step I : Draw the base $QR = 6$ cm.

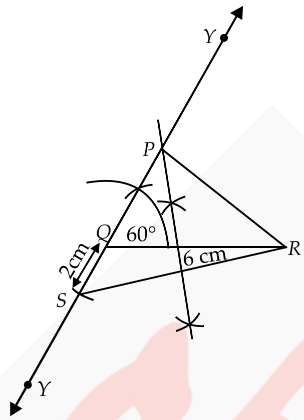
Step II : Construct a line YQY' such that $\angle RQY = 60°$.

Step III : From $\overrightarrow{QY'}$ cut-off $QS = 2$ cm ($= PR - PQ$).

Step IV : Join SR.

Step V : Draw perpendicular bisector of SR, which intersects QY at P.

Step VI : Join PR.



Then, PQR is the required triangle.

4. Steps of Construction :

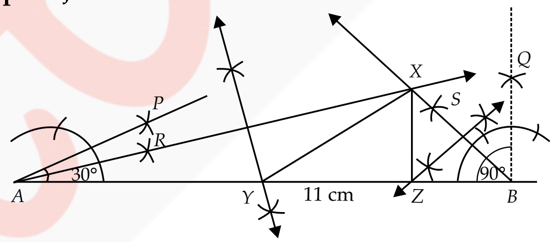
Step I : Draw a line segment $AB = 11$ cm ($= XY + YZ + ZX$)

Step II : Construct $\angle BAP = 30°$ and construct $\angle ABQ = 90°$.

Step III : Draw AR, the bisector of $\angle BAP$ and draw BS, the bisector of $\angle ABQ$. Let AR and BS intersect at X.

Step IV : Draw perpendicular bisector of AX and BX, which intersects AB at Y and Z respectively.

Step V : Join XY and XZ.



Then, XYZ is the required triangle.

5. Steps of Construction :

Step I : Draw base $BC = 12$ cm.

Step II : At point B, construct $\angle CBY = 90°$.

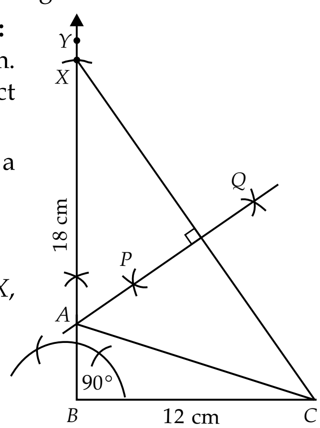
Step III : Along $\overrightarrow{BY}$, cut-off a line segment $BX = 18$ cm.

Step IV : Join CX.

Step V : Draw PQ, perpendicular bisector of CX, which meets BX at A.

Step VI : Join AC.

Then, ABC is the required triangle.



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