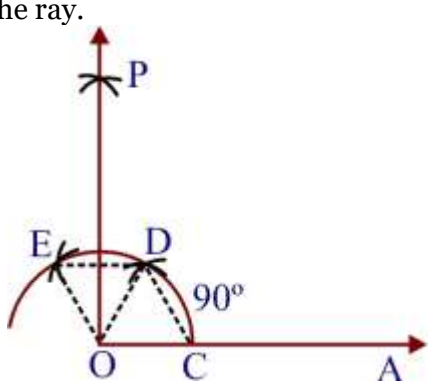
Constructions: Exercise 11.1

Q.1 Construct an angle of 90° at the initial point of a given ray and justify the construction.

***Sol.* Given:** Let OA be the ray.



Steps for construction:

(i) Firstly, draw a ray OA with help of pencil and ruler.
(ii) Take initial point O as centre and any radius, draw an arc which cuts OA at point C.
(iii) Now, take C as centre and same radius, draw an arc which cuts the previous arc at point D.
(iv) And take D as centre and the same radius, draw another arc which cuts the arc at point E.
(v) Now, take D and E as centres, and any radius (more than half of DE), draw two arcs which intersect each other at point P.
(vi) Join OP.
Thus, $\angle AOP = 90^o$ is the required angle.

Justification:

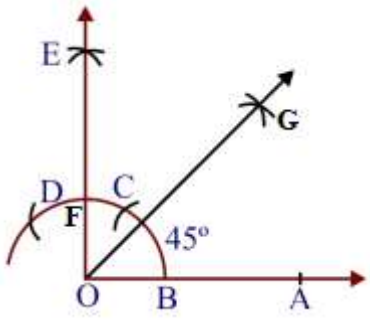
Since, from the construction, OC = CD = OD (arc of same radius)
So, ΔOCD is an equilateral triangle. So, $\angle COD = 60^o$
Again, OD = DE = EO (arc of same radius)
So, ΔODE is also an equilateral triangle. So $\angle DOE = 60^o$
Since, OP bisects $\angle DOE$,

So, $\angle POD = \frac{60^0}{2} = 30^o$.

Now, $\angle AOP = \angle COD + \angle DOP$
$= 60^o + 30^o$
$= 90^o$
Hence Justified.

Q.2 Construct an angle of 45° at the initial point of a given ray and justify the construction.

***Sol.* Given:** Let OA be the ray.



Steps for Construction:

(i) Firstly, draw a ray OA with help of ruler and pencil.
(ii) Take initial point O as centre and any radius draw an arc which cuts OA at point B.

(iii) Take B as centre and same radius cut the previous arc at point C and then take C as centre and same radius cut the arc at point D.
(iv) Now, take points C & D as centre and radius more than half of CD draw the arcs which intersect each other at point E.
(v) Join OE. OE intersect the first arc at point F. Thus, $\angle AOE$ is 90^o.
(vi) Now, take points F & B as centre and radius more than half of arc BD draw the arcs which intersect each other at point G.
(vii) Join OG.
Thus $\angle AOG = 45^o$ is required angle.

Justification:
From the construction, $\angle AOE = 90^o$ and OF is the bisector of $\angle AOE$

So, $\angle AOF = \frac{1}{2}\angle AOE$

$= \frac{1}{2} \times 90^o$

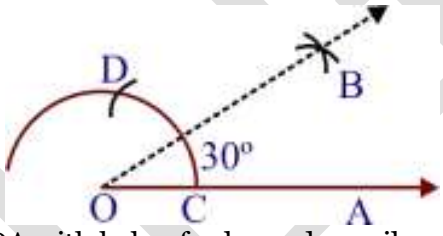
$= 45^o$

Hence Justified.

Q.3 Construct the angles of the following measurements:

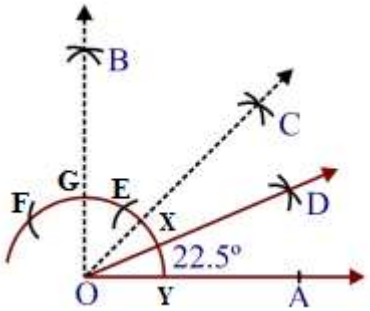
(i) 30^o (ii) $22\frac{1}{2}^o$ (iii) 15^o

***Sol.* Given:** Let OA be the ray.
(i) Steps for Construction:



(i) Firstly, draw a ray OA with help of ruler and pencil.
(ii) Take initial point O as centre and any radius, draw an arc which cuts OA at point C.
(iii) Now, take C as a centre and same radius. Draw an arc which cuts the previous arc at point D.
(iv) Then take points C and D as centres, and any radius (more than half of arc CD), draw two arcs which intersect each other at point B.
(v) Now, join OB.
Thus, $\angle AOB = 30^o$ is the required angle.

(ii) Steps for Construction:



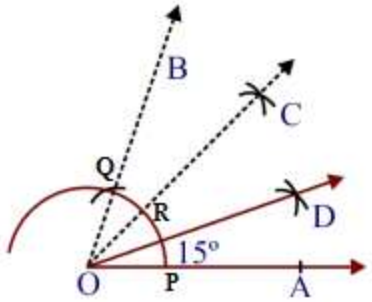
(i) Firstly, draw an angle AOC = 45^o as in previous question.
(ii) Now, take points X and Y as centres, and any radius (more than half of arc XY), draw two arcs which

intersect each other at point D.
(iii) Join OD.

(iv) Thus, angle bisector ∠AOC, such that ∠AOD = ∠COD = $22\frac{1}{2}^{o}$

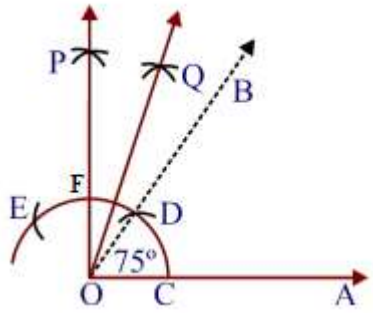
Thus, ∠AOD = $22\frac{1}{2}^{o}$ is required angle.

(iii) Steps for Construction:



(i) Firstly, construct the ∠AOB = 60° as in previous question.
(ii) Now, take points P and Q as centres, and any radius (more than half of arc PQ), draw two arcs which intersect each other at point C.
(iii) Join OC which intersect the arc PQ at R Point. Thus bisector of ∠AOB so that ∠AOC = ∠BOC = 30°.
(iv) Now, take points R and P as centres, and any radius (more than half of arc RP), draw two arcs which intersect each other at point D.
(v) Join OD. Thus, bisector of ∠AOC, so that ∠AOD = ∠COD = 15°
Thus ∠AOD = 15° is the required angle.

Q.4 Construct the following angles and verify by measuring them by a protractor:
(i) 75° (ii) 105° (iii) 135°
***Sol.* (i) Steps for Construction:**



(i) Firstly, draw a ray OA with help of ruler and pencil.
(ii) Now, Construct ∠AOB = 60° and ∠AOP = 90° with help of compass as in previous question.
(iii) Now, take points F and D as centres, and any radius (more than half of arc FD), draw two arcs which intersect each other at point Q.

(iv) Bisector of ∠BOP such that ∠BOQ = $\frac{1}{2}$ ∠BOP

$$= \frac{1}{2}(\angle AOP - \angle AOB)$$

$$= \frac{1}{2}(90^{o} - 60^{o})$$

$= 15^0$

So, $\angle AOQ = \angle AOB + \angle BOQ$

$= 60^0 + 15^0$

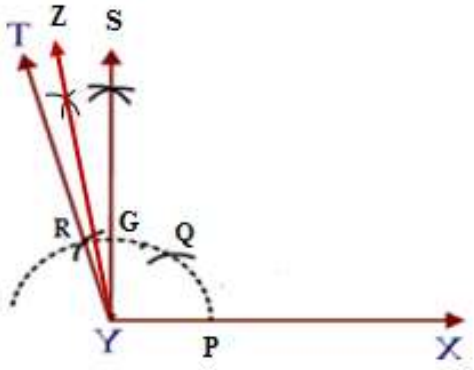
$= 75^0$

Thus, $\angle AOQ = 75^0$ is the required angle.

Verification:

On measuring $\angle AOQ$, with help of the protractor, we find that $\angle AOQ = 75^0$

(ii) Steps for Construction:



(i) Firstly, draw a line segment XY.

(ii) Now, construct $\angle XYT = 120^0$ and $\angle XYS = 90^0$ with help of compass.

$\angle SYT = \angle XYT - \angle XYS$

$= 120^0 - 90^0$

$= 30^0$

(iii) Now, take points R and G as centres, and any radius (more than half of arc RG), draw two arcs which intersect each other at point Z.

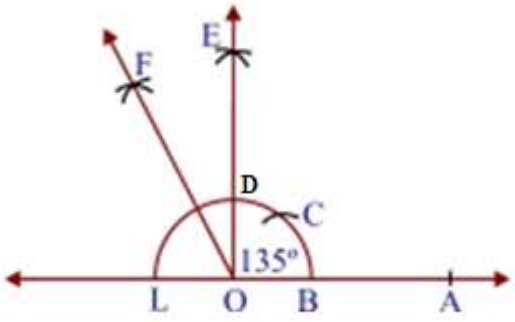
(iv) Join YZ.

ThusAngle bisector $\angle XYZ$ is the required angle of 105^0

Verification:

On measuring $\angle XYZ$, with help of the protractor, we find that $\angle XYZ = 105^0$

(iii) Steps of Construction:



(i) Firstly, draw $\angle AOE = 90^0$ with help of compass as in previous question.

and also $\angle LOE = 90^0$

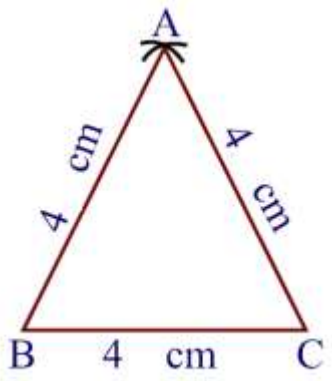
(ii) Now, take points D and L as centres, and any radius (more than half of arc RL), draw two arcs which intersect each other at point F.

(iii) Join FO

Thus, $\angle AOF = 135^0$ is required angle.

Verification:
On measuring ∠AOF, with help of the protractor, we find that ∠AOF = 135°

Q.5 Construct an equilateral triangle, given its side and justify the construction.
Sol. Let's draw an equilateral triangle of side 4 cm (say).



Steps for Construction :
(i) Firstly, draw side BC = 4 cm with help of ruler and pencil.
(ii) Take points B and C as centres and radii equal to BC = 4 cm, then draw two arcs on the same side of BC which intersect each other at point A.
(iii) Now, join AB and AC.

Thus, ABC is the required equilateral triangle.

Justification: Since from construction:
AB = BC = CA = 4 cm
Thus, ΔABC is an equilateral triangle.
Hence justified.