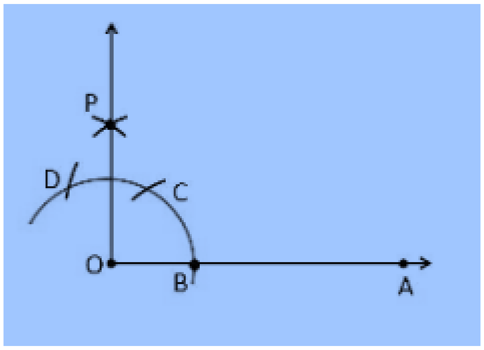
Exercise 11.1

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

Construction Procedure:

To construct an angle 90°, follow the given steps:

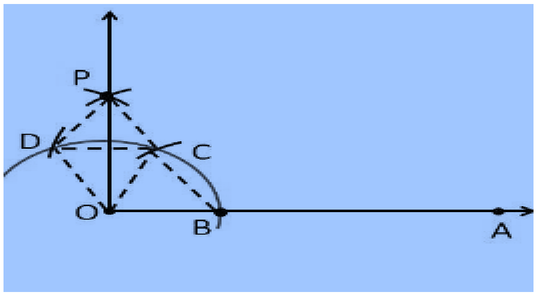
1. Draw a ray OA
2. Take O as a centre with any radius, draw an arc DCB is that cuts OA at B.
3. With B as a centre with the same radius, mark a point C on the arc DCB.
4. With C as a centre and the same radius, mark a point D on the arc DCB.
5. Take C and D as centre, draw two arcs which intersect each other with the same radius at P.
6. Finally, the ray OP is joined which makes an angle 90° with OP is formed.



Justification

To prove ∠POA = 90°

In order to prove this draw a dotted line from the point O to C and O to D and the angles formed are:



From the construction, it is observed that

OB= BC = OC

Therefore OBC is an equilateral triangle

So that, ∠BOC = 60°.

Similarly,

OD= DC = OC

Therefore DOC is an equilateral triangle

So that, ∠DOC = 60°.

From SSS triangle congruence rule

△OBC ≅ OCD

∠BOC= ∠DOC

Therefore, ∠COP = ½ ∠DOC = ½ (60°).

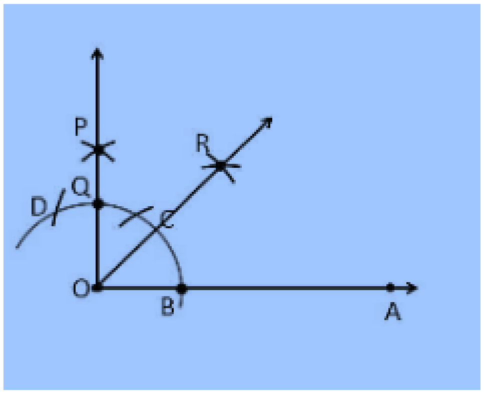
∠COP = 30°

To find the ∠POA = 90°:
∠POA =∠BOC+ ∠COP
∠POA = 60° +30°
∠POA =90°
Hence, justified.

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

Construction Procedure:

1. Draw a ray OA
2. Take O as a centre with any radius, draw an arc DCB is that cuts OA at B.
3. With B as a centre with the same radius, mark a point C on the arc DCB.
4. With C as a centre and the same radius, mark a point D on the arc DCB.
5. Take C and D as centre, draw two arcs which intersect each other with the same radius at P.
6. Finally, the ray OP is joined which makes an angle 90° with OP is formed.
7. Take B and Q as centre draw the perpendicular bisector which intersects at the point R
8. Draw a line that joins the point O and R
9. So, the angle formed ∠ROA = 45°



Justification
From the construction,
∠POA = 90°
From the perpendicular bisector from the point B and Q, which divides the ∠POA into two halves. So it becomes
∠ROA = 1/2 ∠POA
∠ROA = 1/2×90° = 45°
Hence, justified

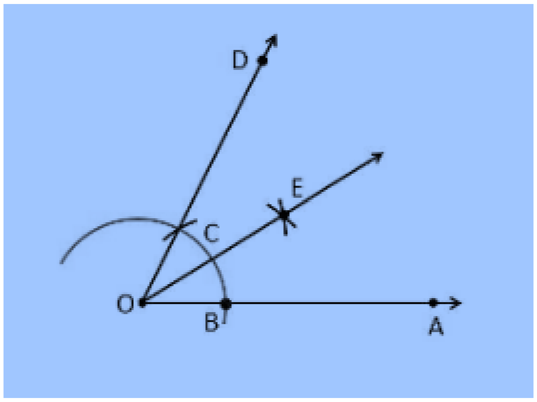
3. Construct the angles of the following measurements:

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

Solution:
(i) 30°

Construction Procedure:

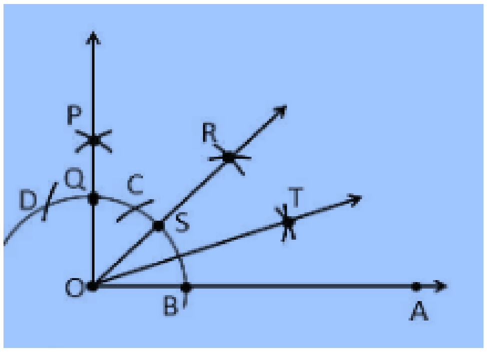
1. Draw a ray OA
2. Take O as a centre with any radius, draw an arc BC which cuts OA at B.
3. With B and C as centres, draw two arcs which intersect each other at the point E and the perpendicular bisector is drawn.
4. Thus, ∠EOA is the required angle making 30° with OA.



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

Construction Procedure:

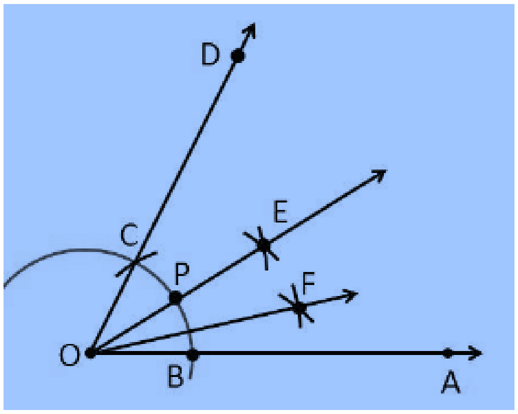
1. Draw an angle ∠POA = 90°
2. Take O as a centre with any radius, draw an arc BC which cuts OA at B and OP at Q
3. Now, draw the bisector from the point B and Q where it intersect at the point R such that it makes an angle ∠ROA = 45°.
4. Again, ∠ROA is bisected such that ∠TOA is formed which makes an angle of 22.5° with OA



(iii) 15°

Construction Procedure:

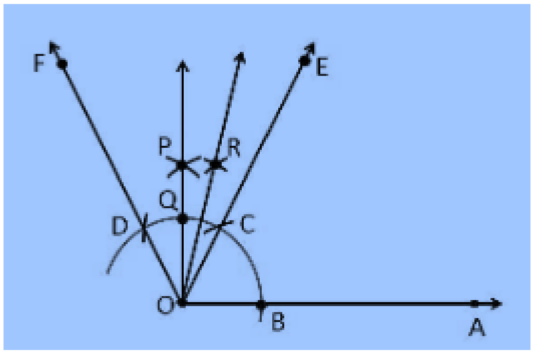
1. An angle ∠DOA = 60° is drawn.
2. Take O as centre with any radius, draw an arc BC which cuts OA at B and OD at C
3. Now, draw the bisector from the point B and C where it intersect at the point E such that it makes an angle ∠EOA = 30°.
4. Again, ∠EOA is bisected such that ∠FOA is formed which makes an angle of 15° with OA.
5. Thus, ∠FOA is the required angle making 15° with OA.



4. Construct the following angles and verify by measuring them by a protractor:
(i) 75° (ii) 105° (iii) 135°

Solution:
(i) 75°

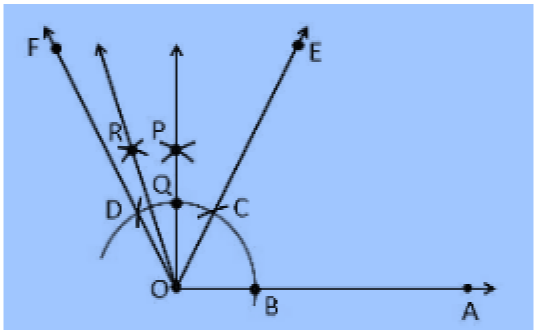
Construction Procedure:
1. A ray OA is drawn.
2. With O as centre draw an arc of any radius and intersect at the point B on the ray OA.
3. With B as centre draw an arc C and C as centre draw an arc D.
4. With D and C as centre draw an arc, that intersect at the point P.
5. Join the points O and P
6. The point that arc intersect the ray OP is taken as Q.
7. With Q and C as centre draw an arc, that intersect at the point R.
8. Join the points O and R
9. Thus, ∠AOE is the required angle making 75° with OA.



(ii) 105°

Construction Procedure:
1. A ray OA is drawn.
2. With O as centre draw an arc of any radius and intersect at the point B on the ray OA.
3. With B as centre draw an arc C and C as centre draw an arc D.

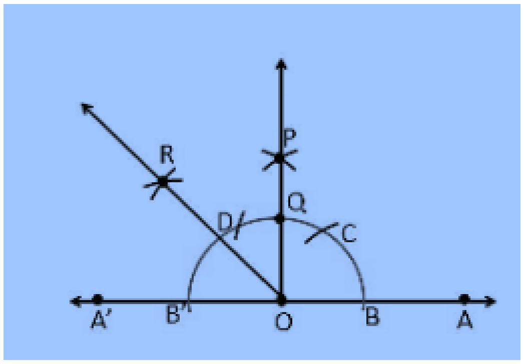
4. With D and C as centre draw an arc, that intersect at the point P.
5. Join the points O and P
6. The point that arc intersect the ray OP is taken as Q.
7. With Q and Q as centre draw an arc, that intersect at the point R.
8. Join the points O and R
9. Thus, ∠AOR is the required angle making 105° with OA.



(iii) 135°

Construction Procedure:

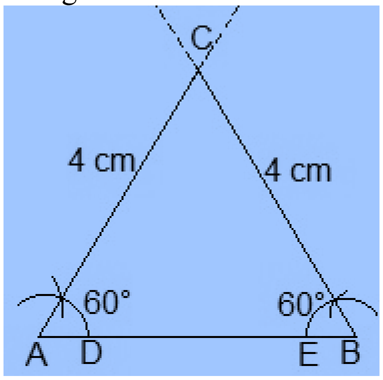
1. Draw a line AOA'
2. Draw an arc of any radius that cuts the line AOA' at the point B and B'
3. With B as centre, draw an arc of same radius at the point C.
4. With C as centre, draw an arc of same radius at the point D
5. With D and C as centre, draw an arc that intersect at the point O
6. Join OP
7. The point that arc intersect the ray OP is taken as Q and it forms an angle 90°
8. With B' and Q as centre, draw an arc that intersects at the point R
9. Thus, ∠AOR is the required angle making 135° with OA.



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

Construction Procedure:

1. Let draw a line segment AB=4 cm .
2. With A and B as centres, draw two arcs on the line segment AB and note the point as D and E.
3. With D and E as centres, draw the arcs that cuts the previous arc respectively that forms an angle of 60° each.
4. Now, draw the lines from A and B that are extended to meet each other at the point C.
5. Therefore, ABC is the required triangle.



Justification:
From construction, it is observed that
AB = 4 cm, $\angle A = 60°$ and $\angle B = 60°$
We know that, the sum of the interior angles of a triangle is equal to 180°
$\angle A + \angle B + \angle C = 180°$
SuBstitute the values
$\Rightarrow 60° + 60° + \angle C = 180°$
$\Rightarrow 120° + \angle C = 180°$
$\Rightarrow \angle C = 60°$
While measuring the sides, we get
BC = CA = 4 cm (Sides opposite to equal angles are equal)
AB = BC = CA = 4 cm
$\angle A = \angle B = \angle C = 60°$
Hence, justified.