

#463868

Topic: Basic Constructions

Show that of all line segments drawn from a given point, not on it, the perpendicular line segment is the shortest.

Solution

Consider a line l on which Y and Z lies.

Now, a point X away from YZ such that $XY \perp l$ and Z is a point on line l other than Y .

In $\triangle XYZ$,

$$\angle Y = 90^\circ$$

So, in $\triangle XYZ$,

$$\Rightarrow \angle YXZ + \angle XZY + \angle XYZ = 180^\circ$$

Putting $\angle XYZ = 90^\circ$

$$\Rightarrow \angle YXZ + \angle XZY = 90^\circ$$

$$\Rightarrow \angle X + \angle Z = 90^\circ$$

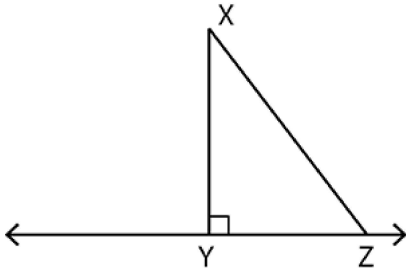
$$\Rightarrow \angle Z < 90^\circ$$

$$\Rightarrow \angle Z < \angle Y$$

$$\Rightarrow XY < XZ$$

(Side opposite to greater angle is greater)

XY is the shortest of all line segments from X to YZ .



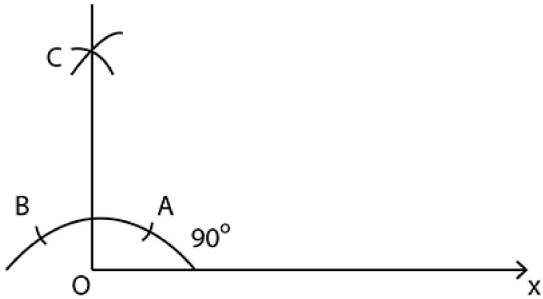
#464070

Topic: Basic Constructions

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

Solution

1. Draw a ray OX .
2. Cut an arc from point O of any length.
3. Cut two arcs A and B on the previous arc (which are at the angle of 60° and 120°).
4. Cut two arcs from points A and B and their point of intersection is C .
5. Join $O - C$. $\angle COX$ is 90° .



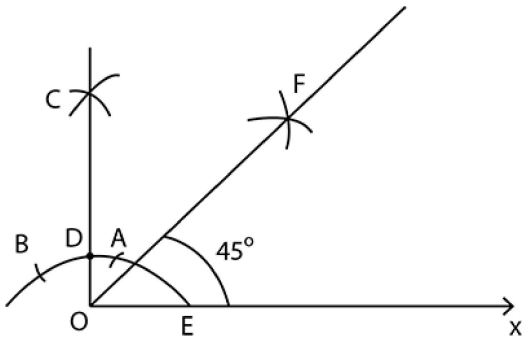
#464071

Topic: Basic Constructions

Construct an angle of 45° from a horizontal line and justify the construction.

Solution

1. Draw a ray OX .
2. Cut an arc from point O of any length.
3. Cut two arcs A and B on the previous arc (which are at the angle of 60 deg and 120 deg).
4. Cut two arc from points A and B and their point of intersection is C .
5. Join $O - C$. $\angle COX$ is 90 deg.
6. Bisect $\angle COX$ through cutting two arcs from D and E , their point of intersection is F .
7. Join $F - O$, $\angle FOX$ is 45 deg.



#464073

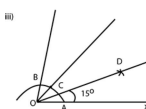
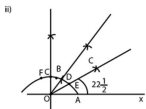
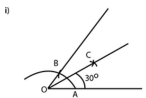
Topic: Basic Constructions

Construct the angles of the following measurements:

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

Solution

- 1)
 1. Draw a ray OX .
 2. Cut an arc from O , cut another arc of same length as OA , which intersects at B .
 3. Cut two arcs from A and B which intersects at C .
 4. Join $O - C$. $\angle COA$ is 30° .
- 2)
 1. Draw a ray OX .
 2. Cut an arc from O , cut 2 another arcs of same length as OA , which intersects as B and F .
 3. Cut two arcs from B and F which intersects at C . ($\angle COX = 90$ deg)
 4. In the similar way, bisect $\angle COX$ to get DOX which is 45 deg angle and then again bisect $\angle DOX$ to get to get EOX .
 6. Join $O - E$. $\angle EOA$ is 22.5° .
- 3)
 1. Draw a ray OX .
 2. Cut an arc from O , cut another arc of same length as OA , which intersects at B .
 3. Cut two arcs from B and A which intersects at C . ($\angle COX = 30$ deg)
 4. In the similar way, bisect $\angle COX$ to get DOX .
 6. Join $O - D$. $\angle DOA$ is 15° .



#464078

Topic: Basic Constructions

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

(i) 75° (ii) 105° (iii) 135° **Solution**

1)

1. Draw a ray OX .
2. Cut an arc from O , cut 2 another arcs of same length as OA , which intersects as B and C .
3. Cut two arcs from B and C which intersects at D . ($\angle DOX = 90^\circ$)
4. Bisect $\angle BOD$ to get DOX to get point E .
6. Join $O - E$. $\angle EOA$ is 75° .

2)

1. Draw a ray OX .
2. Cut an arc from O , cut 2 another arcs of same length as OA , which intersects as B and C .
3. Cut two arcs from B and C which intersects at E . ($\angle EOX = 90^\circ$)
4. In the similar way, bisect $\angle EOC$ to get point D .
6. Join $O - D$. $\angle DOX$ is 105° .

3)

1. Draw a ray OX .
2. Draw angle 90° AOX and draw angle 180° BOX .
3. Cut two arcs from A and B , their point of intersection is C .
6. Join $O - C$. $\angle COX$ is 135° .

