

NCERT Solutions for Class 9 Maths Chapter 11 – Constructions

Exercise 11.1

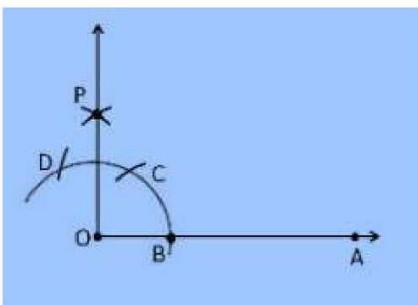
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1. Construct an angle of 90° at the initial point of a given ray and justify the construction.

Construction Procedure:

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

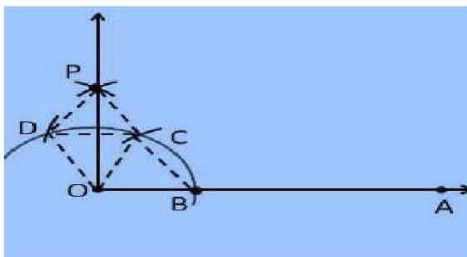
1. Draw a ray OA
2. Take O as a centre with any radius, draw an arc DCB is that cuts OA at B.
3. With B as a centre with the same radius, mark a point C on the arc DCB.
4. With C as a centre and the same radius, mark a point D on the arc DCB.
5. Take C and D as centre, draw two arcs which intersect each 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 $\angle POA = 90^\circ$

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, $\angle BOC = 60^\circ$.

Similarly,

$OD = DC = OC$

Therefore, DOC is an equilateral triangle

So that, $\angle DOC = 60^\circ$.

From SSS triangle congruence rule

$\triangle OBC \cong \triangle OCD$

So, $\angle BOC = \angle DOC$ [By C.P.C.T]

Therefore, $\angle COP = \frac{1}{2} \angle DOC = \frac{1}{2} (60^\circ)$.

$\angle COP = 30^\circ$

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To find the $\angle POA = 90^\circ$:

$$\angle POA = \angle BOC + \angle COP$$

$$\angle POA = 60^\circ + 30^\circ$$

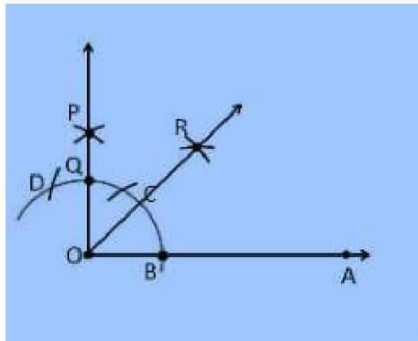
$$\angle POA = 90^\circ$$

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 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 OA.
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 $\angle ROA = 45^\circ$



Justification

From the construction,

$$\angle POA = 90^\circ$$

From the perpendicular bisector from the point B and P, which divides the $\angle POA$ into two halves. So it becomes

$$\angle ROA = \frac{1}{2} \angle POA$$

$$\angle ROA = (\frac{1}{2}) \times 90^\circ = 45^\circ$$

Hence, justified

3. Construct the angles of the following measurements:

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

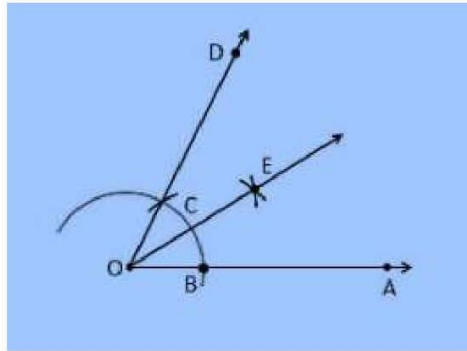
Solution:

(i) 30°

Construction Procedure:

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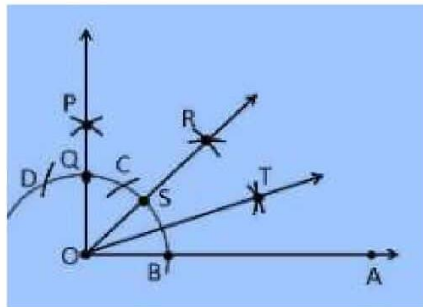
1. Draw a ray OA
2. Take O as a centre with any radius, draw an arc BC which cuts OA at B.
3. With B and C as centres, draw two arcs which intersect each other at the point E and the perpendicular bisector is drawn.
4. Thus, $\angle EOA$ is the required angle making 30° with OA.



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

Construction Procedure:

1. Draw an angle $\angle POA = 90^\circ$
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 intersects at the point R such that it makes an angle $\angle ROA = 45^\circ$.
4. Again, $\angle ROA$ is bisected such that $\angle TOA$ is formed which makes an angle of 22.5° with OA

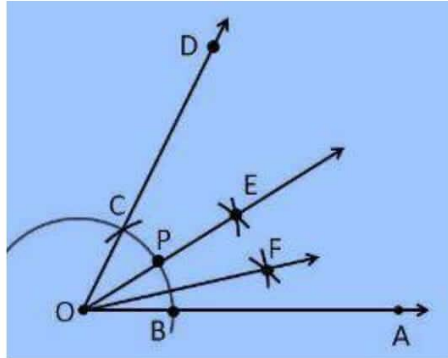


(iii) 15°

Construction Procedure:

1. An angle $\angle DOA = 60^\circ$ 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 intersects at the point E such that it makes an angle $\angle EOA = 30^\circ$.
4. Again, $\angle EOA$ is bisected such that $\angle FOA$ is formed which makes an angle of 15° with OA.
5. Thus, $\angle FOA$ is the required angle making 15° with OA.

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

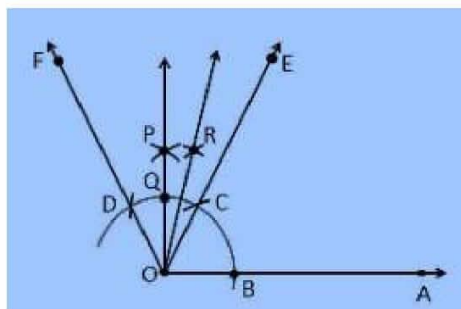
- (i) 75° (ii) 105° (iii) 135°

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, $\angle AOE$ is the required angle making 75° with OA.



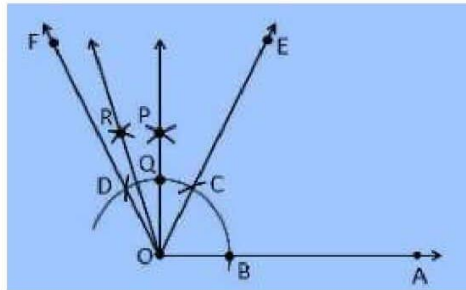
(ii) 105°

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.

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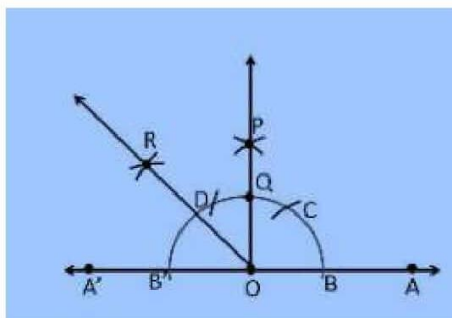
3. With B as centre draw an arc C and C as centre draw an arc D.
4. With D and C as centre draw an arc, that intersect at the point P.
5. Join the points O and P
6. The point that arc intersect the ray OP is taken as Q.
7. With Q and D as centre draw an arc, that intersect at the point R.
8. Join the points O and R
9. Thus, $\angle AOR$ 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 P
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, $\angle AOR$ is the required angle making 135° with OA.

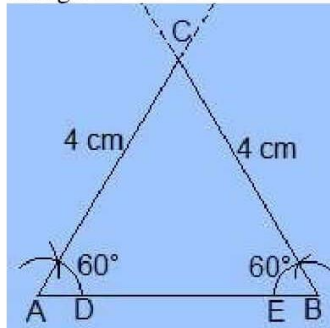


5. Construct an equilateral triangle, given its side and justify the construction.

Construction Procedure:

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1. Let us draw a line segment $AB = 4\text{ cm}$.
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 cut 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

$AB = 4\text{ cm}$, $\angle A = 60^\circ$ and $\angle B = 60^\circ$

We know that, the sum of the interior angles of a triangle is equal to 180°

$$\angle A + \angle B + \angle C = 180^\circ$$

Substitute the values

$$\Rightarrow 60^\circ + 60^\circ + \angle C = 180^\circ$$

$$\Rightarrow 120^\circ + \angle C = 180^\circ$$

$$\Rightarrow \angle C = 60^\circ$$

While measuring the sides, we get

$BC = CA = 4\text{ cm}$ (Sides opposite to equal angles are equal)

$AB = BC = CA = 4\text{ cm}$

$\angle A = \angle B = \angle C = 60^\circ$

Hence, justified.

Exercise 11.2

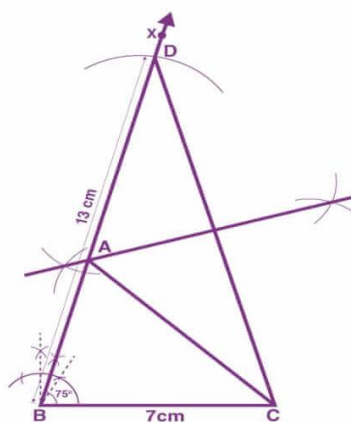
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1. Construct a triangle ABC in which $BC = 7\text{cm}$, $\angle B = 75^\circ$ and $AB+AC = 13\text{ cm}$.

Construction Procedure:

The steps to draw the triangle of given measurement is as follows:

1. Draw a line segment of base $BC = 7\text{ cm}$
2. Measure and draw $\angle B = 75^\circ$ and draw the ray BX
3. Take a compass and measure $AB+AC = 13\text{ cm}$.
4. With B as the centre, draw an arc at the point be D
5. Join DC
6. Now draw the perpendicular bisector of the line DC and the intersection point is taken as A.
7. Now join AC
8. Therefore, ABC is the required triangle.



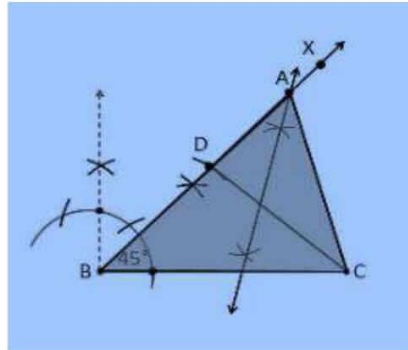
2. Construct a triangle ABC in which $BC = 8\text{cm}$, $\angle B = 45^\circ$ and $AB-AC = 3.5\text{ cm}$.

Construction Procedure:

The steps to draw the triangle of given measurement is as follows:

1. Draw a line segment of base $BC = 8\text{ cm}$
2. Measure and draw $\angle B = 45^\circ$ and draw the ray BX
3. Take a compass and measure $AB-AC = 3.5\text{ cm}$.
4. With B as centre and draw an arc at the point be D on the ray BX
5. Join DC
6. Now draw the perpendicular bisector of the line CD and the intersection point is taken as A.
7. Now join AC
8. Therefore, ABC is the required triangle.

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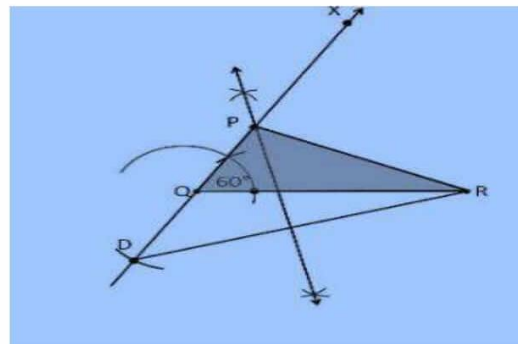


3. Construct a triangle PQR in which $QR = 6\text{cm}$, $\angle Q = 60^\circ$ and $PR - PQ = 2\text{cm}$.

Construction Procedure:

The steps to draw the triangle of given measurement is as follows:

1. Draw a line segment of base $QR = 6\text{ cm}$
2. Measure and draw $\angle Q = 60^\circ$ and let the ray be QX
3. Take a compass and measure $PR - PQ = 2\text{cm}$.
4. Since $PR - PQ$ is negative, QD will be below the line QR .
5. With Q as centre and draw an arc at the point be D on the ray QX
6. Join DR
7. Now draw the perpendicular bisector of the line DR and the intersection point is taken as P .
8. Now join PR
9. Therefore, PQR is the required triangle.



4. Construct a triangle XYZ in which $\angle Y = 30^\circ$, $\angle Z = 90^\circ$ and $XY + YZ + ZX = 11\text{ cm}$.

Construction Procedure:

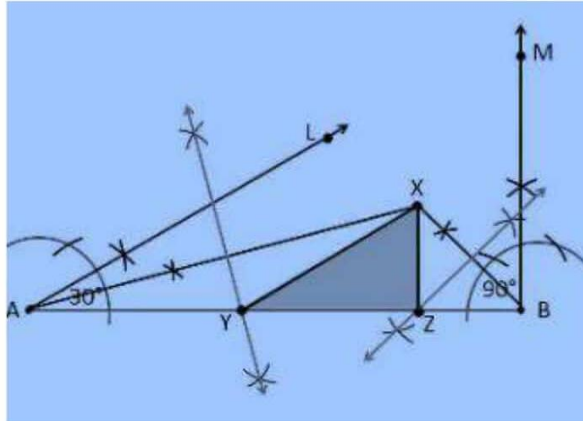
The steps to draw the triangle of given measurement is as follows:

1. Draw a line segment AB which is equal to $XY + YZ + ZX = 11\text{ cm}$.
2. Make an angle $\angle LAB = 30^\circ$ from the point A .
3. Make an angle $\angle MBA = 90^\circ$ from the point B .
4. Bisect $\angle LAB$ and $\angle MBA$ at the point X .
5. Now take the perpendicular bisector of the line XA and XB and the intersection point be Y and Z

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respectively.

6. Join XY and XZ
7. Therefore, XYZ is the required triangle



5. Construct a right triangle whose base is 12cm and sum of its hypotenuse and other side is 18 cm.

Construction Procedure:

The steps to draw the triangle of given measurement is as follows:

1. Draw a line segment of base $BC = 12$ cm
2. Measure and draw $\angle B = 90^\circ$ and draw the ray BX
3. Take a compass and measure $AB + AC = 18$ cm.
4. With B as centre and draw an arc at the point be D on the ray BX
5. Join DC
6. Now draw the perpendicular bisector of the line CD and the intersection point is taken as A.
7. Now join AC
8. Therefore, ABC is the required triangle.

