

**NCERT Solutions for Class 9th Maths Chapter 11
Construction**

Exercise 11.1

Question1.

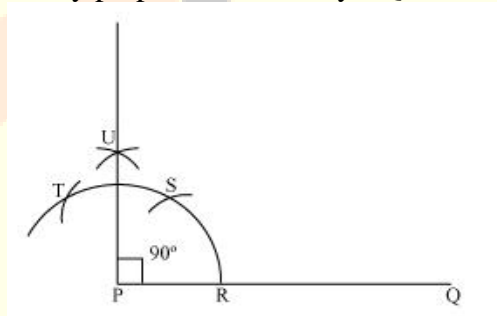
Construct an angle of 90° at the initial point of a given ray and justify the construction

Solution:

The steps for construction are as follows:

PQ is the given ray

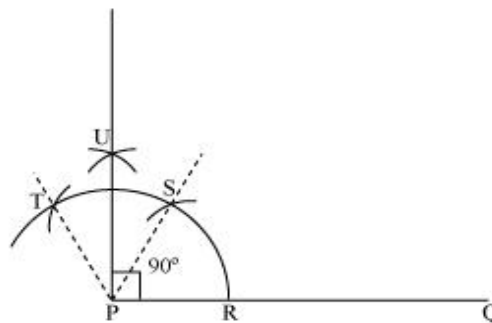
- 1) Draw an arc of some radius with P as its center, intersecting PQ at R.
- 2) With R as center and with the same radius as before, draw an arc intersecting the previously drawn arc, name it S.
- 3) With S as center and with the same radius as before, draw an arc intersecting the arc, name it T.
- 4) With S and T as centers, draw arcs of same radius to intersecting each other. Name it U.
- 5) Join PU, which is the required ray perpendicular to ray PQ.



Justification:

We can justify the construction by proving $\angle UPQ = 90^\circ$.

For this, join PS and PT.



We know that,

$$\angle SPQ = \angle TPS = 60^\circ.$$

And PU is the bisector of $\angle TPS$

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$$\angle UPS = \frac{1}{2} \times \angle TPS = 30^\circ$$

Also, $\angle UPQ = \angle SPQ + \angle UPS = 60^\circ + 30^\circ = 90^\circ$

Question 2:

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

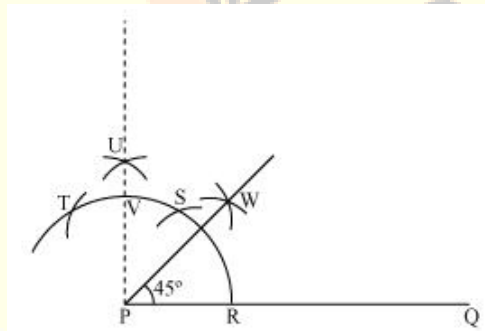
Solution:

Following are the steps of construction:

PQ is the given ray

The below given steps will be followed to construct an angle of 45° .

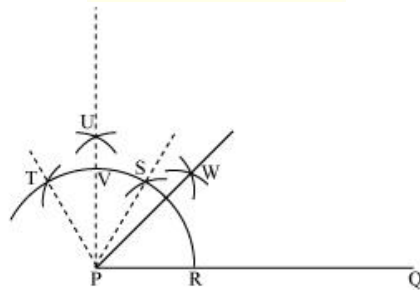
- (i) Draw arc of some radius with P as its center, intersecting PQ at R.
- (ii) With R as center and with the same radius as before, draw arc intersecting the previous arc at S.
- (iii) With S as center and with the same radius as before, draw arc intersecting the arc at T.
- (iv) With S and T as centers, draw arcs of same radius to intersecting each other at U.
- (v) Join PU intersecting arc at V.
- (vi) From R and V, draw arcs with radius more than $\frac{1}{2}RV$ intersecting each other at W. Join PW. PW is the required ray making 45° with PQ.



Justification

We can justify the construction by proving $\angle WPQ = 45^\circ$.

For this, join PS and PT.



Given, $\angle SPQ = \angle TPS = 60^\circ$.

In step (iii) and step (iv) of the construction,

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PU was drawn as the bisector of $\angle TPS$.

$$\angle UPS = \frac{1}{2} \angle TPS = \frac{1}{2} 60 = 30^\circ$$

$$\text{Given, } \angle UPQ = \angle SPQ + \angle UPS = 60^\circ + 30^\circ = 90^\circ$$

In step (vi) of the construction,

PW was drawn as the bisector of $\angle UPQ$.

$$\angle WPQ = 45^\circ$$

Question3:

Construct the angles of the following measurements:

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

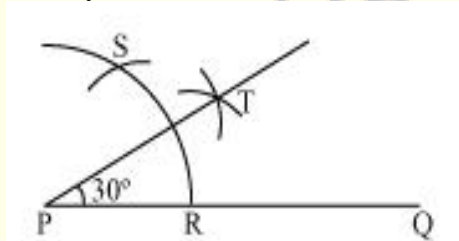
Solution:

- (i) 30°

PQ is the given ray

The below given steps will be followed to construct an angle of 30° .

- (1) Draw arc of some radius with P as its center, intersecting PQ at R.
- (2) With R as center and with the same radius as before, draw an arc intersecting the previously drawn arc at point S.
- (3) With R and S as centers and radius more than $\frac{1}{2}$ RS draw arcs intersecting each other at T. Join PT which makes 30° with the given ray PQ.



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

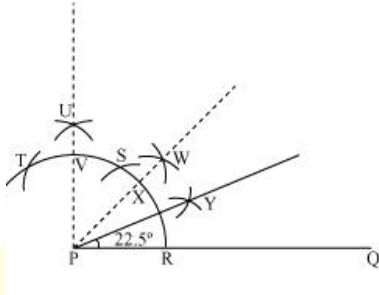
PQ is the given ray

The below given steps will be followed to construct an angle of $22\frac{1}{2}^\circ$.

- (1) Draw arc of some radius with P as its center, intersecting PQ at R
- (2) With R as center and with the same radius as before, draw an arc intersecting the previously drawn arc at point S.
- (3) With S as center and with the same radius as before, draw an arc intersecting the arc at T
- (4) With S and T as centers, draw arcs of same radius intersecting each other at U.
- (5) Join PU let it intersect the arc, name the point V.

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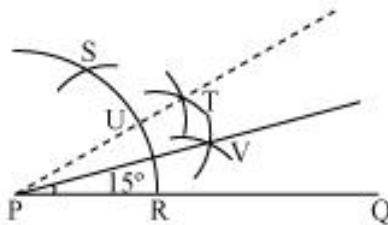
- (6) With R and V, draw arcs with radius more than $\frac{1}{2}RV$ intersecting each other at W. Join PW.
- (7) Let PW intersect the arc at X. With X and R as centers and radius more than $\frac{1}{2}RX$, draw arcs intersecting each other at Y.
- Join PY which is the required ray making an angle of $22\frac{1}{2}^\circ$ with PQ



- (iii) 15°
PQ is the given ray

The below given steps will be followed to construct an angle of 15° .

- (1) Draw arc of some radius with P as its center, intersecting PQ at R
 - (2) With R as center and with the same radius as before, draw an arc intersecting the previously drawn arc at point S.
 - (3) With R and S as centers and radius more than $\frac{1}{2}RS$ draw arcs intersecting each other at T.
 - (4) Let it intersect the arc at U. With U and R as centers and with radius more than $\frac{1}{2}RU$, draw arcs to intersect each other name it V.
- Join PV which makes 15° with the given ray PQ.



Question 4:

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

- (i) 75° (ii) 105° (iii) 135°

Solution:

- (i) 75°
PQ is the given ray

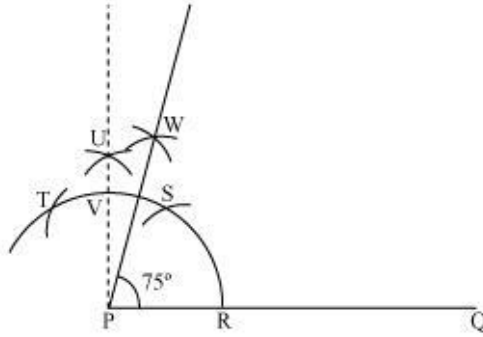
The below given steps will be followed to construct an angle of 75° .

- (i) Draw arc of some radius with P as its center, intersecting PQ at R.

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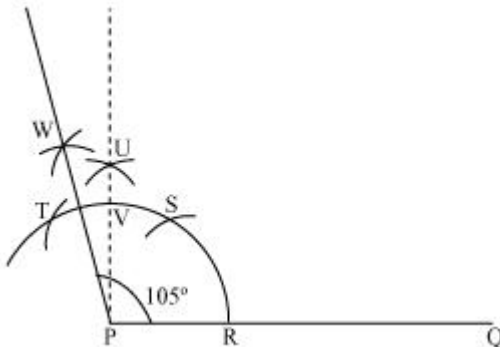
- (ii) With R as center and with the same radius as before, draw arc intersecting the previous arc at S.
 - (iii) With S as center and with the same radius as before, draw arc intersecting the arc at T.
 - (iv) With S and T as centers, draw arcs of same radius to intersecting each other at U.
 - (v) Join PU intersecting arc at V. With S and V as centers, draw arcs with radius more than $\frac{1}{2} SV$. Let them intersect each other at W.
- Join PW which makes 75° with the given ray PQ.



- (ii) 105°
PQ is the given ray

The below given steps will be followed to construct an angle of 105° .

- (i) Draw arc of some radius with P as its center, intersecting PQ at R.
 - (ii) With R as center and with the same radius as before, draw arc intersecting the previous arc at S.
 - (iii) With S as center and with the same radius as before, draw arc intersecting the arc at T.
 - (iv) With S and T as centers, draw arcs of same radius to intersecting each other at U.
 - (v) Join PU. Let it intersect the arc at V. With T and V as centers, draw arcs with radius more than $\frac{1}{2}TV$. Let these arcs intersect each other at W.
- Join PW which is the required ray making 105° with the given ray PQ.

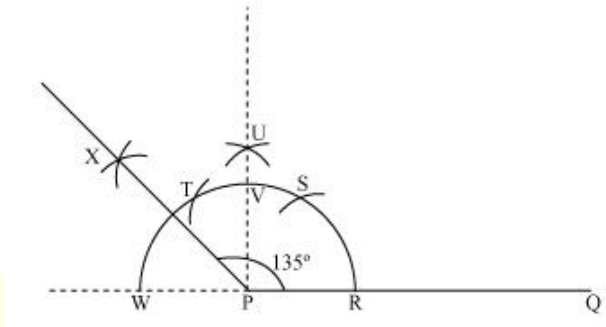


- (iii) 135°
PQ is the given ray

The below given steps will be followed to construct an angle of 135° .

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- (i) Draw arc of some radius with P as its center, intersecting PQ at R.
 - (ii) With R as center and with the same radius as before, draw arc intersecting the previous arc at S.
 - (iii) With S as center and with the same radius as before, draw arc intersecting the arc at T.
 - (iv) With S and T as centers, draw arcs of same radius to intersecting each other at U.
 - (v) Join PU. Let it intersect the arc at V. With V and W as centers and with radius more than $\frac{1}{2} VW$, draw arcs intersecting each other at X.
- Join PX, which makes 135° with the given line PQ.



Question 5:

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

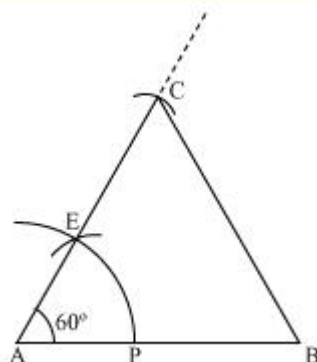
Solution:

Let us draw an equilateral triangle of side 5 cm.
Hence, every sides of the equilateral triangle will be 5 cm.
We also know that every angle of an equilateral triangle is 60° .

The below given steps will be followed to draw an equilateral triangle of 5 cm side.

- (i) Draw a line segment AB of length 5 cm . Draw an arc of some radius, with A as its center. Let it intersect AB at P.
- (ii) With P as center, draw an arc to intersect the previous arc at E. Join AE.
- (iii) With A as center, draw an arc of 5 cm radius, which intersects line segment AE at C. Join AC and BC.

ABC is the required equilateral triangle of side 5 cm



Justification

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We can justify the construction by proving $AB = BC = AC = 5 \text{ cm}$ and $\angle A = \angle B = \angle C = 60^\circ$.

In $\triangle ABC$, we have $AC = AB = 5 \text{ cm}$ and $\angle A = 60^\circ$.

Since $AC = AB$,

$\angle B = \angle C$ (Angles opposite to equal sides)

In $\triangle ABC$, $\angle A + \angle B + \angle C = 180^\circ$

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

$$60^\circ + 2\angle C = 180^\circ$$

$$2\angle C = 180^\circ - 60^\circ = 120^\circ$$

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

We have, $\angle A = \angle B = \angle C = 60^\circ$

$\angle A = \angle B$ and $\angle A = \angle C$

$BC = AC$ and $BC = AB$ (Sides opposite to equal angles)

$AB = BC = AC = 5 \text{ cm}$

$\triangle ABC$ is an equilateral triangle.

