CHAPTER 11 : Geometric Construction

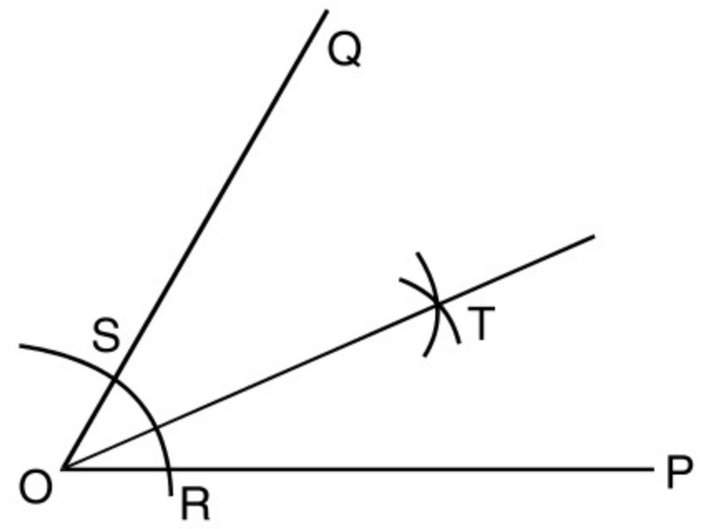
I. Construction of Angle Bisector :

Given : $\angle POQ$.

Required : To construct the bisector of $\angle POQ$.

Steps of Construction :

1. With O as centre and any suitable radius, draw an arc to meet OP at R and OQ at S.
2. With R as centre and any suitable radius (not necessarily equal to radius of step 1 but $> \frac{1}{2} RS$), draw an arc. Also, with S as centre and same radius, draw another arc to meet the previous arc at T.
3. Join OT and produce it, then OT is the required bisector of $\angle POQ$.

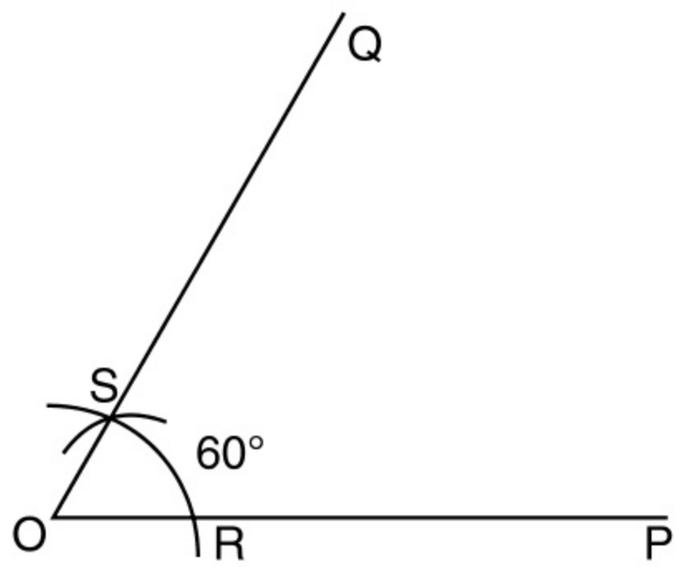


II. Construction of Important Angles :

(i) To construct an angle of 60° :

Steps of Construction :

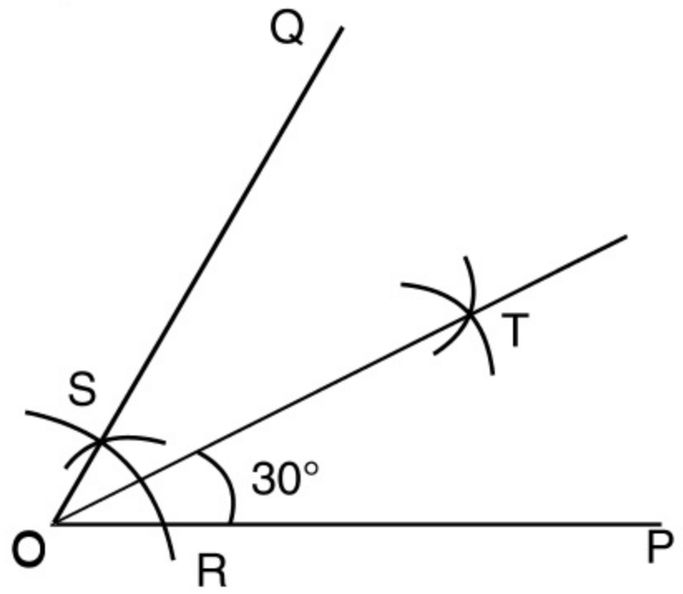
1. Draw any line OP.
2. With O as centre and any suitable radius, draw an arc to meet OP at R.
3. With R as centre and same radius (as in step 2), draw an arc to meet the previous arc at S.
4. Join OS and produce it to Q, then $\angle POQ = 60°$.



(ii) To construct an angle of 30° :

Steps of Construction :

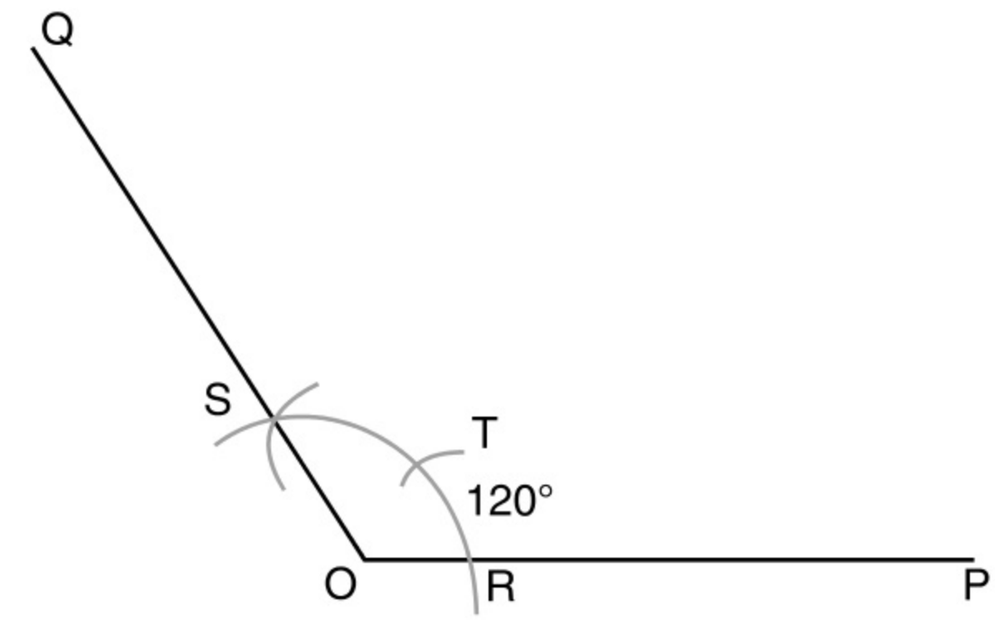
1. Construct $\angle POQ = 60°$ (as above).
2. Bisect $\angle POQ$ (as in construction I). Let OT be the bisector of $\angle POQ$, then $\angle POT = 30°$.



(iii) To construct an angle of 120° :

Steps of Construction :

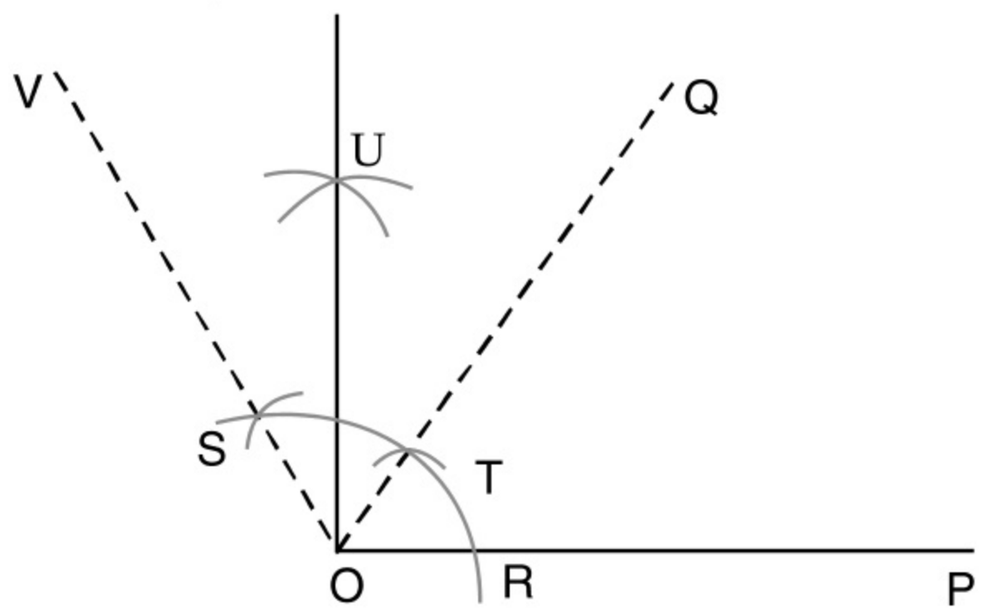
1. Draw any line segment OP.
2. With O as centre and any suitable radius, draw an arc to meet OP at R.
3. With R as centre and same radius (as in step 2), draw an arc to meet the previous arc at T. With T as centre and same radius, draw another arc to cut the first arc at S.
4. Join OS and produce it to Q, then $\angle POQ = 120°$.



(iv) To construct an angle of 90° :

Steps of Construction :

1. Construct $\angle POQ = 60°$ [as in construction II (i)].
2. Construct $\angle POV = 120°$ [as in construction II (iii)].
3. Bisect $\angle QOV$ (as in construction I). Let OU be the bisector of $\angle QOV$, then $\angle POU = 90°$.

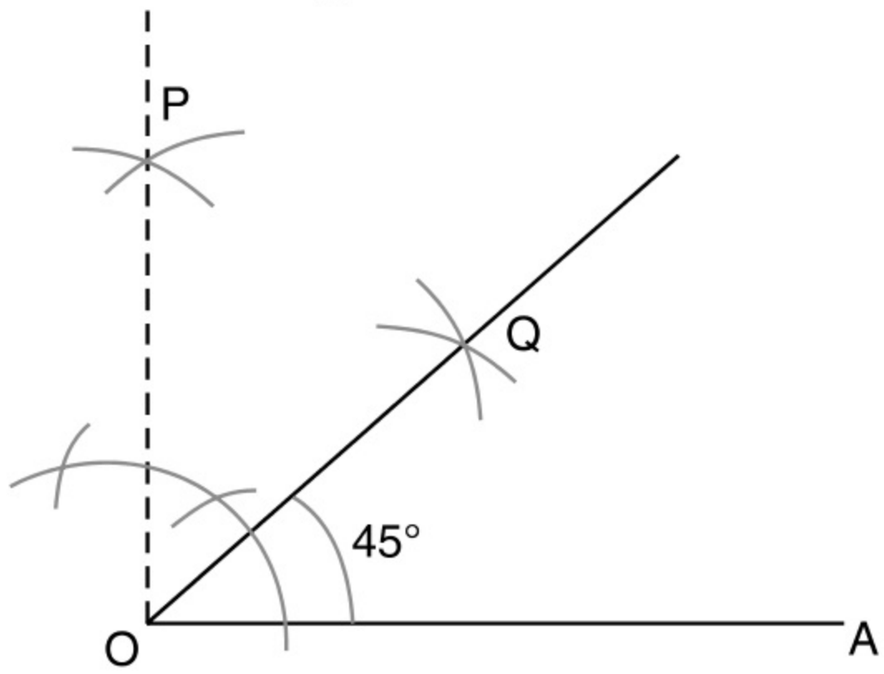


(v) To construct an angle of 45° :

Steps of Construction :

1. Construct $\angle AOP = 90°$ [II (iv)].
2. Bisect $\angle AOP$ [as in construction I].

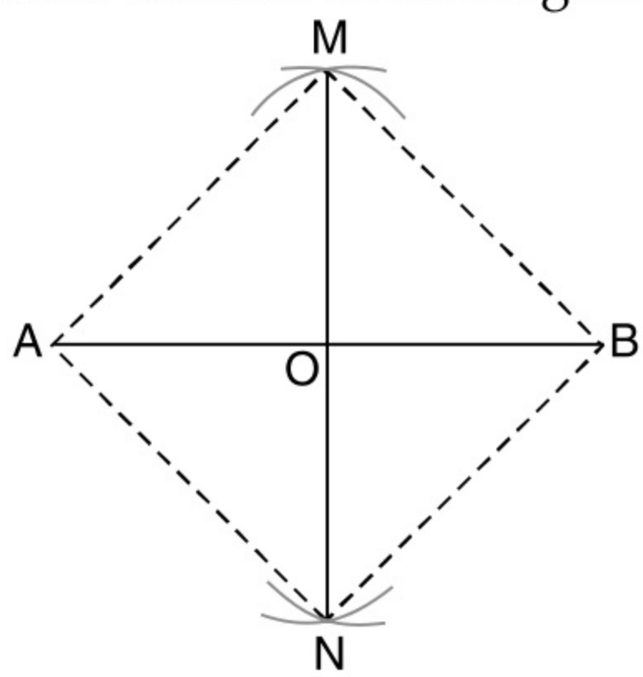
Let OQ be the bisector of $\angle AOP$, then $\angle AOQ = 45°$.



III. Construction of Perpendicular Bisector :

Given : Any line segment AB.

Required : To construct a perpendicular bisector of line segment AB.



Steps of Construction :

1. Draw a line segment AB.
2. Taking A and B as the centres and radius of more than half the length of AB, draw arcs on both sides of AB.
3. Let these arcs intersect each other at points M and N.
4. Join the points of intersection M and N. Thus, MN is the required perpendicular bisector of AB.

IV. Construction of a triangle, given its base, difference of the other two sides and one base angle.

***e.g.*, : Construct a triangle with base of length 7.5 cm, the difference of the other two sides is 2.5 cm, and one base angle of 45°.**

Given : In ΔABC, base $BC = 7.5$ cm, the difference of the other two sides, $AB - AC$ or $AC - AB = 2.5$ cm and one base angle is 45°.

Required : To construct the ΔABC.

CASE (i) $AB - AC = 2.5$ cm.

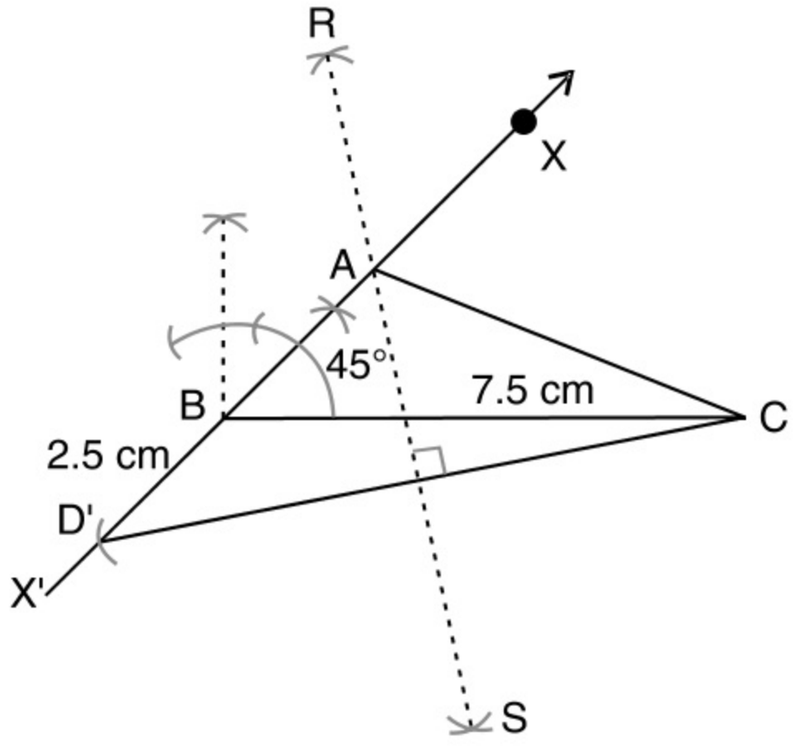
Steps of Construction :

1. Draw $BC = 7.5$ cm.
2. At B, construct $\angle CBX = 45°$.
3. From BX, cut off $BD = 2.5$ cm.
4. Join CD.
5. Draw the perpendicular bisector RS of CD intersecting BX at a point A.
6. Join AC. Then ΔABC is the required triangle.

CASE (ii) $AC - AB = 2.5$ cm.

Steps of Construction :

1. Draw $BC = 7.5$ cm.
2. At B, construct $\angle CBX = 45°$ and produce XB to form a line XBX'.
3. From BX', cut off $BD' = 2.5$ cm.
4. Join CD'.
5. Draw the perpendicular bisector RS of CD' intersecting BX at a point A.
6. Join AC. Then ΔABC is the required triangle.



V. Construction of a triangle of given perimeter and base angles. *e.g.* : Construct a triangle with perimeter 11.8 cm and base angles 60° and 45°.

Given : In ΔABC, $AB + BC + CA = 11.8$ cm, $\angle B = 60°$ and $\angle C = 45°$.

Required : To construct the ΔABC.

Steps of Construction :

1. Draw $DE = 11.8$ cm.
2. At D, construct $\angle EDP = \frac{1}{2}$ of $60° = 30°$ and at E, construct $\angle DEQ = \frac{1}{2}$ of $45° = 22\frac{1}{2}°$.
3. Let DP and EQ meet at A.
4. Draw a perpendicular bisector of AD to meet DE at B.
5. Draw a perpendicular bisector of AE to meet DE at C.
6. Join AB and AC. Then ΔABC is the required triangle.