Chapter – 11

Constructions

To construct the bisector of a given angle

Basic Constructions

Construction 1: To construct the bisector of a given angle.

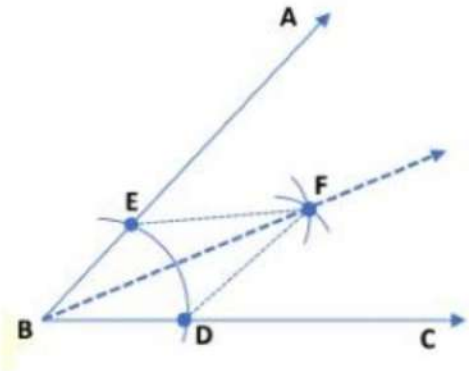
Given an angle ABC, we want to construct its bisector.

Steps of Construction

1. Taking B as the center, draw an arc of any radius, intersecting BA and BC at points E and D respectively.

2. With radius greater than $\frac{1}{2}$ DE, taking D and E as centers draw two arcs such that they intersect each other at F.

3. Join BF.
Thus, Ray BF is the bisector of the ∠ ABC.



Example: Using a protractor, draw an angle of measure 60°. With this angle as given, draw an angle of measure 30°.

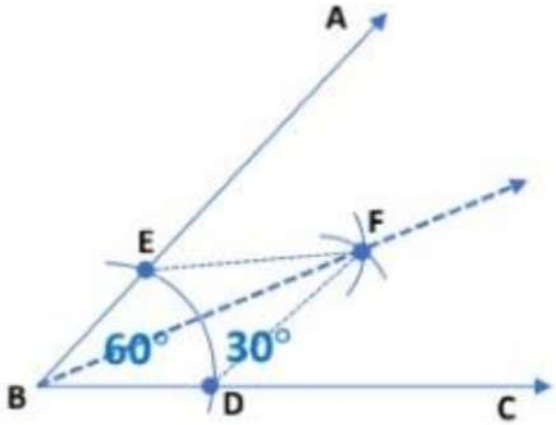
Steps of Construction

1. Using a protractor, we draw an angle of measure 60°. Taking B as the center, draw an arc of any radius, intersecting BA and BC at points E and D respectively.

2. Taking D and E as centers and with the radius more than $\frac{1}{2}$ DE, draw arcs to intersect each other at F.

3. Join BF.

Thus, Ray BF is the bisector of the $\angle ABC = 60°$.

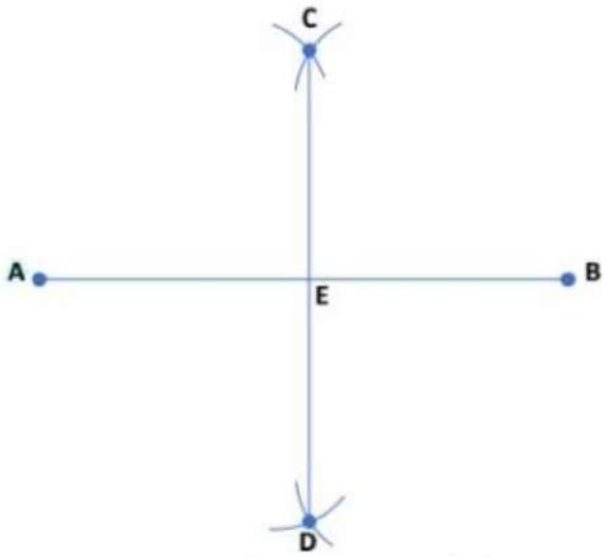


To construct the perpendicular bisector of a given line segment

Basic Constructions

Construction 2: To construct the perpendicular bisector of a given line segment.

Given a line segment AB, we want to construct its perpendicular bisector.



Steps of Construction

1. Taking A as center and radius more than 1 2 AB, draw arcs on both sides of AB.

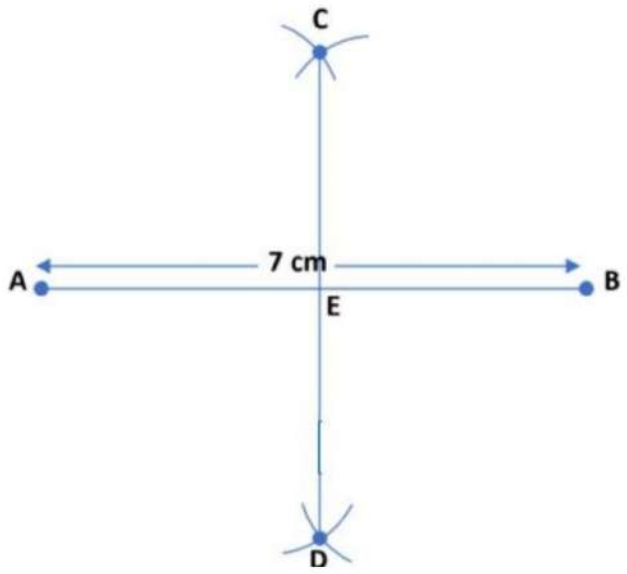
2. Taking B as center and the same radius as before, draw arcs on both sides of AB.

3. Let the point where the arc intersects on top of AB be C and the point where arcs intersect at the bottom be D. Join DC.

4. Let DC intersect AB at point E.

Thus, line CED is the required perpendicular bisector of AB

Example: Draw a line segment AB of length 7 cm. Draw the perpendicular bisector of this line segment.



Steps of Construction

1. We draw a line segment AB of 7cm.

2. Taking A as center and radius more than 1 2 AB, draw arcs on both sides of AB.

3. Taking B as center and the same radius as before, draw arcs on both sides of AB.

4. Name the point where arcs intersect on above of AB as C and name the point where arcs intersect below AB as D.

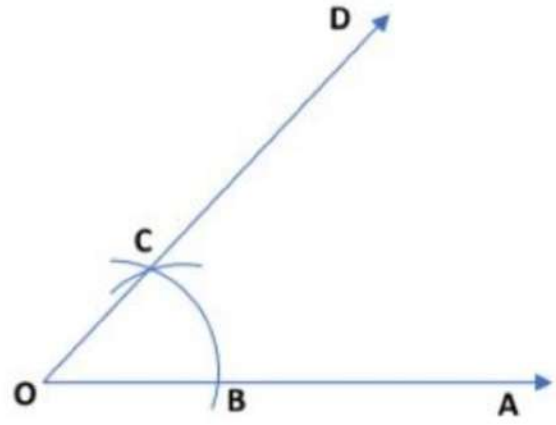
5. Join DC such that it intersects AB at E.

Thus, line CED is the required perpendicular bisector of AB = 7cm.

To construct an angle of 60° at the initial point of a given ray

Basic Constructions

Construction 3: To construct an angle of 60° at the initial point of a given ray.



Steps of Construction

1. Draw a ray OA.

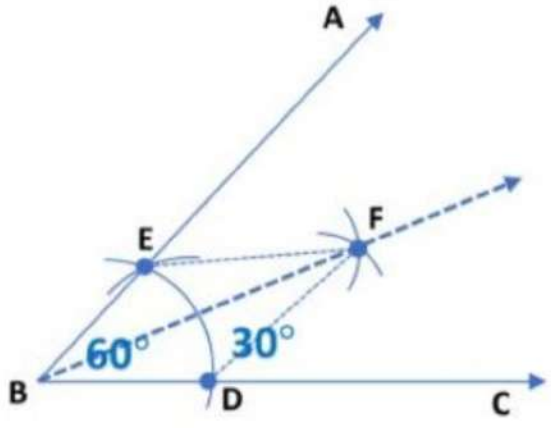
2. With center O and any radius draw an arc with the help of compasses, cutting the ray OA at B.

3. Without changing the radius (From step-2) taking B as center draw an arc that cuts the previous arc at C

4. Join OC and produce it to obtain ray OD.

The angle ∠AOD so obtained is the angle of measure 60°.

Example: To construct an angle of 30° at the initial point of a given ray.



Steps of Construction

1. Draw a ray BC. With center B any radius draw an arc with the help of compasses, cutting the ray BC at D.

2. With center D and same radius draw an arc cutting the arc at E.

3. Join BE and produce it to obtain ray AB. Thus, the angle ∠ABC so obtained is equal to 60°.

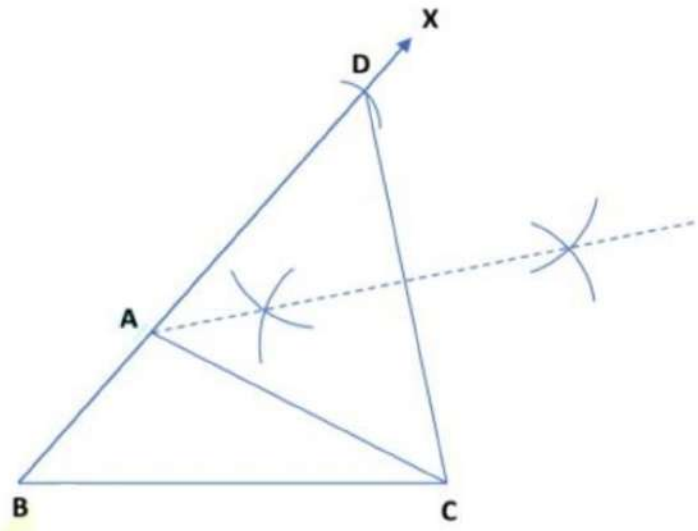
4. Next, taking D and E as centers and with the radius more than $\frac{1}{2}$ DE, draw arcs to intersect each other at F.

5. Join BF. Thus, ∠ FBC = 30°.

To construct a triangle, given its base, a base angle & sum of other two sides

Some Constructions of Triangles

Construction 4: To construct a triangle, given its base, a base angle, and the sum of the other two sides.



Steps of Construction

1. Obtain the base, base angle and the sum of the other two sides. Let BC be the base, ∠ABC be the base angle and the sum AB + AC of the other two sides of a

triangle ABC.

2. Draw the base BC.

3. Draw ∠XBC of measure equal to that of ∠ABC.

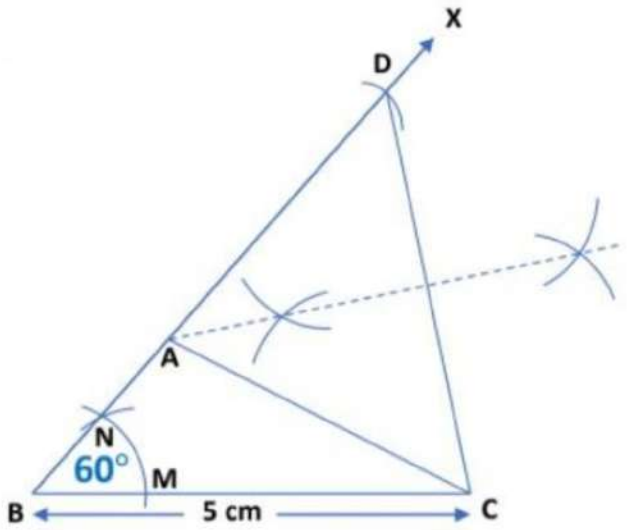
4. From ray BX, cut-off line segment BD equal to the sum AB + AC of the other two sides

5. Join CD.

6. Draw the perpendicular bisector of CD meeting BD at A.

7. Join AC to obtain the required triangle ABC.

Examples: Construct a triangle ABC in which BC = 5 cm, AB + AC = 8.5 cm and ∠ABC = 60°.



Steps of Construction

1. Draw a ray BC = 5 cm. With center B any radius an arc with the help of compasses, Cutting the ray BC at M.

2. With center M and same radius draw an arc cutting the arc at N.

3. Join BN and produce it to obtain ray BX. Thus, the angle ∠XBC so obtained is equal to 60°.

4. From ray BX, cut off line segment BD = AB + AC = 8.5 cm.

5. Draw ∠XBC of measure equal to that of ∠ABC = 60°.

6. Join CD.

7. Draw the perpendicular bisector of CD meeting BD at A.

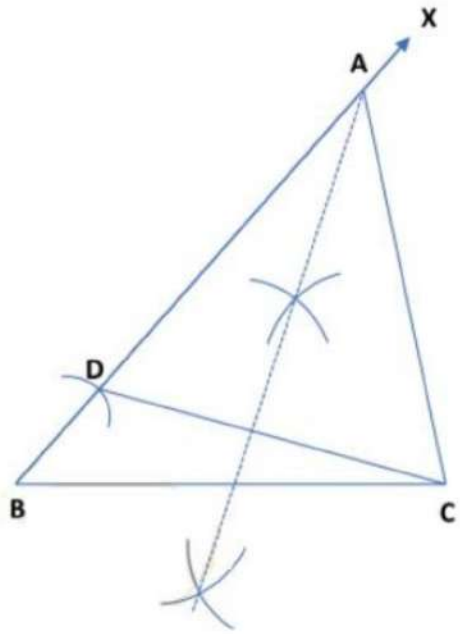
8. Join AC to obtain the required triangle ABC.

To construct a triangle, given its base, a base angle & the difference of other two sides

Some Constructions of Triangles

Construction 5: To construct a triangle, given its base, a base angle and the difference of the other two sides.

There are the following two cases: (I) AB – AC, (II) AC – AB



CASE I: AB – AC [Given]

Steps of Construction

1. Obtain the base, base angle and the sum of the other two sides. Let BC be the base, ∠ABC be the base angle and the difference AB – AC of the other two sides of a triangle ABC.

2. Draw the base BC.

3. Draw ∠XBC of measure equal to that of ∠ABC.

4. From ray BX, the cut-off line segment BD equal to the difference of the other two sides (AB – AC).

5. Join CD.

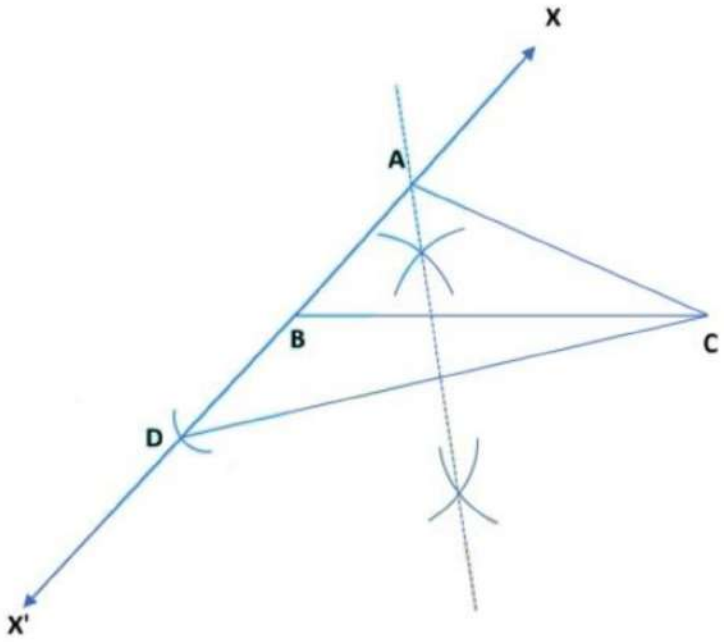
6. Draw the perpendicular bisector of CD meeting BX at A.

7. Join AC to obtain the required triangle ABC.

CASE II: AC – AB [Given]

Steps of Construction

1. Obtain the base, base angle and the sum of the other two sides. Let BC be the base, ∠ABC be the base angle and the difference AC – AB of the other two sides of a triangle ABC.



2. Draw ∠XBC of measure equal to that of ∠ABC.

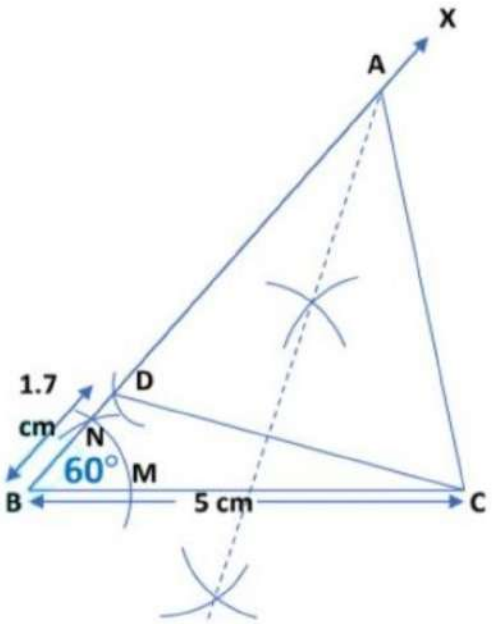
3. Extend BX to X' on the opposite side of AB and cut off segment (AC – AB) from ray AX'

4. Join CD.

5. Draw the perpendicular bisector of CD meeting BD at A.

6. Join AC to obtain the required triangle ABC.

Example 1: Construct a triangle ABC in which base BC = 5 cm, ∠ABC = 60° and AB – AC = 1.7 cm.



Steps of Construction

1. Draw a ray BC = 5 cm. With centre B any radius an arc with the help of compasses, cutting the ray BC at M.

2. With centre M and same radius draw an arc cutting the arc at N.

3. Join BN and produce it to obtain ray BX. Thus, the angle ∠XBC so obtained is equal to 60°.

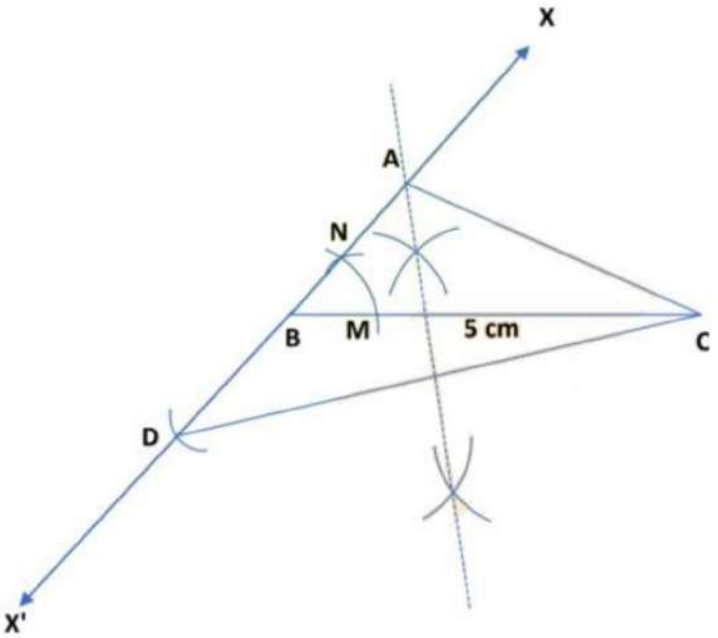
4. On ray BX, cut off line segment BD = AB – AC = 1.7 cm.

5. Join CD.

6. Draw the perpendicular bisector of CD meeting BD at A.

7. Join AC to obtain the required triangle ABC.

Example 2: Construct a triangle ABC in which base BC = 5 cm, ∠ABC = 60° and AC – AB = 1.7 cm



1. Draw a ray BC = 5 cm. With centre B any radius an arc with the help of compasses, cutting the ray BC at M.

2. With centre M and same radius draw an arc cutting the arc at N.

3. Join BN and produce it to obtain ray BX. Thus, the angle ∠XBC so obtained is equal to 60° =∠ABC.

4. Extend BX to X' on the opposite side of AB and cut off segment (AC – AB) from ray AX'

5. Join CD.

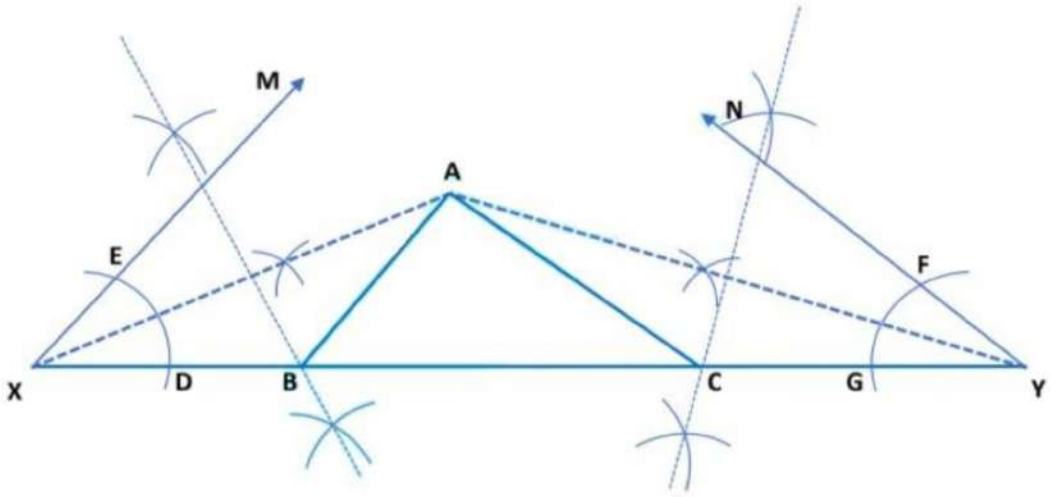
6. Draw the perpendicular bisector of CD meeting BD at A.

7. Join AC to obtain the required triangle ABC.

To construct a triangle, given its perimeter and its two base angles

Some Constructions of Triangles

Construction 6: To construct a triangle, given its perimeter and its two base angles.



Steps of Construction

1. Obtain the perimeter (AB + BC + CA) and the base angles ∠ABC & ∠ACB of the triangle ABC.

2. Draw a line segment XY equal to the perimeter (AB + BC + CA) of ΔABC.

3. Construct ∠MXY = ∠ABC and ∠NYX = ∠ACB.

4. Draw bisector of angles ∠MXY and ∠NYX and extend them to join at A.

5. Draw the perpendicular bisectors of XA and YA meeting XY at B and C respectively.

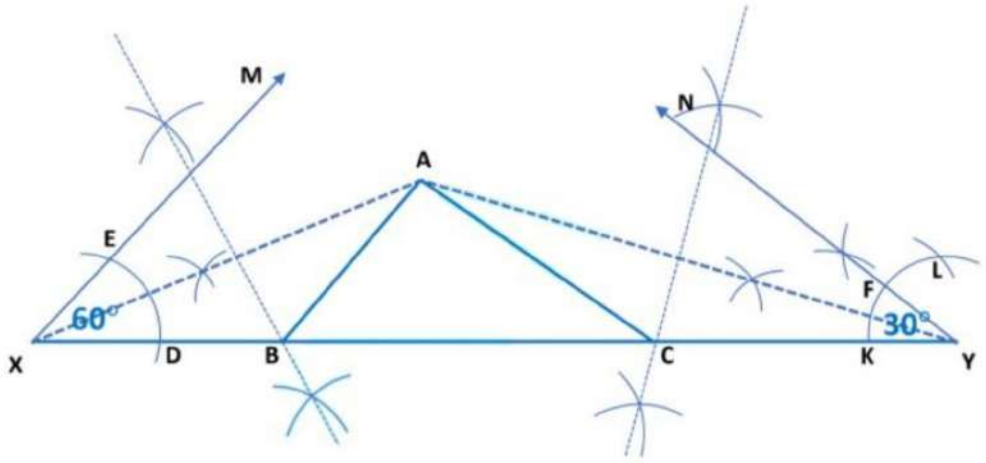
6. Join AB and AC to obtain the triangle ABC.

Example: Construct a triangle ABC whose perimeter is equal to 15 cm, ∠ABC = 60° and ∠ACB = 30°.

Steps of Construction

1. Draw a line segment XY = AB + BC + CA = 15 cm. With center X any radius an arc with the help of compasses, cutting the line segment XY at D.

2. With center D and same radius draw an arc cutting the arc at E.



3. Join XE and produce it to obtain ray XM. Thus, the angle ∠MXY= ∠ABC so obtained is equal to 60°.

4. With center Y any radius an arc with the help of compasses, Cutting the line segment YX at K.

5. With center K and the same radius draw an arc cutting the arc at L

6. Next, taking K and L as centers and with the radius more than 12 KL, draw arcs to intersect each other.

7. Join YF and produce it to obtain ray YN. Thus, ∠NYX = 30°.

8. Draw the bisector of angles ∠MXY and ∠NYX mark their intersection point as A.

9. Draw the perpendicular bisectors of XA and YA meeting XY at B and C respectively.

10. Join AB and AC to obtain the triangle ABC whose perimeter is 15 cm.