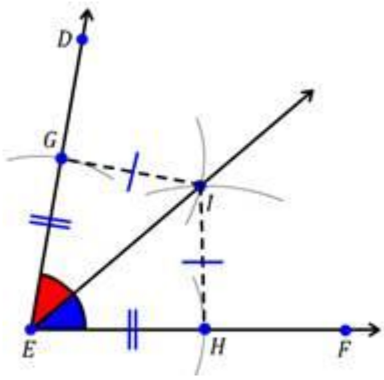
Basic Constructions

Geometrical instruments are used in drawing geometric figures such as triangles, circles, quadrilaterals, polygons etc. with given measuremets. A geometrical construction is the method of drawing a geometrical figure using an ungraduated ruler and a compass.
An angle bisector is a ray, which divides an angle in to two equal parts. The bisector of a line segment is a line that cuts the line segment into two equal halves. A perpendicular bisector is a line, which divides a given line segment into two equal halves and is also perpendicular to the line segment.

Construction of the bisector of a given angle:

Consider ∠DEF to construct the bisector.

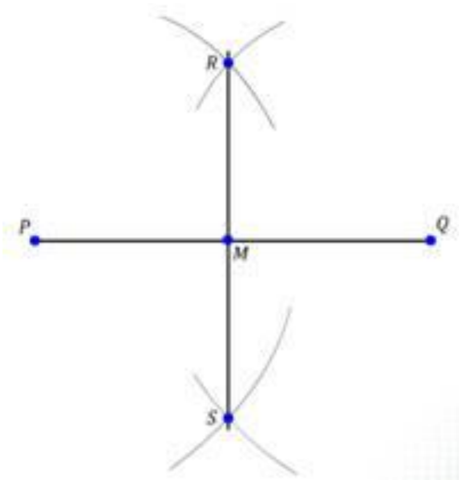
Steps of construction:
Step 1: With E as centre and small radius draw arcs on the rays ED and EF.
Step 2: Let the arcs intersect the rays ED and EF at G and H respectively.
Step 3: With centres G and H, draw two more arcs with the same radius such that they intersect at a point. Let the point of intersection be I.
Step 4: Draw a ray with E as the starting point and passing through I.
EI is the bisector of the ∠DEF.



Construction of the perpendicular bisector of a line segment:

Consider the line segment PQ to construct the perpendicular bisector.

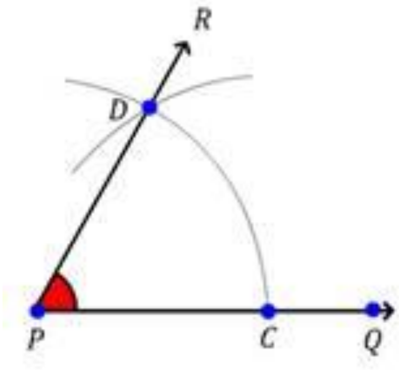
Steps of Construction:
Step 1: Draw a line segment PQ.
Step 2: With P as centre, draw two arcs on either sides of PQ with radius more the half the length of the given line segment.
Step 3: Similarly draw two more arcs with same radius from point Q such that they intersect the previous arcs at R and S respectively.
Step 4: Join the points R and S.
RS is the required perpendicular bisector of the given line segment PQ.



Construction of an angle of 60° at the initial point of a given ray.

Consider ray PQ with P as the initial point. Construction of a ray PR such that it makes angle of 60° with PQ.

Steps of Construction:
Step 1: Draw a ray PQ.
Step 2: With P as centre, draw an arc with small radius such that it intersects the ray PQ at C.
Step 3: With C as centre and same radius draw another arc to intersect the previous arc at D.
Step 4: Draw a ray PR from point P through D.
Hence, ∠RPQ is equal to 60°.

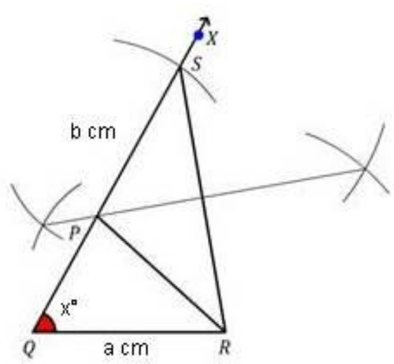


Constructions of Triangles

Measurements of at least three parts of a triangle are required for the construction of a triangle. But all the combinations of three parts are not sufficient for the purpose. For example, it is not possible to construct a unique triangle when the measurements of two sides and an angle which is not included in between the given sides are given.

A triangle can be constructed when (i) the base, one base angle and the sum of the other two sides are given (ii) the base, a base angle and the difference between the other two sides are given (iii) perimeter and two base angles are given.

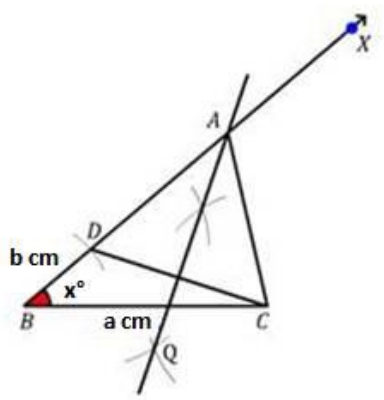
Construction of a triangle when the base, one base angle and the sum of the other two sides of the triangle are given.



Construction of ΔPQR, QR = 'a' cm, ∠PQR = x°, and PQ + PR = 'b' cm.

Step 1: Draw the base QR = 'a' cm.
Step 2: Draw ∠XQR = x°.
Step 3: Mark an arc S on QX such that QS = 'b' cm.
Step 4: Join RS.
Step 5: Draw the perpendicular bisector of RS such that it intersects QS at P.
Step 6: Join PR.
Thus, ΔPQR is the required triangle.

Construction of a triangle when the base, a base angle and the difference between the other two sides of the triangle are given.



In ΔABC, given BC = 'a' cm, ∠B = x° and difference of two sides AB and AC is equal to 'b' cm.

Case I: AB > AC

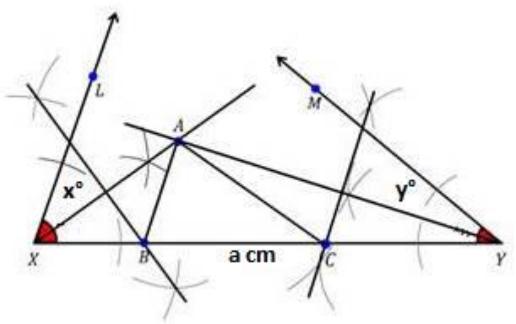
Step 1: Draw the base BC = 'a' cm.
Step 2: Make ∠XBC = x°.
Step 3: Mark a point D on ray BX such that BD = 'b' cm.
Step 4: Join DC.
Step 5: Draw the perpendicular bisector of DC such that, it intersects the ray BX at a point A.
Step 6: Join AC.
Thus, ABC is the required triangle.
Case II: AB < AC

Step 1: Draw the base BC = 'a' cm.
Step 2: Make ∠XBC = x° and extend ray BX in the opposite direction.
Step 3: Mark a point D on the extended ray BX such that BD = 'b' cm.
Step 4: Join DC.
Step 5: Draw the perpendicular bisector of DC such that, it intersects the ray BX at a point A.

Step 6: Join AC.

Thus, ABC is the required triangle.

Construction of a triangle when the perimeter and two base angles of the triangle are given.



Construction of ΔABC, given the perimeter (AB + BC + CA) = 'a' cm, ∠B = x° and ∠C = y°.

Steps of construction:

Step 1: Draw the line segment XY = 'a' cm.

Step 2: Draw the ray XL at X making an angle of x° with XY.

Step 3: Draw the ray YM at Y making an angle of y° with XY.

Step 4: Draw angle bisector of ∠LXY.

Step 5: Draw angle bisector of ∠MYX such that it intersects the angle bisector of ∠LXY at a point A.

Step 6: Draw the perpendicular bisector of AX such that it intersects XY at a point B.

Step 7: Draw the perpendicular bisector of AY such that it intersects XY at a point C.

Step 8: Join AB and AC.

Thus, ABC is the required triangle.