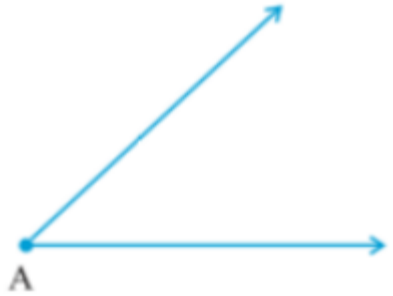
Chapter- 18

Constructions

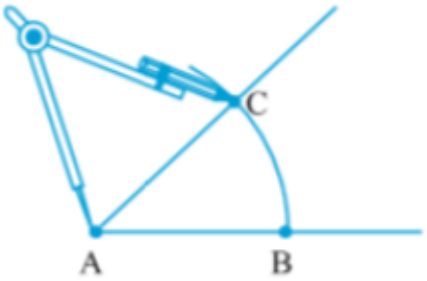
Construction of a copy of an angle of unknown measure (using a ruler and a compass).

Draw a copy of ∠A.

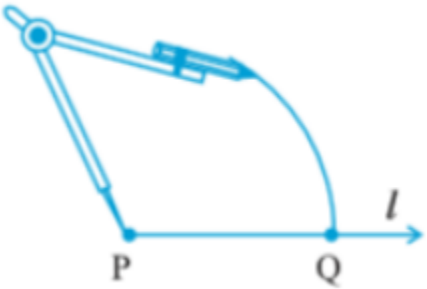


Step 1: P is a point on the line l.

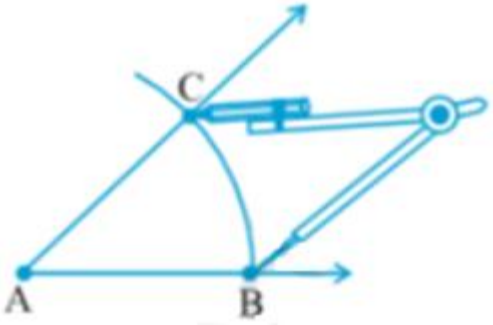
Step 2: Take A as the centre in the given angle and draw an arc of any radius which cuts the two rays at B and C.



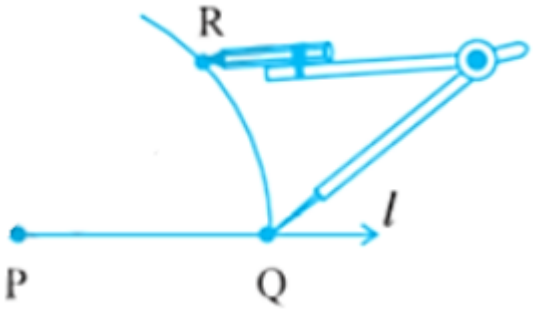
Step 3: In the line l, take P as the centre and draw an arc with the same radius as above which cuts line l at Q.



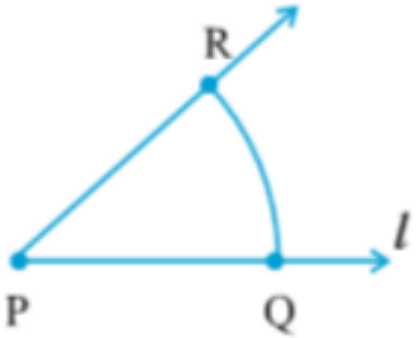
Step 4: Open your compass to take the length of the arc BC.



Step 5: Take Q as the centre and draw an arc with the same radius, to cut the arc drawn earlier, at point R.



Step 6: Join PR. It will make the angle of the same measure as given.



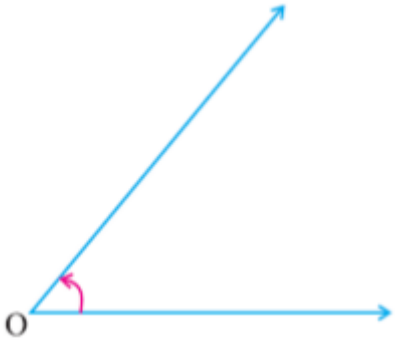
Hence, ∠P = ∠A

3. The bisector of an angle

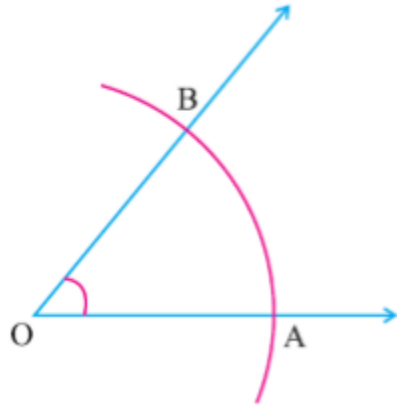
An angle bisector is the line segment which divides a particular angle into two equal parts. It is also called the line of symmetry of the angle.

Construction of angle bisector (using a ruler and a compass)

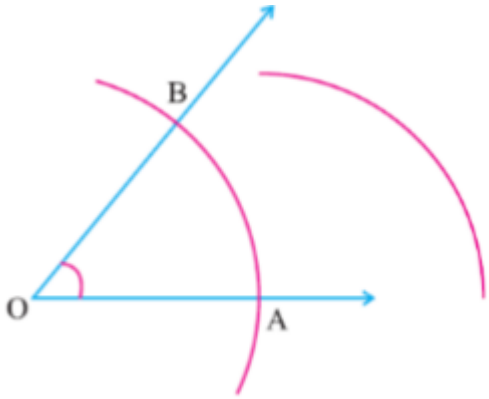
Draw the angle bisector of ∠O.



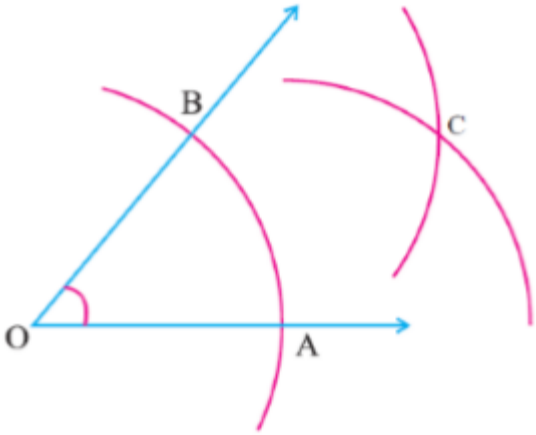
Step 1: Put the pointer on O and draw an arc of any radius so that it cut the rays at point A and B.



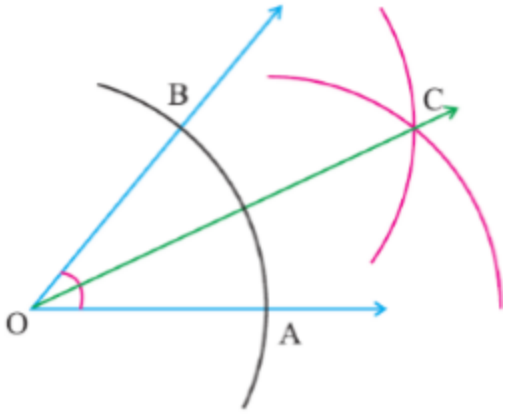
Step 2: Put the pointer on point A and draw an arc of the radius of more than half of AB.



Step 3: While taking B as the centre we will draw an arc of the same radius so that it cut the previous arc at point C.



Step 4: Join OC.OC is the required angle bisector of ∠O.



Hence, ∠BOC = ∠COA.

4. Angles of special measures

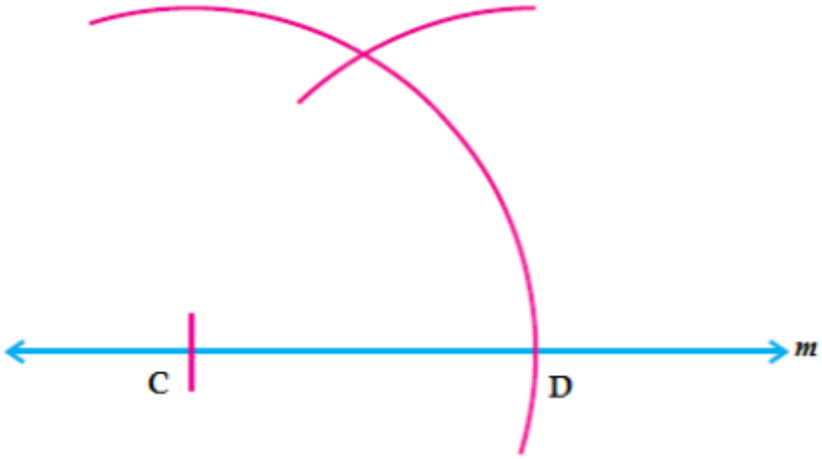
There are some angles which we can construct accurately with the help of a compass without using a protractor.

a. Construction of 60° angle.

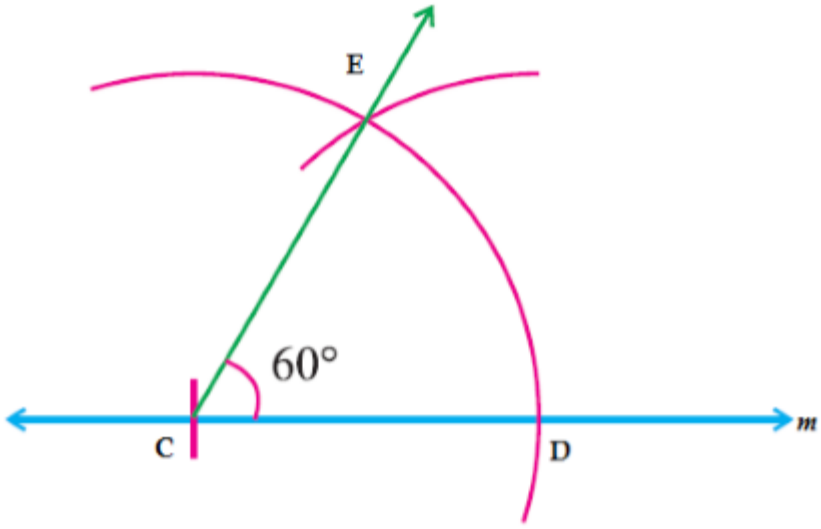
Step 1: Draw a line m and mark a point C on it.

Step 2: Take C as the centre and draw an arc of any radius to cut the line at point D.

Step 3: While taking D as the centre we need to draw an arc of the same radius to cut the previous arc.



Step 4: Join CE. ∠C = 60°.

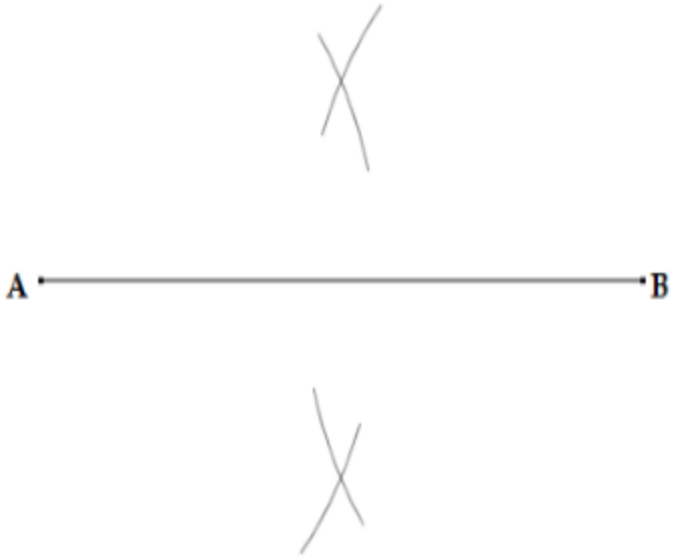


The perpendicular bisector of a line segment (using ruler and compass)

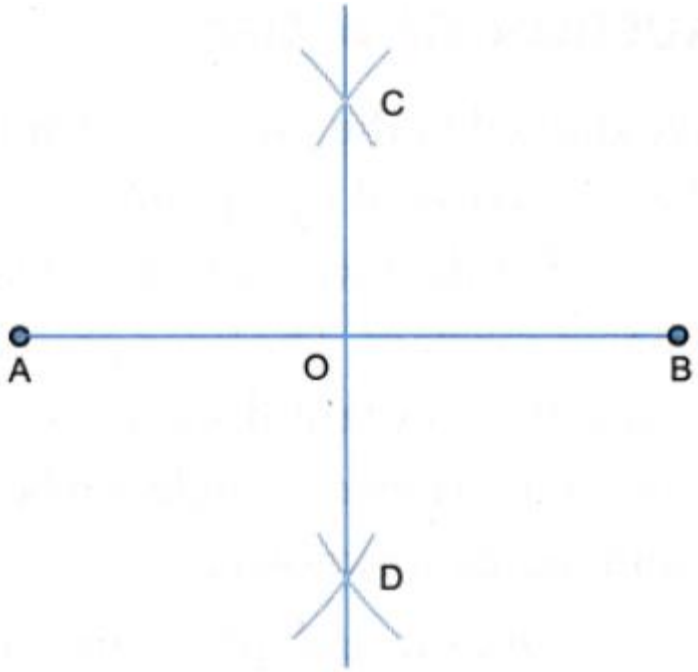
Step 1: Draw a line segment AB.

Step 2: Take A as the centre and draw two arcs – one upside and one downside with the radius of more than half of the length of AB. Or you can draw a circle taking A as the centre for the convenience.

Again make the arcs with taking B as the centre so that they intersect the previous arcs.



Step 3: Join the intersections of the arcs and name them as C and D.



Step 4: The required perpendicular bisector of AB is CD. Hence, AO = OB.

Constructing a Quadrilateral

A quadrilateral has some measurements like - 4 sides, 4 angles and 2 diagonals.

We can construct a unique quadrilateral if we know the five measurements.

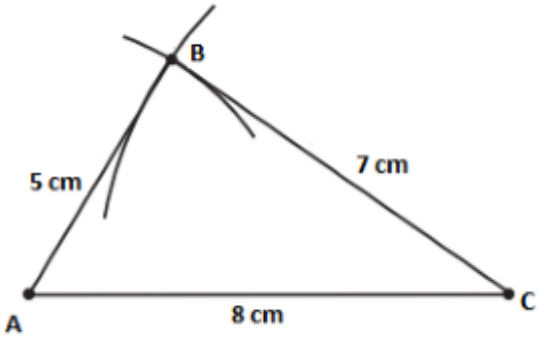
1. If the four sides and a diagonal of the quadrilateral are given.

Example

Construct a quadrilateral ABCD in which AB = 5 cm, BC = 7 cm, CD = 6 cm, DA = 6.5 cm and AC = 8 cm.

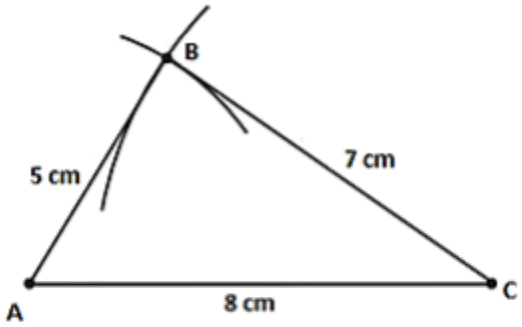
Solution

Step 1: ΔABC can be constructed using SSS criterion of the construction of triangle.

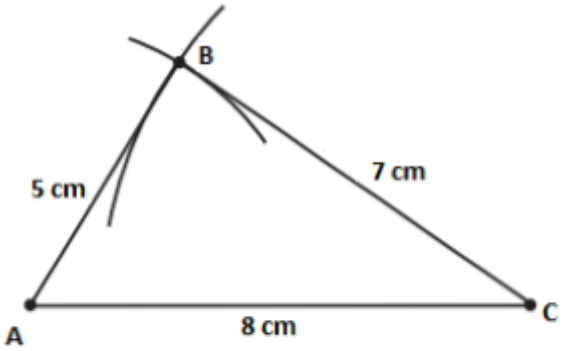


Step 2: Here we can see that AC is diagonal, so D will be somewhere opposite to B with reference to AC.

AD = 6.5 cm so draw an arc from A as the centre with radius 6.5 cm.



Step 3: Now draw an arc with C as the centre and by taking radius 6 cm so that it intersects the above arc.



Step 4: The point of intersection of the two arcs is point D. Now join AD and DC to complete the quadrilateral.

Hence, ABCD is the required quadrilateral.

2. If two diagonals and three sides of the quadrilateral are given

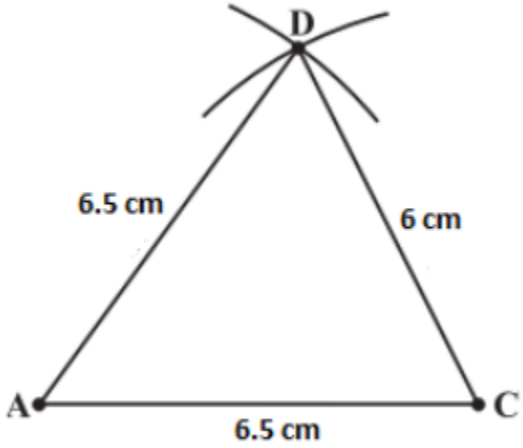
Example

Construct a quadrilateral ABCD if the two diagonals are AC = 6.5 cm and BD = 8 cm. The other sides are BC = 5.5 cm, AD = 6.5 cm and CD = 6 cm.

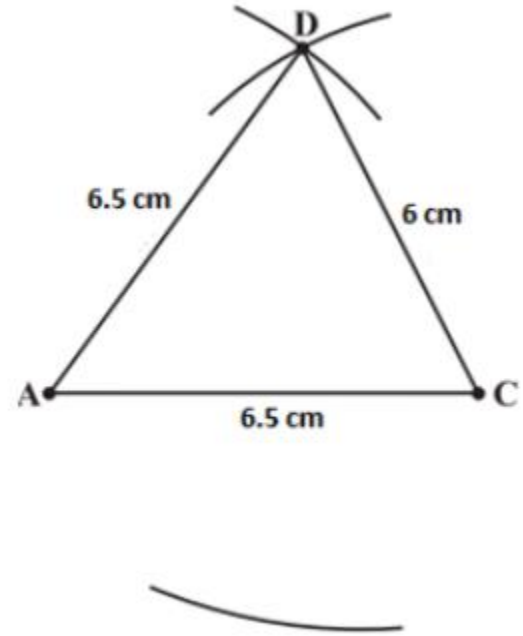
Solution

First of all, draw a rough sketch of the quadrilateral by using the given measurements. Then start constructing the real one.

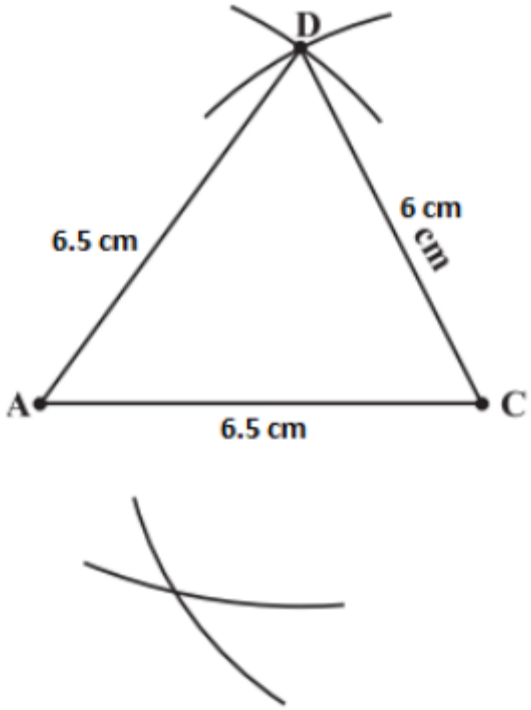
Step 1: We can see that AD, AC and DC are given so we can construct a triangle ΔACD by using SSS criterion.



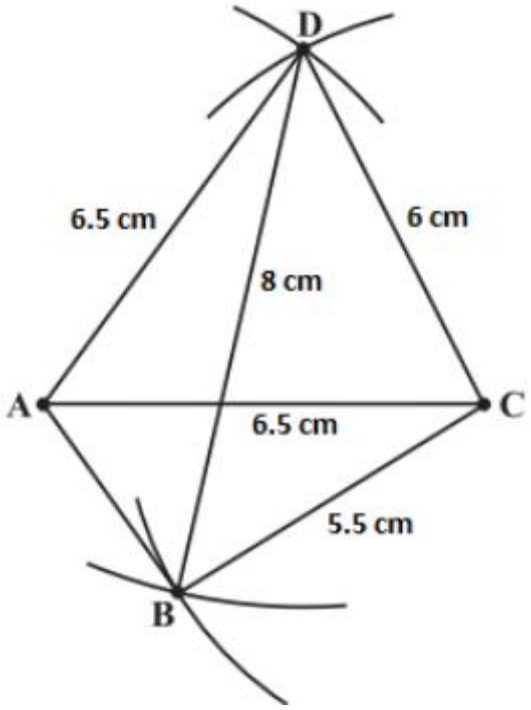
Step 2: Now, we know that BD is given so we can draw the point B keeping D as the centre and draw an arc of radius 8 cm just opposite to the point D with reference to AC.



Step 3: BC is given so we can draw an arc keeping C as centre and radius 5.5 cm so that it intersects the other arc.



Step 4: That point of intersection of the arcs is point B. Join AB and BC to complete the quadrilateral.



ABCD is the required quadrilateral.

3. If three angles and two adjacent sides of the quadrilateral are given.

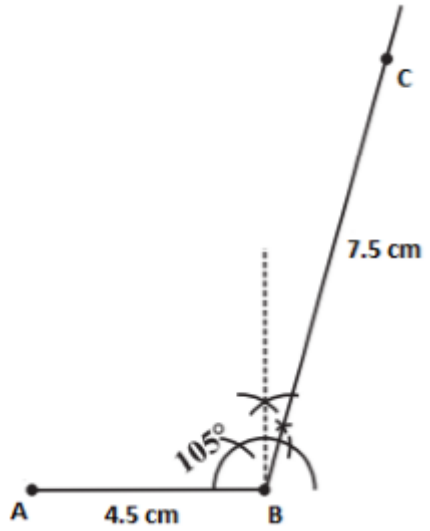
Example

Construct a quadrilateral ABCD in which the two adjacent sides are AB = 4.5 cm and BC = 7.5 cm. The given three angles are ∠A = 75°, ∠B = 105° and ∠C = 120°.

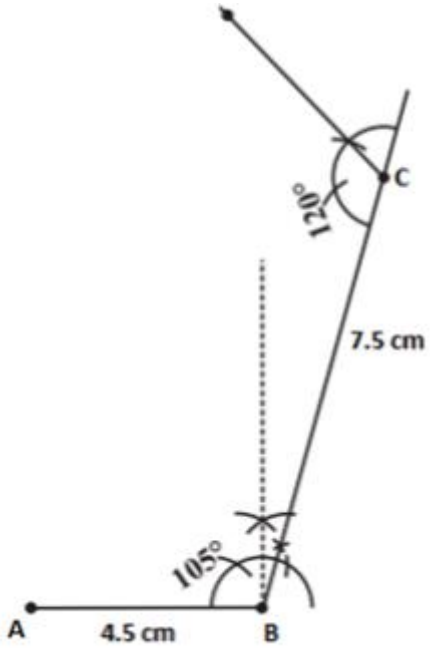
Solution

Draw a rough sketch so that we can construct easily.

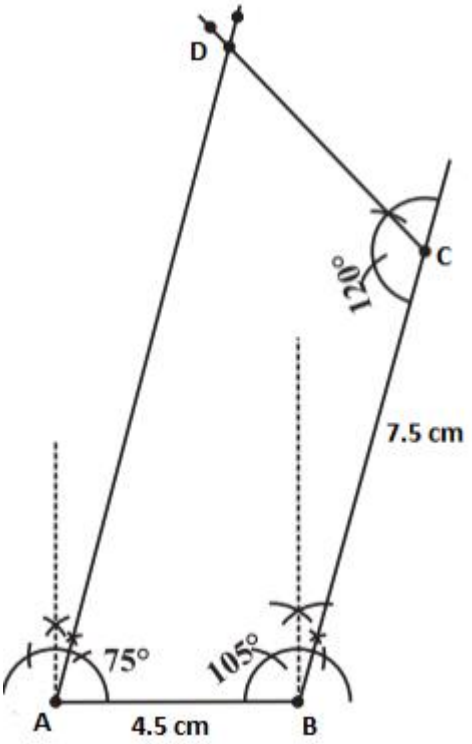
Step 1: Draw AB = 4.5 cm. Then measure ∠B = 105° using protractor and draw BC = 7.5 cm.



Step 2: Draw ∠C = 120°.



Step 3: Measure ∠A = 75° and make a line until it touches the line coming from point C.



ABCD is the required quadrilateral.

4. If the three sides with two included angles of the quadrilateral are given.

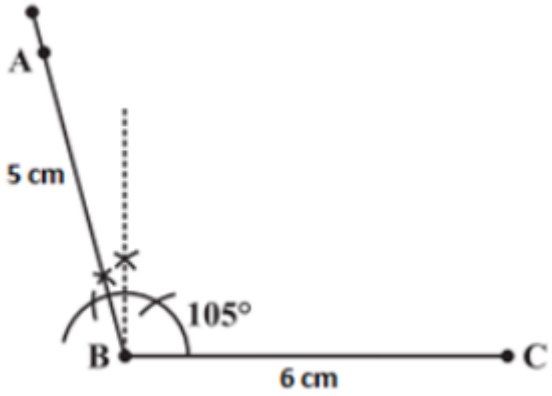
Example

Construct a quadrilateral ABCD in which the three sides are AB = 5 cm, BC = 6 cm and CD = 7.5 cm. The two included angles are ∠B = 105° and ∠C = 80°.

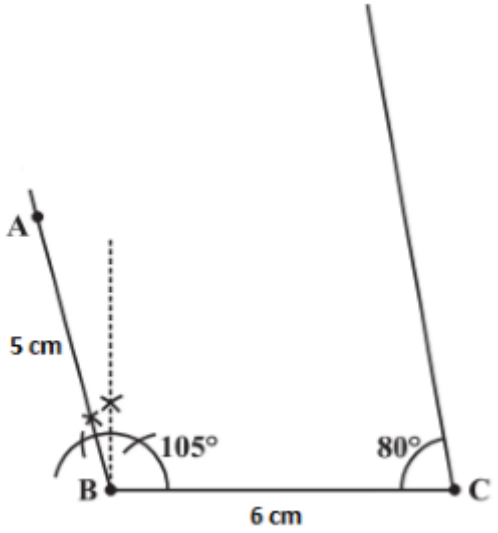
Solution

Draw a rough sketch.

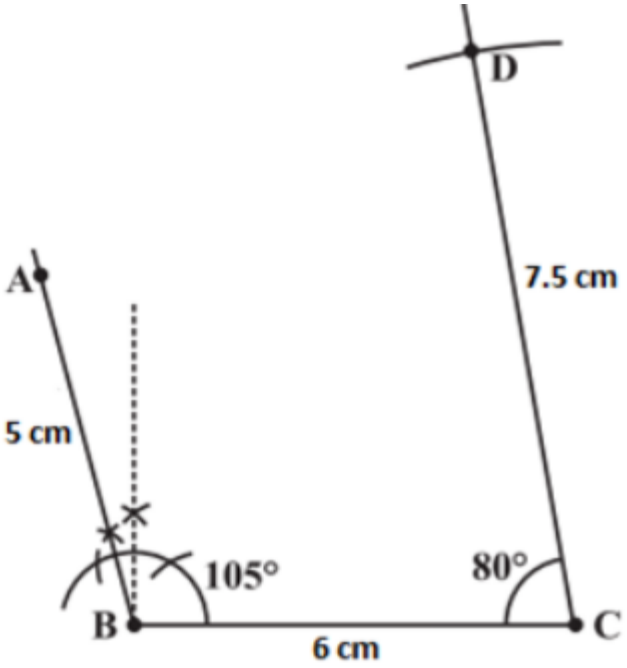
Step 1: Draw the line BC = 6 cm. Then draw ∠B = 105° and mark the length of AB = 5 cm.



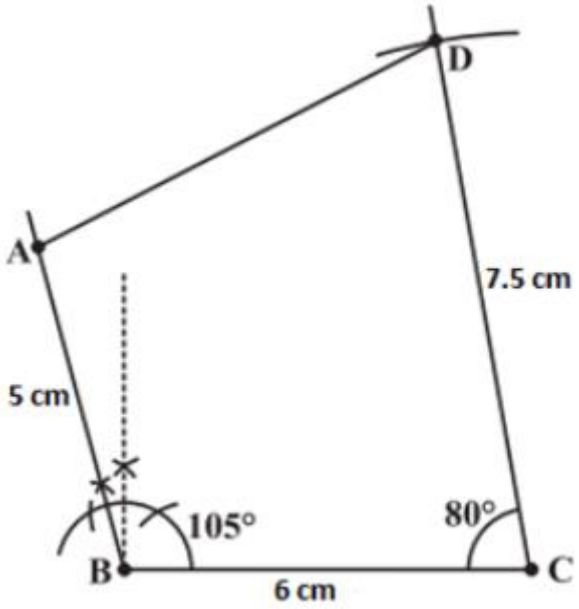
Step 2: Draw ∠C = 80° using protractor towards point B.



Step 3: Mark the length of CD i.e.7.5 cm from C to make CD = 7.5 cm.



Step 4: Join AD which will complete the quadrilateral ABCD.



Hence ABCD is the required quadrilateral.

Some Special Cases

There are some special cases in which we can construct the quadrilateral with less number of measurements also.

Example

Construct a square READ with RE = 5.1 cm.

Solution

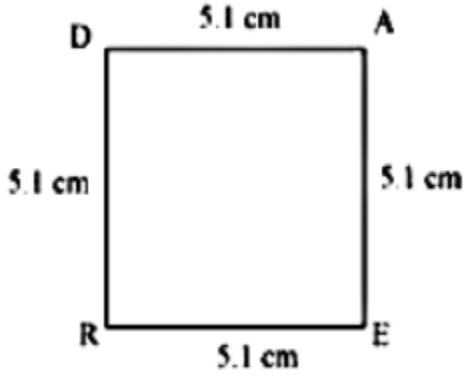
Given Re = 5.1 cm.

As it is a special quadrilateral called square, we can get more details out of it.

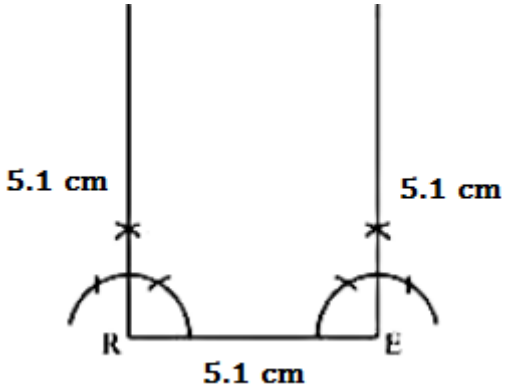
a. All sides of square are equal, so RE = EA = AD = RD = 5.1 cm.

b. All the angles of a square are 90°, so ∠R = ∠E = ∠A = ∠D = 90°

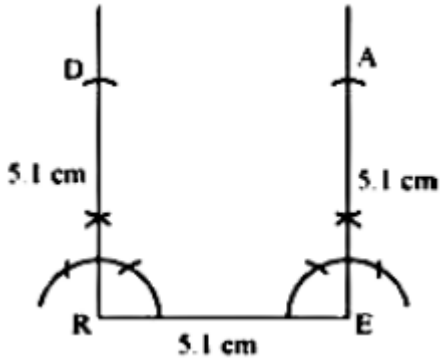
Step 1: Draw a rough sketch of the square.



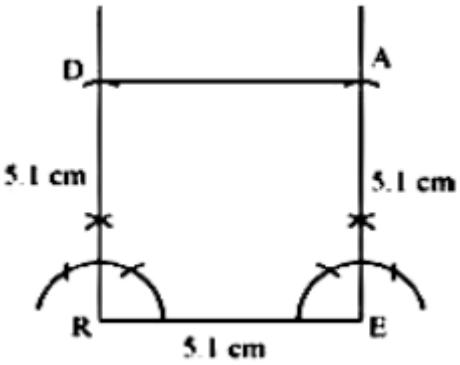
Step 2: To construct a square, draw a line segment RE = 5.1 cm. Then draw the angle of 90° at both ends R and E of the line segment RE.



Step 3: As all the sides of the square READ are equal, draw the arc of 5.1 cm from the vertex R and E to cut the lines RD and EA respectively.



Step 4: Join A and D to make a line segment AD.



READ is the required square.