PRACTICAL GEOMETRY

CONSTRUCTION OF QUADRILATERAL

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(1) When four sides and one diagonal are given.

(2) When two diagonals and three sides are given.

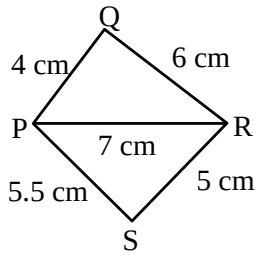
(3) When two adjacent sides and three angles are given.

(4) When three sides and two included angles are given.

(5) When other special properties are known.

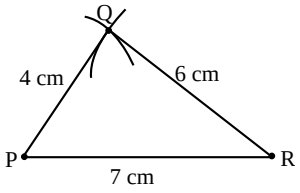
When the lengths of four sides and a diagonal are given

Ex.1 Construct a quadrilateral PQRS where PQ = 4 cm, QR = 6 cm, RS = 5 cm, PS = 5.5 cm and PR = 7 cm.



Sol. A rough sketch will help us in visualising the quadrilateral. We draw this first and mark the measurements.

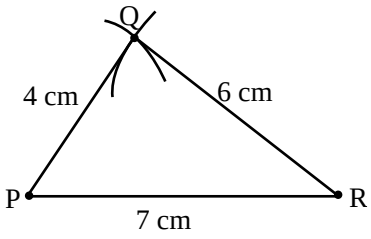
Step 1 From the rough sketch, it is easy to see that ΔPQR can be constructed using SSS construction condition. Draw ΔPQR



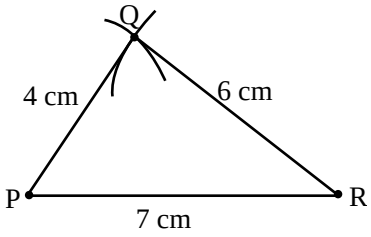
Step 2 Now, we have to locate the fourth point S. This 'S' would be on the side opposite to

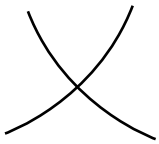
Q with reference to PR. For that, we have two measurements.

S is 5.5 cm away from P. So, with P as centre, draw an arc of radius 5.5 cm. (The point S is somewhere on this arc!).

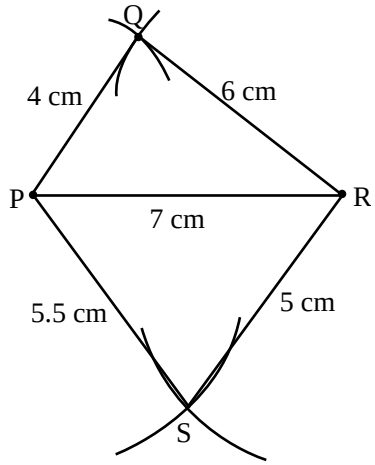


Step 3 S is 5 cm away from R. So with R as centre, draw an arc of radius 5 cm (The point S is somewhere on this arc also!)





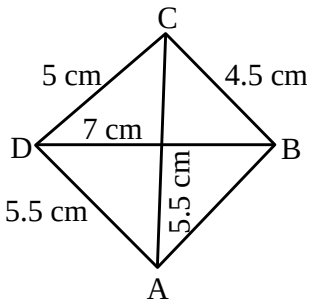
Step 4 S should lie on both the arcs drawn. So it is the point of intersection of the two arcs. Mark S and complete PQRS. PQRS is the required quadrilateral.



When two diagonals and three sides are given

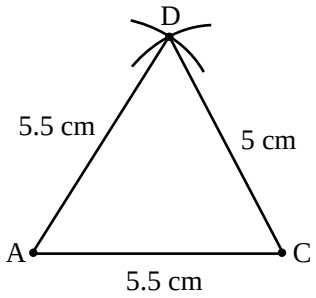
When four sides and a diagonal were given, we first drew a triangle with the available data and then tried to locate the fourth point. The same technique is used here.

Ex.2 Construct a quadrilateral ABCD, given that BC = 4.5 cm, AD = 5.5 cm, CD = 5 cm the diagonal AC = 5.5 cm & diagonal BD = 7 cm.

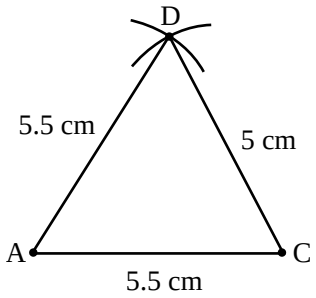


Sol. Here is the rough sketch of the quadrilateral ABCD. Studying this sketch, we can easily see that it is possible to draw ΔACD first.

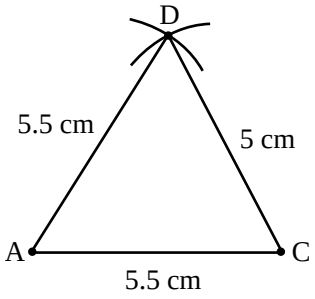
Step 1 Draw ΔACD using SSS construction. (We now need to find B at a distance of 4.5 cm from C and 7 cm from D).



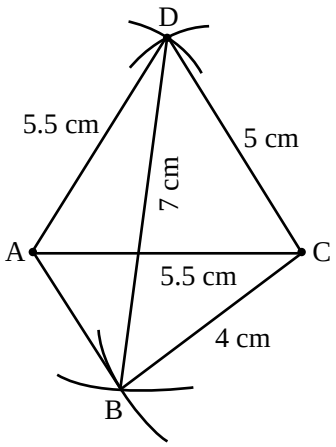
Step 2 With D as centre, draw an arc of radius 7 cm. (B is somewhere on this arc)



Step 3 With C as centre, draw an arc of radius 4.5 cm (B is somewhere on this arc also).



Step 4 Since B lies on both the arcs, B is the point intersection of the two arcs. Mark B and complete ABCD. ABCD is the required quadrilateral.

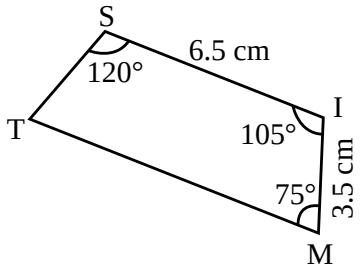


When two adjacent sides and three angles are known

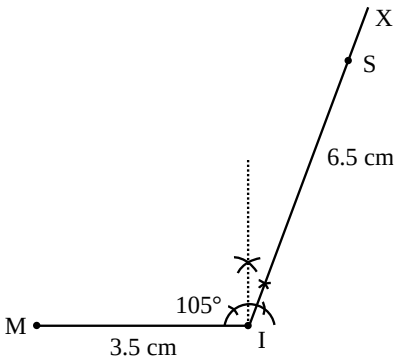
As before, we start with constructing a triangle and then look for the fourth point to complete the quadrilateral.

Ex.3 Construct a quadrilateral MIST where MI = 3.5 cm, IS = 6.5 cm, $\angle M = 75°$, $\angle I = 105°$ and $\angle S = 120°$.

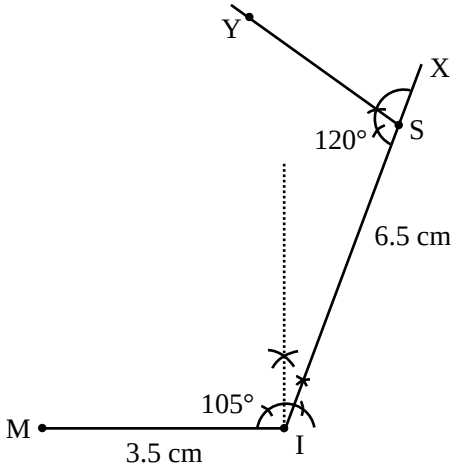
Sol. Here is a rough sketch that would help us in deciding our steps of construction. We give only hints for various steps.



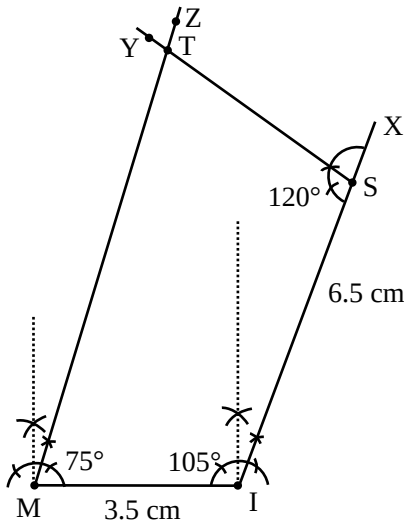
Step 1 How do you locate the points? What choice do you make for the base and what is the first step?



Step 2 Make $\angle ISY = 120°$ at S.



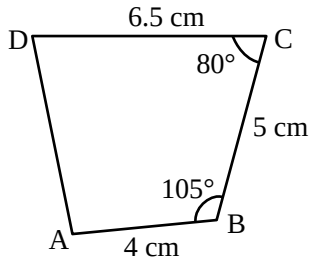
Step 3 Make $\angle IMZ = 75°$ at M. (where will SY and MZ meet ?) Mark that point as T. We get the required quadrilateral MIST.



When three sides and two included angles are given

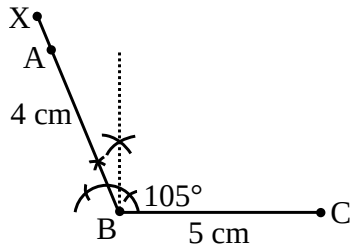
Under this type, when you draw a rough sketch, note carefully the ''included'' angles in particular.

Ex.4 Construct a quadrilateral ABCD, where AB = 4 cm, BC = 5 cm, CD = 6.5 cm and $\angle B = 105°$ and $\angle C = 80°$.

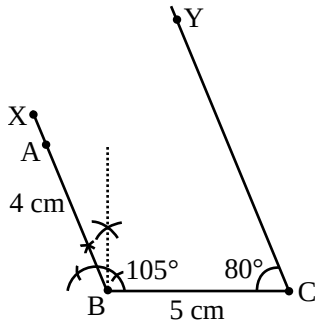


Sol. We draw a rough sketch, as usual, to get an idea of how we can start off. Then we can devise a plan to locate the four points.

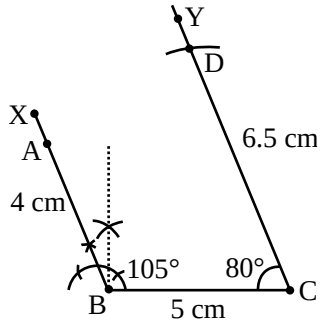
Step 1 Start with taking BC = 5 cm on B. Draw an angle of 105° along BX. Locate A 4 cm away on this. We now have B, C and A.



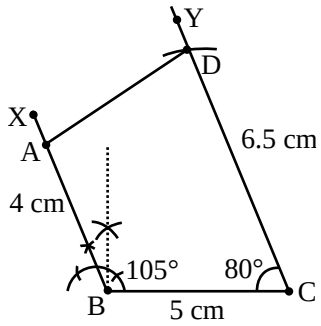
Step 2 The fourth point D is on CY which is inclined at 80° to BC. So make ∠BCY = 80° at C on BC.



Step 3 D is at a distance of 6.5 cm on CY. With C as centre, draw an arc of length 6.5 cm. It cuts CY at D.



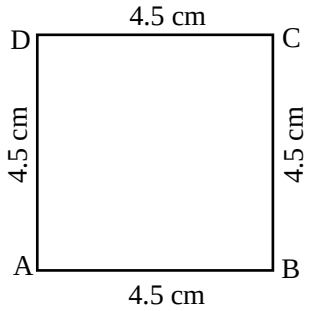
Step 4 Complete the quadrilateral ABCD. ABCD is the required quadrilateral.



Ex.5 Draw a square of side 4.5 cm.

Sol. Initially it appears that only one measurement has been given. Actually we have many more details with us, because the figure is a special quadrilateral, namely a square. We now know that each of its angles is a right angle. (See the rough figure).

Rough figure



This enables us to draw Δ ABC using SAS condition. Then D can be easily located. Try yourself now to draw the square with the given measurements.

Ex.6 Is it possible to construct a rhombus ABCD where AC = 6 cm and BD = 7 cm? Justify your answer.

Sol. Only two (diagonal) measurements of the rhombus are given. However, since it is a rhombus, we can find more help from its properties.

The diagonals of a rhombus are perpendicular bisectors of one another.

So, first draw AC = 7 cm and then construct its perpendicular bisector. Let them meet at 0. Cut off 3 cm lengths on either side of the drawn bisector. You now get B and D.

Draw the rhombus now, based on the method described above.

Rough figure