

Practical Geometry

- A unique quadrilateral can be constructed, if any five measurements of the quadrilateral are given.
- **Construction of a quadrilateral when four sides and a diagonal are given:**

Example: Construct a quadrilateral WXYZ, where $WX = 4.5$ cm, $XY = 5$ cm, $YZ = 5.5$ cm, $ZW = 3$ cm, and $WY = 6$ cm.

Solution: Step 1:

Draw a line WY of length 6 cm. Draw an arc of radius 4.5 cm with W as centre and another arc of length 5 cm with Y as centre. The intersection of the two arcs will be the point, X.

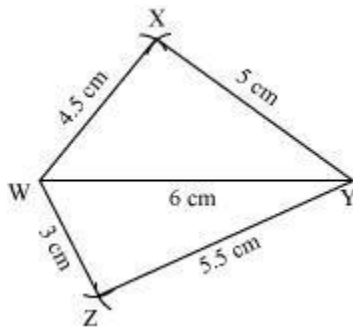
Join WX and XY.

Step 2: The point, Z, will be on the opposite side of point X with respect to WY.

Draw an arc of length 3 cm taking W as centre and another arc of length 5.5 cm taking Y as centre. The intersection of these arcs will be the point, Z.

Join WZ and YZ.

WXYZ is the required quadrilateral.



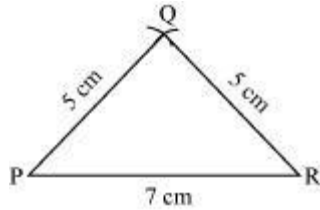
- **Construction of a quadrilateral when two diagonals and three sides are given**

Example: Construct a quadrilateral PQRS, where $PR = 7$ cm, $QS = 8$ cm, $PQ = 5$ cm, $QR = 5$ cm, and $PS = 5.5$ cm.

Solution: The steps of constructing quadrilateral PQRS are as follows:

Step 1: Draw a line PR of length 7 cm. Draw an arc of radius 5 cm taking P as centre and an arc of radius 5 cm taking R as centre. The point of intersection of these two arcs will be the point, Q.

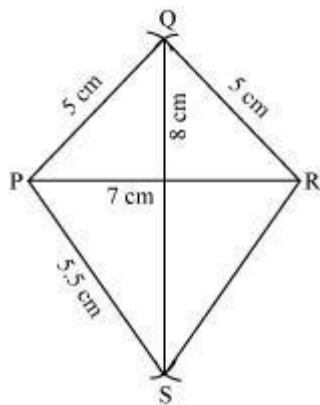
Join PQ and RQ.



Step 2: With Q as centre, draw an arc of radius 8 cm. The point, S, will lie on this arc.

Then, taking P as centre, draw an arc of radius 5.5 cm. The intersection point of the two arcs will be the point, S.

Join PS and RS.



PQRS is the required quadrilateral.

- Construction of a quadrilateral when two adjacent sides and three angles are given:**

Example: Construct a quadrilateral ABCD, where $AB = 6$ cm, $AD = 4$ cm, $\angle A = 90^\circ$, $\angle B = 105^\circ$, and $\angle D = 60^\circ$.

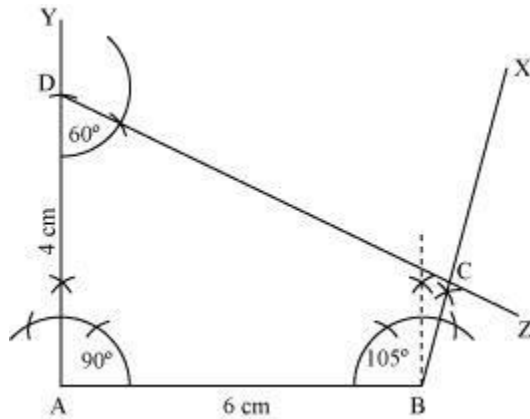
Solution:

Step 1: Draw a line segment AB of length 6 cm. Make $\angle ABX = 105^\circ$ at B and $\angle BAY = 90^\circ$ at A.

Step 2: With A as centre, draw an arc of radius 4 cm to cut the ray AY at point D. At D, draw $\angle ADZ = 60^\circ$.

The point of intersection of the rays, BX and DZ, will be the point, C.

ACD is the required quadrilateral.

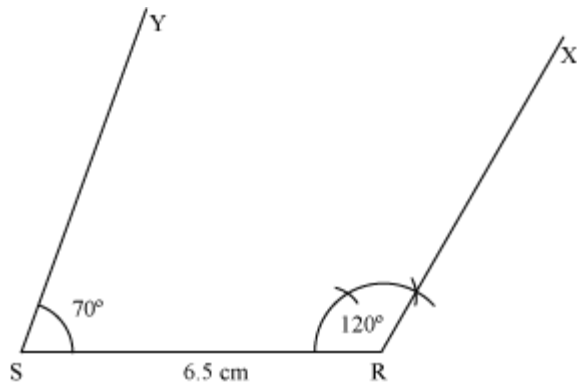


- **Construction of a quadrilateral when three sides and two included angles are given**

Example: Construct a quadrilateral PQRS with $SR = 6.5$ cm, $PS = 5$ cm, $QR = 3$ cm, $\angle R = 120^\circ$, and $\angle S = 70^\circ$.

Solution: The steps of construction are as follows:

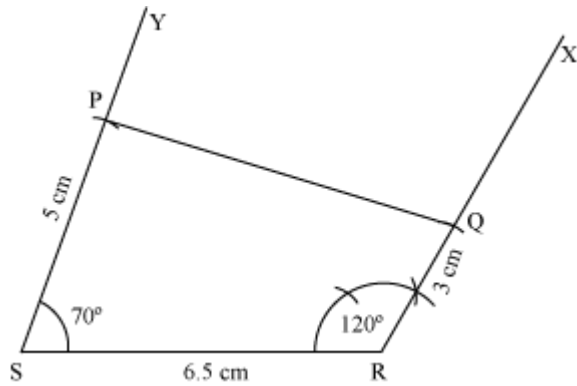
Step 1: Draw $SR = 6.5$ cm. Draw $\angle SRX = 120^\circ$ at R and $\angle RSY = 70^\circ$ at S.



Step 2: With S as centre, draw an arc of radius 5 cm intersecting SY at P.

With R as centre, draw an arc of radius 3 cm intersecting RX at Q.

Join PQ to obtain the required quadrilateral PQRS.



- **Construction of special quadrilaterals such as square, rhombus, rectangle, kite, and parallelogram can be done by using their properties.**

- In a square, all the sides are equal and all the angles are equal to 90° . Therefore, a square can be constructed, if one of its sides is given.
- In a rhombus, all the sides are equal. Also, the diagonals of a rhombus are perpendicular bisectors of one another. Therefore, a rhombus can be constructed, if only the measures of two diagonals are given.

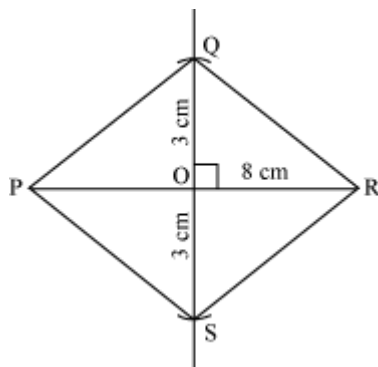
For example, if the diagonals of a rhombus PQRS are given as $PR = 8\text{ cm}$ and $QS = 6\text{ cm}$, then draw one of the diagonals, say $PR = 8\text{ cm}$

Then, construct its perpendicular bisector and let them meet at O.

With O as centre, cut off two arcs at the bisector on the opposite side of PR, each arc of radius 3 cm.

Then, the points, Q and S, are obtained.

Join PQ, QR, PS, and SR to obtain the required rhombus, PQRS.



- In a rectangle, all angles are of measure 90° and the opposite sides are equal. Therefore, a rectangle can be constructed even if two of its adjacent sides are given.

- In a kite, the adjacent sides are equal. Therefore, if two adjacent sides and a diagonal are given, then the required kite can be constructed.
- In a parallelogram, the opposite sides are equal and parallel. Therefore, a parallelogram can be constructed even if two of its sides and one angle or a diagonal are given.

For example, a parallelogram ABCD with $AB = 5$ cm, $BC = 4$ cm, $\angle B = 110^\circ$ can be constructed as follows:

First, draw $AB = 5$ cm and then construct $\angle ABX = 110^\circ$

With B as centre, draw an arc of radius 4 cm cutting the ray, BX, to obtain the point, C.

Then, draw a line CY parallel to AB. With C as centre, cut an arc of radius 5 cm at CY to obtain the point, D.

Join AD to obtain the parallelogram, ABCD.

