

## PRACTICAL GEOMETRY

## WE KNOW THAT

A triangle has six elements – 3 sides and 3 angles. To construct a unique triangle, 3 elements out of six elements are required under a certain combination. A quadrilateral has 8 elements – 4 sides and 4 angles. In addition to these elements a quadrilateral has 2 diagonals which play an important role in determining the size and shape of a quadrilateral. Thus a quadrilateral has 10 elements (4 sides, 4 angles and 2 diagonals) or measurements.

## CONSTRUCTION A QUADRILATERAL

To construct a unique quadrilateral we need to know 5 measurements (elements).

Note : To construct a unique quadrilateral simply the knowledge of any five elements is not sufficient. We will need to know a combination of specific 5 elements.

VARIOUS COMBINATIONS OF ELEMENTS FOR  
CONSTRUCTING A UNIQUE QUADRILATERAL

With the help of the following measurements we can construct quadrilaterals.

- |  |  |
|--|--|
| (i) Four sides and a diagonal.           | (ii) Three sides and two diagonals.                          |
| (iii) Four sides and an angle.           | (iv) Three sides and two included angles.                    |
| (v) Two adjacent sides and three angles. | (vi) Using special properties of a square or a rhombus, etc. |

## WHEN THE LENGTHS OF FOUR SIDES AND A

## DIAGONAL ARE GIVEN

Ex. 1 Construct a quadrilateral ABCD when  $AB = 4$  cm,  $BC = 6$  cm,  $CD = 5$  cm,  $AD = 5.5$  cm and  $AC = 7$  cm.

Sol.

## REMEMBER

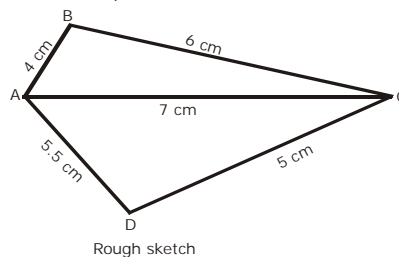
First of all make a rough sketch. Do not start construction without drawing a rough sketch showing sides, angles and diagonals, etc. with correct name.

Step I. Draw a rough sketch and mark the measurements.

Step II. Draw  $AC = 7$  cm.

Step III. With A as centre and radius 4 cm, draw an arc above AC.

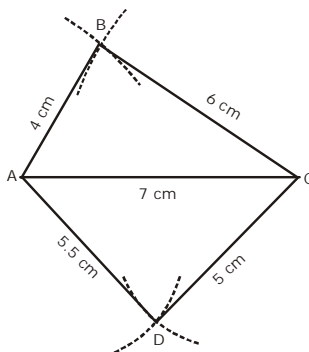
Step IV. With C as centre and radius 6 cm, draw another arc intersecting the previous arc at B.



Step V. With centre A and radius 5.5 cm, draw an arc below AC.

Step VI. With centre C and radius 5 cm, draw another arc to intersect the previous arc at D.

Step VII. Join DA and DC.

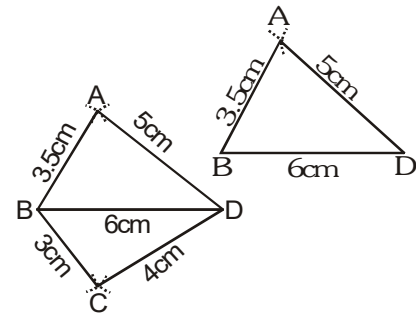


Step I

Draw  $BD = 6\text{ cm}$ . With B and D as centres and radii 3.5 cm and 5 cm respectively, draw two arcs to cut each other at A. Join BA and DA.

Step II

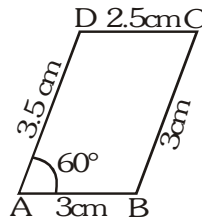
With B and D as centres and radii 3 cm and 4 cm respectively, draw two arcs on the other side of BD to cut each other at C. Join BC and CD. ABCD is the required quadrilateral.



(B) To construct a quadrilateral when the measurements of four sides and one angle are given.

Ex.4 Construct a quadrilateral ABCD in which  $AB = 3\text{ cm}$ ,  $BC = 3\text{ cm}$ ,  $CD = 2.5\text{ cm}$ ,  $DA = 3.5\text{ cm}$  and  $\angle A = 60^\circ$ .

Sol. We first draw the rough sketch of the quadrilateral as shown in fig.

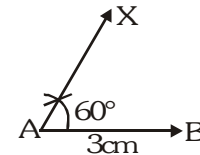


STEPS

Step I

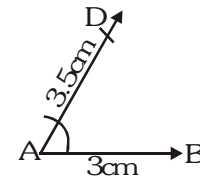
Draw  $AB = 3\text{ cm}$ . At A make an angle  $\angle BAX = 60^\circ$

CONSTRUCTION



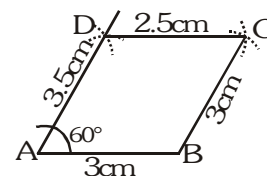
Step II

Cut off  $AD = 3.5\text{ cm}$



Step III

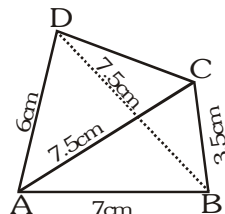
With B and D as centres and radii 3 cm and 2.5 cm respectively, draw two arcs intersecting each other at C. Join DC and BC. ABCD is the required quadrilateral



(C) To construct a quadrilateral when the measurements of three sides and both the diagonals are given.

Ex.5 Construct a quadrilateral ABCD, given that  $AB = 7\text{ cm}$ ,  $AD = 6\text{ cm}$ ,  $AC = 7.5\text{ cm}$ ,  $BD = 7.5\text{ cm}$  and  $BC = 3.5\text{ cm}$ .

Sol. We first draw the rough sketch of the quadrilateral and indicate the lengths of the sides as shown in fig.



## STEPS

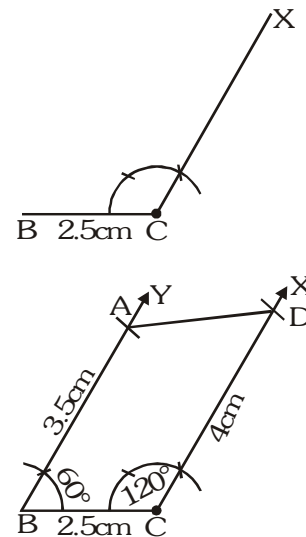
Step I

Draw  $BC = 2.5$  cm. At C make  $\angle BCX = 120^\circ$ .

Step II

At B make an  $\angle CBY = 60^\circ$ . With B as centre and radius 3.5 cm, draw an arc cutting BY at A. With C as centre and radius 4 cm draw an arc, cutting CX at D. Join AD. Thus, ABCD is the required quadrilateral.

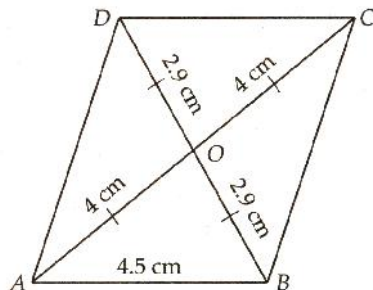
## CONSTRUCTION



## CONSTRUCTION OF SPECIAL TYPES OF QUADRILATERALS

Ex.8 Construct a parallelogram ABCD in which  $AB = 4.5$  cm,  $AC = 8$  cm,  $BD = 5.8$  cm.

Sol. First we draw the rough sketch of this parallelogram with the given measurements.



Steps of Construction :

Step-I Draw  $AB = 4.5$  cm.

Step-II With A as centre and  $AO = \frac{8}{2} = 4$  cm as radius, draw an arc.

Step-III With B as centre and  $BO = \frac{5.8}{2} = 2.9$  cm, draw another arc which intersects the previous arc in step-II at point O and join AO and OB.

Step-IV Now, extend AO and BO to C and D respectively such that  $OC = OA$  and  $OD = OB$ .

Step-V Now, join AD, BC and DC.

Hence, ABCD is the required parallelogram.

Ex.9 Construct a parallelogram ABCD, given that  $AC = 4.5$  cm and  $BD = 4$  cm and the angle between the diagonal is  $30^\circ$ .

Sol. We first draw a rough sketch of the parallelogram ABCD as shown in fig.

Steps of Construction :

Step-I Draw  $AC = 4.5$  cm

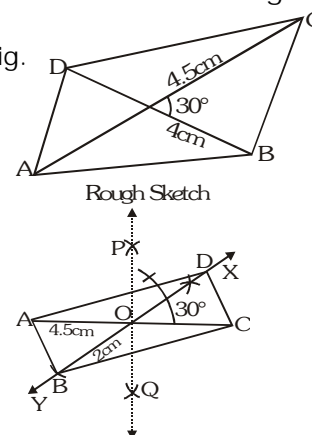
Step-II Draw PQ, the perpendicular bisector of AC meeting AC at O.

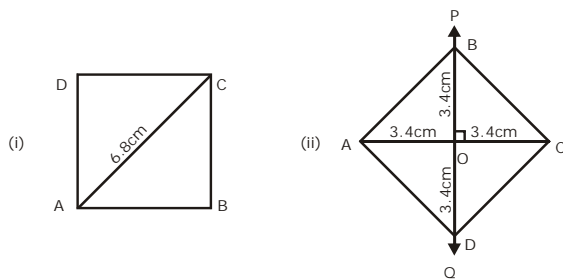
Step-III Through O draw a line XY, making  $\angle XOC = 30^\circ$ .

Step-IV Cut off  $OD = OB = 2$  cm  $\left( = \frac{1}{2}BD \right)$  from XY.

Join A to B, B to C, C to D and A to D.

Then, ABCD is the required parallelogram





Steps of Construction :

Step-I Draw a line segment  $AC = 6.8$  cm.

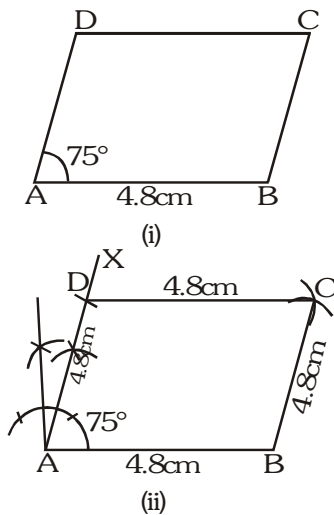
Step-II Draw  $PQ$  its right bisector, meeting  $AC$  at  $O$ .

Step-III Cut off  $OD$  and  $OB$  each equal to  $3.4$  cm.  
i.e.  $\frac{1}{2}$  of the diagonal  $AC$ . Join  $AD$ ,  $DC$ ,  $AB$  and  $BC$ .

Then,  $ABCD$  is the required square.

Ex.6 Construct a rhombus  $ABCD$  whose side is  $4.8$  cm and an angle is  $75^\circ$ .

Sol. We first draw a rough sketch of rhombus  $ABCD$  as shown in the fig.



Steps of Construction :

Step-I Draw a line segment  $AB = 4.8$  cm.

Step-II At  $A$ , draw an angle  $\angle BAX = 75^\circ$  and from  $AX$  cut off  $AD = 4.8$  cm.

Step-III With  $B$  and  $D$  as centres and radii equal to  $4.8$  cm, draw arcs intersecting each other at  $C$ .

Join  $BC$  and  $DC$

Then,  $ABCD$  is the required rhombus.

Ex.7 Construct a rhombus  $ABCD$  whose side is  $AB = 5$  cm and a diagonal  $AC = 7.5$  cm.

Sol. Steps of Construction :

Step-I Draw a line segment  $AB = 5$  cm.

Step-II With  $A$  and  $B$  as centres and radii equal to  $7.5$  cm and  $5$  cm, draw arcs cutting each other at  $C$ . Join  $AC$ .

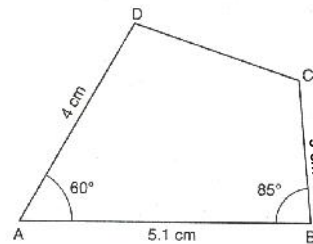
Step-III Again with  $A$  and  $C$  as centres and radii equal to  $5$  cm, each draw arcs cutting each other at  $D$ .

Join  $AD$ ,  $CD$ .

Then,  $ABCD$  is the required rhombus.

Ex.8 Construct a quadrilateral  $ABCD$  given  $AB = 5.1$  cm,  $AD = 4$  cm,  $BC = 3$  cm,  $\angle A = 60^\circ$  and  $\angle B = 85^\circ$

Sol. First we draw the rough sketch of quadrilateral  $ABCD$  and indicate the data on it as shown in fig. So, we follow the following steps of construction.



Steps of Construction :

Step-I Draw  $AB = 5.1$  cm.

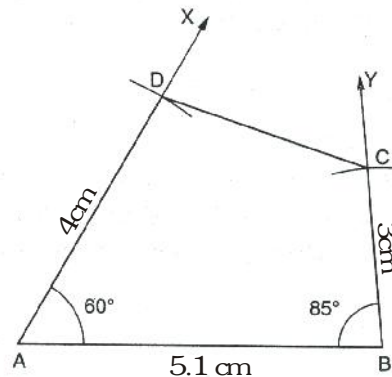
Step-II Construct  $\angle XAB = 60^\circ$  at  $A$ .

Step-III With  $A$  as centre and radius  $AD = 4$  cm, cut off  $AD = 4$  cm along  $AX$ .

Step-IV Construct  $\angle ABY = 85^\circ$  at  $B$ .

Step-V With  $B$  as centre and radius  $BC = 3$  cm, cut off  $BC = 3$  cm along  $BY$ .

Step-VI Join  $CD$ .



The quadrilateral  $ABCD$  so obtained is the required quadrilateral.

Q.27 Construct a trapezium PQRS, in which  $PQ \parallel RS$ ;  $PQ = 8$  cm,  $QR = 6$  cm,  $RS = 4$  cm and  $\angle Q = 60^\circ$ . Also, write steps of construction.

Q.28 Draw a trapezium ABCD, in which  $AB \parallel DC$ ,  $AB = 7$  cm,  $BD = 5$  cm,  $AD = 6.5$  cm and  $\angle B = 60^\circ$ .

Q.29 Construct a quadrilateral ABCD, when  $AB = 3$  cm,  $CD = 3$  cm,  $DA = 7.5$  cm,  $AC = 8$  cm and  $BD = 4$  cm.

Q.30 Construct a quadrilateral ABCD, in which  $AB = 4$  cm,  $BC = 3$  cm,  $AD = 2.5$  cm,  $AC = 4.5$  cm and  $BD = 4$  cm. Write steps of construction also.

Q.31 Construct a square, whose diagonal is  $6.4$  cm.

Q.32 Construct a quadrilateral ABCD, in which  $AB = BC = 3$  cm,  $AD = CD = 5$  cm and  $\angle ABC = 120^\circ$ .

Q.33 Construct a rhombus with side  $5.2$  cm, and one of its angles  $75^\circ$ .

Q.34 Construct a quadrilateral PQRS, in which  $\angle Q = 45^\circ$ ,  $\angle R = 90^\circ$ ,  $QR = 5$  cm,  $PQ = 4$  cm and  $RS = 3$  cm.

Q.35 Construct a quadrilateral ABCD, in which  $AB = 6$  cm,  $BC = 5$  cm,  $\angle A = 55^\circ$ ,  $\angle B = 110^\circ$  and  $\angle D = 90^\circ$ . Also write steps of construction.

Q.36 Construct a quadrilateral ABCD, in which  $AB = 6$  cm,  $BC = 5$  cm,  $\angle A = 70^\circ$ ,  $\angle B = 110^\circ$  and  $\angle D = 85^\circ$ .

Q.37 Using ruler and compasses, construct a quadrilateral ABCD in which  $AB = 4$  cm,  $BC = 5$  cm,  $CD = 4.5$  cm,  $\angle B = 60^\circ$  and  $\angle C = 135^\circ$ . Measure AD. Write steps of construction also.

Q.38 Construct the quadrilateral TRUE, in which  $TR = 3.5$  cm,  $RU = 3$  cm,  $UE = 4$  cm,  $\angle R = 75^\circ$ , and  $\angle U = 120^\circ$ .

Q.39 Construct the quadrilateral JUMP, in which  $JU = 3.5$  cm,  $UM = 4$  cm,  $MP = 5$  cm,  $PJ = 4.5$  cm and  $PU = 6.5$  cm.

Q.40 Construct a trapezium ABCD, when  $AB \parallel CD$ ,  $AD = BC = 3.2$  cm,  $AB = 6.4$  cm, and  $CD = 9.6$  cm. Measure  $\angle B$  and  $\angle A$ .

Q.41 Draw a parallelogram ABCD, If  $AB = 4.5$  cm,  $DA = 3.4$  cm and  $\angle A = 85^\circ$ . Find the measure of  $\angle B$  write steps of construction.

Q.42 Using ruler and compasses, construct a quadrilateral ABCD in which  $\overline{AB} = 4.5$  cm,  $\overline{BC} = 5$  cm,  $\angle A = 60^\circ$ ,  $\angle B = 120^\circ$ ,  $\angle C = 60^\circ$ . Draw diagonal  $\overline{AC}$  and measure it. Also, write the steps of construction.

Q.43 Construct the quadrilateral GOLD, in which  $OL = 7.5$  cm,  $GL = 6$  cm,  $GD = 6$  cm,  $LD = 5$  cm and  $OD = 10$  cm.

Q.44 Construct a parallelogram HEAR,  $HE = 5$  cm,  $EA = 6$  cm,  $\angle R = 85^\circ$ .

Q.45 Construct a rectangle OKAY, in which  $OK = 7$  cm and  $KA = 5$  cm.

Q.46 Construct a quadrilateral ABCD in which  $AB = 5$  cm,  $BC = 6.5$  cm,  $\angle A = 75^\circ$ ,  $\angle B = 105^\circ$  and  $\angle C = 120^\circ$ .