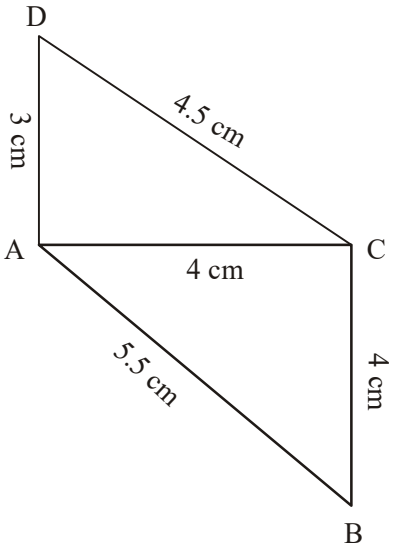
4 Practical Geometry

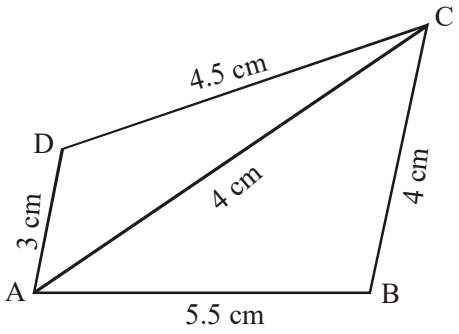
To construct a quadrilateral when four sides and one diagonal are given

Example. Construct a quadrilateral ABCD given that AB = 5.5 cm, BC = 4 cm, CD = 4.5 cm, DA = 3 cm and the diagonal AC = 4 cm.

Steps of construction:

1. Draw AC = 4 cm.
2. With A as centre and a radius 3 cm draw an arc on one side of AC.
3. With C as centre and radius 4.5 cm draw an arc cutting the first arc at D.
4. Join A to D and also C to D.
5. With A as centre and radius 5.5 cm draw an arc on the other side of AC.
6. With C as centre and radius 4 cm draw another arc cutting the previous arc at B.
7. Join A to B and also C to B. Then ABCD is the required quadrilateral.





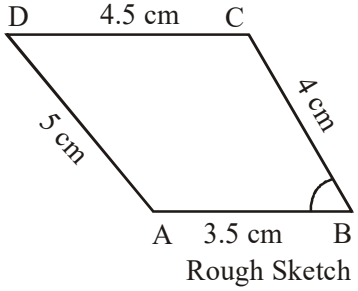
Notes :
1. Since four sides and a diagonal of quadrilateral are given, it is convenient to think that it is made up of two triangles on opposite sides of a common base.
2. Sum of any two sides of a triangle is greater than the third side.

To construct a quadrilateral when four sides and one angle are given :

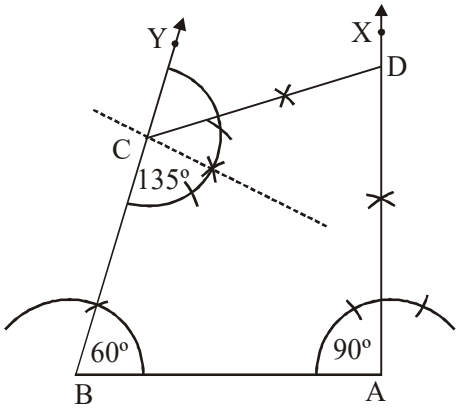
Example. Construct a quadrilateral ABCD, having given AB = 3.5 cm, BC = 4 cm, CD = 4.5 cm, DA = 5 cm and $\angle B = 60^\circ$

Steps of Construction

1. Draw AB = 3.5 cm.
2. At B draw ∠ABY = 60º.
3. Cut off from BY, a segment BC = 4 cm.
4. With A as centre and radius 5 cm draw an arc.
5. With C as centre and radius 4.5 cm draw an arc cutting the first arc at D.
6. Join A to D and also C to D. Then ABCD is the required quadrilateral.



Rough Sketch

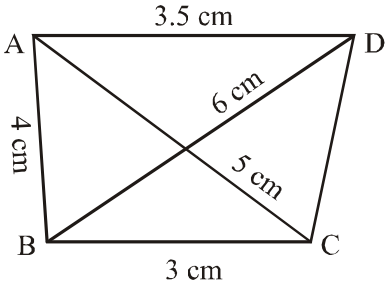


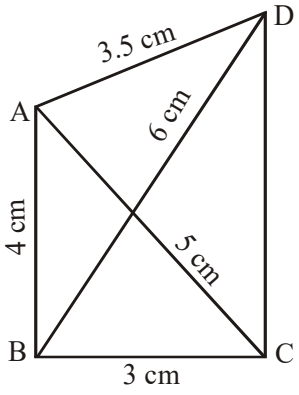
To construct a quadrilateral when three sides and two diagonals are given :

Example. Construct a quadrilateral ABCD, given that AB = 4 cm, BC = 3 cm, AD = 3.5 cm, diagonal AC = 5 cm and diagonal BD = 6 cm.

Steps of Construction:

1. Draw BC = 3 cm.
2. With B as centre and radius 4 cm draw an arc.
3. With C as centre and radius 5 cm draw an arc cutting the first arc at A.
4. Join B to A and also C to A.
5. With A as centre and radius 3.5 cm draw an arc.
6. With B as centre and radius 6 cm draw an arc cutting the first arc at D.
7. Join C to D, B to D and also A to D.
   Then ABCD is the required quadrilateral.



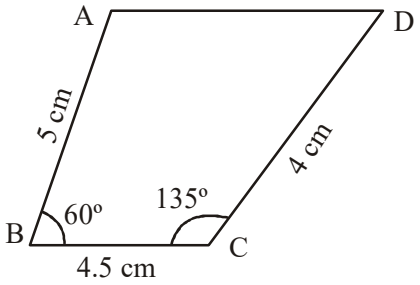


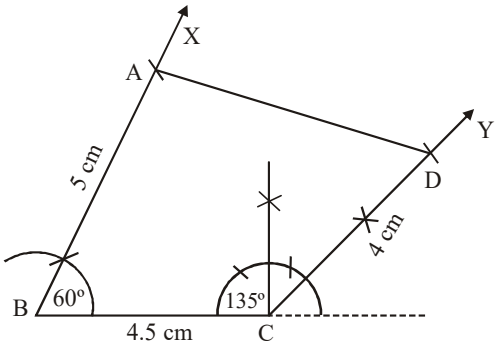
To construct a quadrilateral when three sides and two included angles are given :

Example. Construct a quadrilateral ABCD, given that AB = 5 cm, BC = 4.5 cm, CD = 4 cm, ∠B = 60º and ∠C = 135º.

Steps of Construction:

1. Draw BC = 4.5 cm.
2. At B and C draw angles of 60º and 135º respectively.
3. Cut off BA = 5 cm and CD = 4 cm.
4. Join A to D.
   Then ABCD is the required quadrilateral.



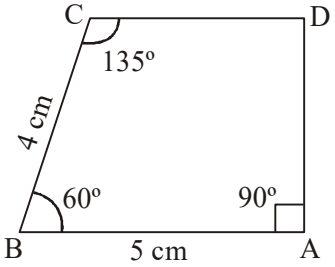


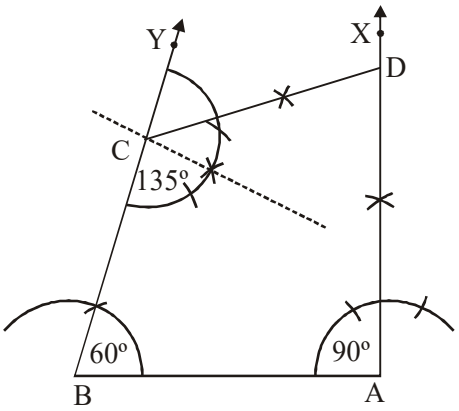
To construct a quadrilateral when two adjacent sides and three angles are given :

Example. Construct a quadrilateral ABCD, given that AB = 5 cm, BC = 4 cm, ∠B = 60º, ∠A = 90º and ∠C = 135º.

Steps of construction:

1. Draw AB = 5 cm.
2. At B draw ∠ABY = 60º.
3. From BY cut off BC = 4 cm.
4. At A draw ∠BAX = 90º.
5. At C draw ∠BCD = 135º, so that its arm CD cuts AX at D.
   Then ABCD is the required quadrilateral.





Note:	We know that sum of the angles of a quadrilateral is 360º. Hence the sum of the given three angles should be less than 360º.

Construction of special types of quadrilaterals :

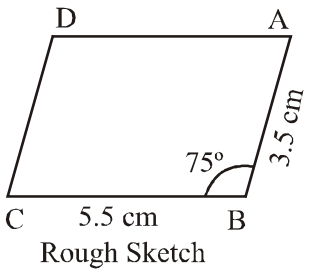
We have learnt earlier some properties of the parallelograms, we are now in a position to construct parallelograms, rectangles, squares, rhombuses and trapeziums when a suitable number of elements are given.

Example 1. Construct a parallelogram ABCD, given that AB = 3.5 cm, BC = 5.5 cm and ∠B = 75º.

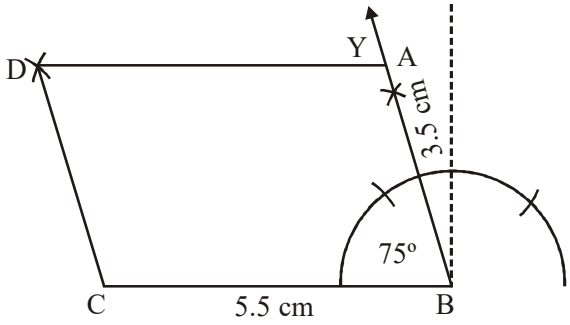
Steps of Construction:

1. Draw BC = 5.5 cm.
2. At B draw ∠CBY = 75º.
3. From BY, cut off BA = 3.5 cm.
4. With A as centre and radius 5.5 cm draw an arc.
5. With C as centre and radius 3.5 cm draw another arc cutting the first arc at D.
6. Join A to D and C to D.

   Then ABCD is the required parallelogram.



Rough Sketch

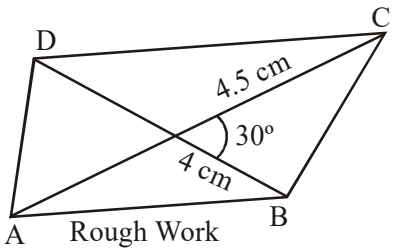


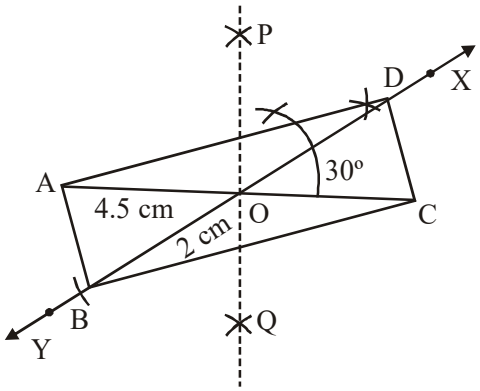
Example 2. Construct a parallelogram ABCD, given that AC = 4.5 cm and BD = 4 cm and the angle between the diagonals is 30º.

Steps of Construction:

1. Draw AC = 4.5 cm.
2. Draw PQ, the perpendicular bisector of AC meeting AC at O.
3. Through O draw a line XY, making ∠XOC = 30º.
4. Cut of OD = OB = 2 cm (= $\frac{1}{2}$ BD) from XY.
5. Join A to B, B to C, C to D and A to D.

   Then ABCD is the required parallelogram.

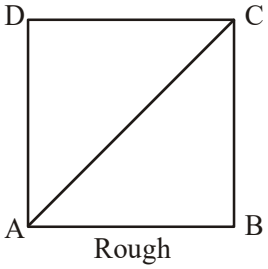


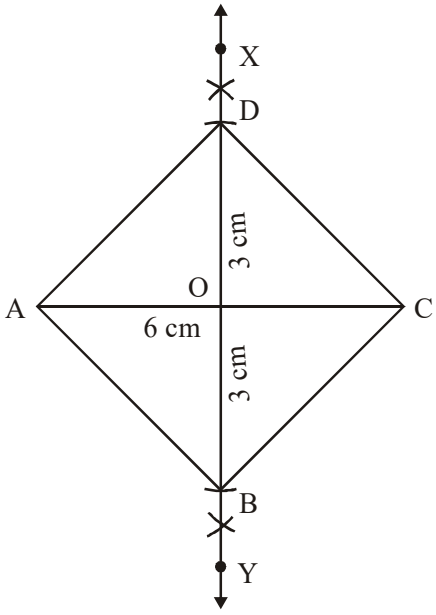


Example 3. Construct a square ABCD, given that diagnonal AC = 6 cm.

Steps of Construction:

1. Draw a segment AC = 6 cm.
2. Draw XY, the right bisector of AC meeting AC at O.
3. Cut off OD = OB = 3 cm (= $\frac{1}{2}$ AC) from OX and OY respectively.
4. Join A to B, B to C, C to D and A to D. Then ABCD is the required square.





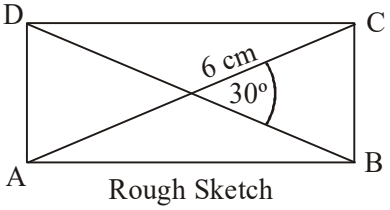
Note : Diagonals of a square are equal and bisect each other at right angles.

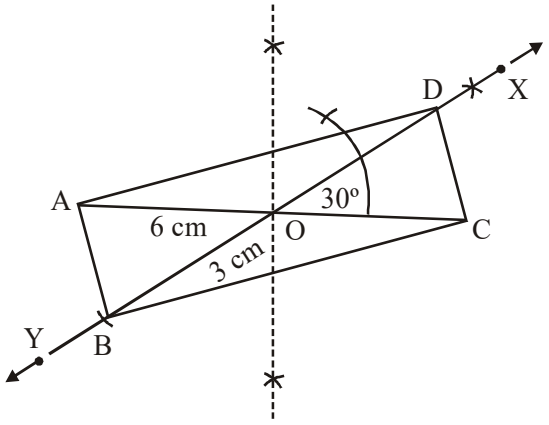
Example 4. Construct a rectangle ABCD whose diagonal AC = 6 cm and the angle between the diagonals is 30°.

Steps of Construction:

1. Draw AC = 6 cm.
2. Bisect AC at O.
3. At O, draw XY making ∠COX = 30°.
4. Cut off OB = OD = 3 cm (= $\frac{1}{2}$ × AC).

5. Join A to B, B to C, C to D and A to D.
Then ABCD is the required rectangle.



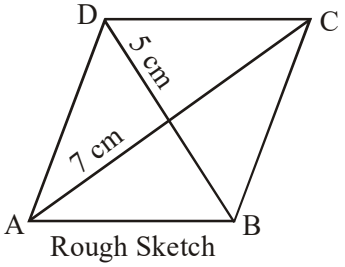


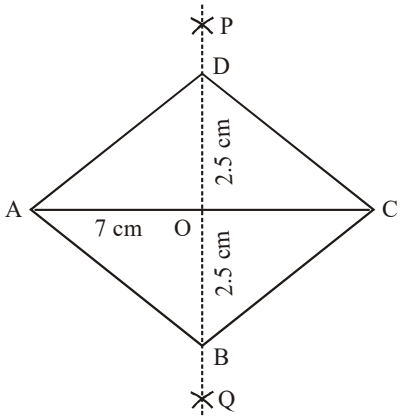
Example 5. Construct a rhombus ABCD whose diagonals AC and BD are 7 cm and 5 cm respectively.

Steps of Construction:

1. Draw AC = 7 cm.
2. Draw PQ the perpendicular bisector of AC, meeting AC at O.
3. From OP and OQ cut off OD = OB = 2.5 cm $\left(=\frac{1}{2}BD\right)$ respectively.
4. Join A to B, B to C, C to d and D to A.
Then ABCD is the required rhombus.

Note: Diagonals of a rhombus bisect each other at right angles.





IMPORTANT TIPS FOR COMPETITIVE EXAMS

1. The figure formed by four line segments is called a quadrilateral.
2. A quadrilateral has four sides, four angles and two diagonals.
3 A quadrilateral in which the measure of each angle is less than 180° is known as a convex quadrilateral.
4. A quadrilateral in which one of the angles measures more than 180° is known as a concave quadrilateral.
5. The sum of all angles in a quadrilateral is 360°.
6. To construct a quadrilateral, we need five measurements.

REVISION EXERCISE

LEVEL - I

1. Construct a quadrilateral ABCD given that AB = 3 cm, BC = 3.5 cm, CD = 4 cm, DA = 5.5 cm and AC = 6 cm.

2. Is it possible to construct a quadrilateral in which AB = 3 cm, BC = 4 cm, CD = 5.4 cm, DA = 4.9 cm and diagonal AC = 8 cm? If not why?

3. Construct a quadrilateral ABCD in which AB = 4 cm, BC = 4.5 cm, CD = 5 cm, DA = 4.5 cm and $\angle C = 60°$.

4. Construct a quadrilateral ABCD, having given AB = 4 cm, BC = 4.5 cm, AD = 4 cm, AC = 6 cm and BD = 6.5 cm.

5. Construct a quadrilateral PQRS in which PQ = 5 cm, RS = 4 cm, PS = 8 cm, PR = 10 cm and QS = 7 cm. Measure the fourth side.

6. Construct a quadrilateral PQRS in which PQ = 3 cm, $\angle Q = 80°$, PR = 6 cm and PS = RS = 5 cm

7. Construct q quadrilateral ABCD, given that AB = 4 cm, BC = 4.5 cm, CD = 5 cm, $\angle B = 75°$ and $\angle C = 100°$.

8. Construct a quadrilateral PQRS in which RS = 6 cm, QR = 5 cm, PQ = 5 cm $\angle Q = 135°$, $\angle R = 90°$. Measure PS.

9. Construct a quadrilateral ABCD in which BC = 4.5 cm, AB = 4 cm, $\angle B = 75°$, $\angle A = 90°$ and $\angle C = 120°$.

10. Is it possible to construct a quadrilateral PQRS in which PQ = 4 cm, QR = 5 cm, $\angle Q = 120°$, $\angle P = 105°$ and $\angle R = 135°$? If not why?

LEVEL - II

1. Construct a parallelogram PQRS in which PR = 6 cm and QS = 4 cm and the angle between PR and QS is 50°.

2. Construct a square on a diagonal 6 cm long.

3. Construct a rhombus ABCD, given that AB = 5 cm and an anlge is 70°.

4. Construct is rhombus whose diagonals are 5 cm and 4 cm.

5. Construct a parallelogram ABCD whose side AB = 5.5 cm and its two diagonals are 1 cm and 8 cm.

MULTIPLE CHOICE QUESTIONS

1. The minimum number of dimensions needed to construct a rectangle is
   (A) 1 (B) 2 (C) 3 (D) 4

2. The minimum number of measurements needed to construct a square is
   (A) 1 (B) 2 (C) 3 (D) 4

3. In a quadrilateral PQRS, if $\angle P = \angle R = 100°$ and $\angle S = 75°$ then $\angle Q =$ ____.
   (A) 50° (B) 85° (C) 120° (D) 306°

4. The sum of the angles in a quadrilateral is equal to _____
   (A) 2 right angles (B) 3 right angles (C) 4 right angles (D) 360 right angles

5. If the lengths of two diagonals of a rhombus are 12 cm and 16 cm, then the length of each side of the rhombus is
   (A) 10 cm (B) 14 cm (C) cannot be determined (D) none of these

6. If one of the angle measures more than 180° in a quadrilateral, then that is known as
   (A) a parallelogram (B) a concave quadrilateral
   (C) a convex quadrilateral (D) a trapezium

7. A quadrilateral which has exactly one pair of parallel sides is called
   (A) a parallelogram (B) a rectangle (C) a trapezium (D) a kite

8. Which of the following statements is true?
   (A) The diagonals of a rectangle are perpendicular.
   (B) The diagonals of a rhombus are equal.
   (C) Every square is a rhombus.
   (D) None of these.

9. The number of measurements required to construct a quadrilateral is
   (A) 5 (B) 4 (C) 3 (D) 2

10. To construct a parallelogram, the minimum number of measurements required is
    (A) 2 (B) 3 (C) 4 (D) 1

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