



# Practical Geometry

## Understanding the Lesson

- Construction of four sided figures when
  - Four sides and one diagonal are given.
  - Two diagonals and three sides are given.
  - Two adjacent sides and three angles are given.
  - Three sides and two included angles are given.
- Some special cases:
  - To construct a square when only one side is given.
  - To construct a trapezium.

## Conceptual Facts

- Quadrilaterals basically has ten parts in all, four sides, four angles and two diagonals.
- To construct a quadrilateral, we need the measurement of five specified parts.
- Before constructing a figure, we need to draw a rough free hand sketch.
- Using the properties of the quadrilateral, we can construct parallelograms, squares, rectangles, rhombuses and trapeziums.

### EXERCISE 4.1

Q1. Construct the following quadrilaterals.

(i) Quadrilateral ABCD

$$AB = 4.5 \text{ cm}$$

$$BC = 5.5 \text{ cm}$$

$$CD = 4 \text{ cm}$$

$$AD = 6 \text{ cm}$$

$$AC = 7 \text{ cm}$$

(ii) Quadrilateral JUMP

$$JU = 3.5 \text{ cm}$$

$$UM = 4 \text{ cm}$$

$$MP = 5 \text{ cm}$$

$$PJ = 4.5 \text{ cm}$$

$$PU = 6.5 \text{ cm}$$

(iii) Parallelogram MORE

$$OR = 6 \text{ cm}$$

$$RE = 4.5 \text{ cm}$$

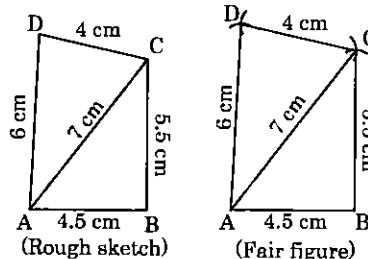
$$EO = 7.5 \text{ cm}$$

(iv) Rhombus BEST

$$BE = 4.5 \text{ cm}$$

$$ET = 6 \text{ cm}$$

Sol. (i) We have to draw first rough sketch.



#### Construction:

**Step I:** Draw  $AB = 4.5 \text{ cm}$

**Step II:** Draw an arc with centre B and radius 5.5 cm.

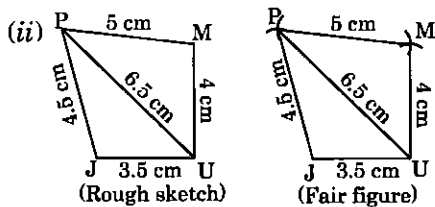
**Step III:** Draw another arc with centre A and radius 7 cm to meet the previous arc at C.

**Step IV:** Draw an arc with centre C and radius 4 cm.

**Step V:** Draw another arc with centre A and radius 6 cm to cut the former arc at D.

**Step VI:** Join BC, AC, CD and AD.

Thus ABCD is the required quadrilateral.



**Construction:**

**Step I:** Draw  $JU = 3.5$  cm.

**Step II:** Draw an arc with centre J and radius 4.5 cm.

**Step III:** Draw another arc with centre U and radius 6.5 cm to meet the previous arc at P.

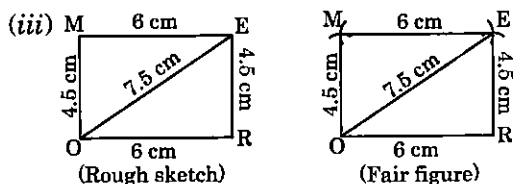
**Step IV:** Join JP and UP.

**Step V:** Draw an arc with centre U and radius 4 cm.

**Step VI:** Draw another arc with centre P and radius 5 cm to meet the previous arc at M.

**Step VII:** Join UM and PM.

Thus, JUMP is the required quadrilateral.



**Construction:** (Opposite sides of a parallelogram are equal)

**Step I:** Draw  $OR = 6$  cm.

**Step II:** Draw an arc with centre R and radius 4.5 cm.

**Step III:** Draw another arc with centre O and radius 7.5 cm to meet the previous arc at E.

**Step IV:** Join RE and OE.

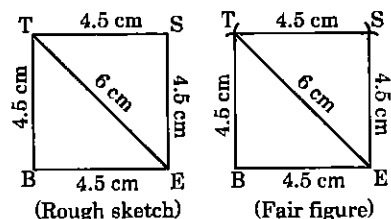
**Step V:** Draw an arc with centre E and radius 6 cm.

**Step VI:** Draw another arc with centre O and radius 4.5 cm to meet the former arc at M.

**Step VII:** Join EM and OM.

Thus, MORE is the required parallelogram.

(iv) **Construction:** (All sides of a rhombus are equal)



**Step I:** Draw  $BE = 4.5$  cm

**Step II:** Draw an arc with centre B and radius 4.5 cm.

**Step III:** Draw another arc with centre E and radius 6 cm to meet the previous arc at T.

**Step IV:** Join BT and ET.

**Step V:** Draw two arcs with centres E and T with equal radii 4.5 cm to meet each other at S.

**Step VI:** Join ES and TS.

Thus, BEST is the required rhombus.

**EXERCISE 4.2**

Q1. Construct the following quadrilaterals.

(i) Quadrilateral LIFT

LI = 4 cm

IF = 3 cm

TL = 2.5 cm

LF = 4.5 cm

IT = 4 cm

(ii) Quadrilateral GOLD

OL = 7.5 cm

GL = 6 cm

GD = 6 cm

LD = 5 cm

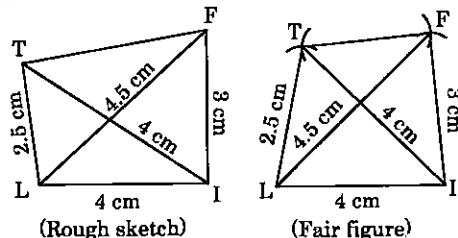
OD = 10 cm

(iii) Rhombus BEND

BN = 5.6 cm

DE = 6.5 cm

Sol. (i) **Construction:**



**Step I:** Draw  $LI = 4$  cm.

**Step II:** Draw an arc with centre I and radius 3 cm.

**Step III:** Draw another arc with centre L and radius 4.5 cm to meet the former arc at F.

**Step IV:** Join LF and IF.

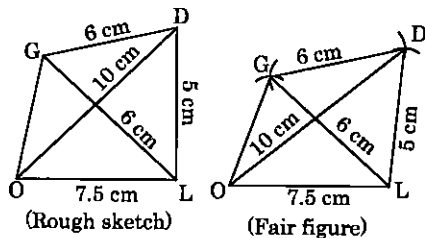
**Step V:** Draw an arc with centre L and radius 2.5 cm.

**Step VI:** Draw another arc with centre I and radius 4 cm to meet the previous arc at T.

**Step VII:** Join LT and IT.

Thus LIFT is the required quadrilateral.

(ii) **Construction:**



**Step I:** Draw  $OL = 7.5$  cm

**Step II:** Draw an arc with centre O and radius 10 cm.

**Step III:** Draw another arc with centre L and radius 5 cm to meet the previous arc at D.

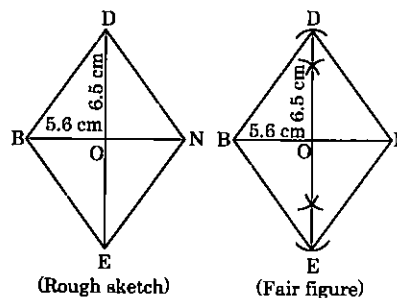
**Step IV:** Join OD and LD.

**Step V:** Draw an arc with centre L and D with equal radii of 6 cm to meet each other at G.

**Step VI:** Join LG and DG.

Thus GOLD is the required quadrilateral.

(iii) **Construction:** (The diagonals of a rhombus bisect each other at right angle)



**Step I:** Draw  $BN = 5.6$  cm.

**Step II:** Draw the right bisector of BN at O.

**Step III:** Draw two arcs with centre O and radius  $\frac{1}{2} \times DE$ , i.e.,  $\frac{1}{2} \times 6.5 = 3.25$  cm to meet the right bisector at D and E.

**Step IV:** Join BE, EN, ND and BD.

Thus, BEND is the required rhombus.

### EXERCISE 4.3

Q1. Construct the following quadrilaterals:

(i) Quadrilateral MORE

$MO = 6$  cm  $\angle R = 105^\circ$

$OR = 4.5$  cm

$\angle M = 60^\circ$

$\angle O = 105^\circ$

(ii) Quadrilateral PLAN

$PL = 4$  cm

$LA = 6.5$  cm

$\angle P = 90^\circ$

$\angle A = 110^\circ$

$\angle N = 85^\circ$

(iii) Parallelogram HEAR

$HE = 5$  cm

$EA = 6$  cm

$\angle R = 85^\circ$

(iv) Rectangle OKAY

$OK = 7$  cm

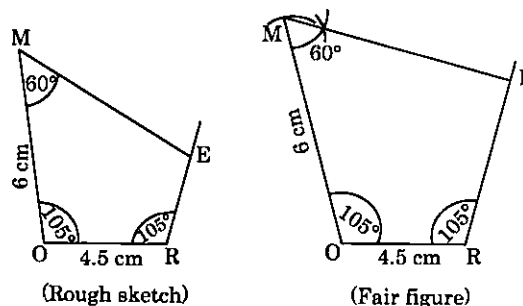
$KA = 5$  cm

Sol. (i) **Construction:**

**Step I:** Draw  $OR = 4.5$  cm

**Step II:** Draw two angles of  $105^\circ$  each at O and R with the help of protractor.

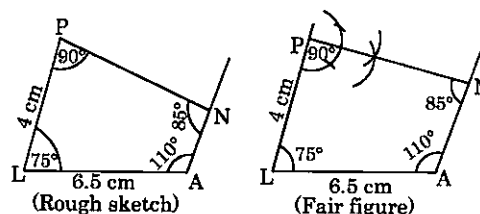
**Step III:** Cut  $OM = 6$  cm.



**Step IV:** Draw an angle of  $60^\circ$  at M to meet the angle line through R at E.

Thus, MORE is the required quadrilateral.

(ii) **Construction:**



**Step I:** Draw  $LA = 6.5$  cm

**Step II:** Draw an angle of  $75^\circ$  at L and  $110^\circ$  at A with the help of a protractor.

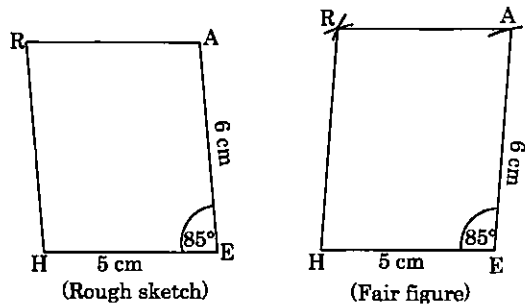
$$[\because 360^\circ - (110^\circ + 90^\circ + 85^\circ) = 75^\circ]$$

**Step III:** Cut  $LP = 4$  cm.

**Step IV:** Draw an angle of  $90^\circ$  at P which meets the angle line through A at N.

Thus PLAN is the required quadrilateral.

(iii) **Construction:** (Opposite sides of a parallelogram are equal)



**Step I:** Draw  $HE = 5$  cm.

**Step II:** Draw an angle of  $85^\circ$  at E and cut  $EA = 6$  cm.

**Step III:** Draw an arc with centre A and radius 5 cm.

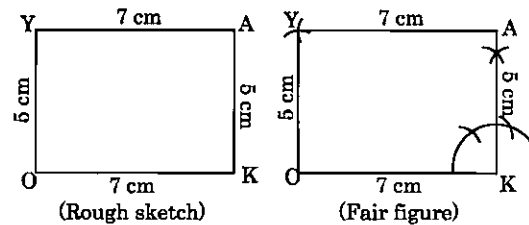
**Step IV:** Draw another arc with centre H and radius 6 cm to meet the previous arc at R.

**Step V:** Join HR and AR

Thus, HEAR is the required parallelogram.

(iv) **Construction:**

(Each angle of a rectangle is  $90^\circ$  and opposite sides are equal.)



**Step I:** Draw  $OK = 7$  cm.

**Step II:** Draw angle of  $90^\circ$  at K and cut  $KA = 5$  cm.

**Step III:** Draw an arc with centre O and radius 5 cm.

**Step IV:** Draw another arc with centre A and radius 7 cm to meet the previous arc at Y.

**Step V:** Join OY and AY.

Thus OKAY is the required rectangle.

### EXERCISE 4.4

Q1. Construct the following quadrilaterals:

(i) Quadrilateral DEAR

$DE = 4$  cm

$EA = 5$  cm

$AR = 4.5$  cm

$\angle E = 60^\circ$

$\angle A = 90^\circ$

(ii) Quadrilateral TRUE

$TR = 3.5$  cm

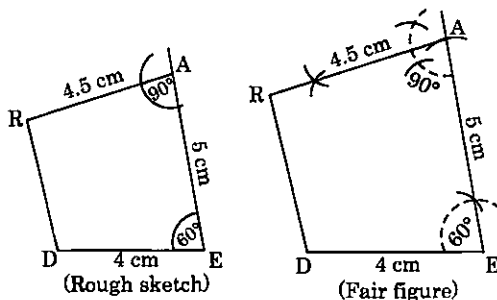
$RU = 3$  cm

$UE = 4.5$  cm

$\angle R = 75^\circ$

$\angle U = 120^\circ$

Sol. (i) **Construction:**



**Step I:** Draw  $DE = 4$  cm.

**Step II:** Draw an angle of  $60^\circ$  at E.

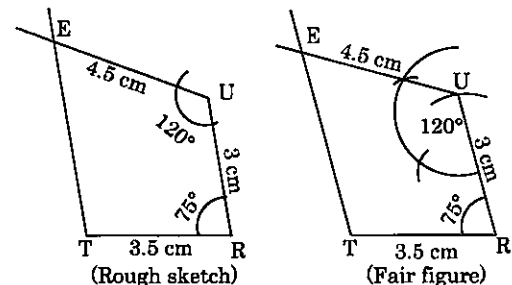
**Step III:** Draw an arc with centre E and radius 5 cm to meet the angle line at A.

**Step IV:** Draw an angle of  $90^\circ$  at A and cut  $AR = 4.5$  cm.

**Step V:** Join DR.

Thus, DEAR is the required quadrilateral.

(ii) **Construction:**



**Step I:** Draw  $TR = 3.5$  cm

**Step II:** Draw an angle of  $75^\circ$  at R and cut  $RU = 3$  cm.

**Step III:** Draw an angle of  $120^\circ$  at U and cut  $UE = 4.5$  cm.

**Step IV:** Join TE.

Thus, TRUE is the required quadrilateral.

TRY THESE (PAGE 67)

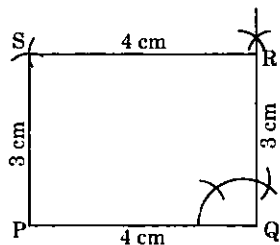
Q1. How will you construct a rectangle PQRS if you know only the lengths PQ and QR?

Sol. Since opposite sides of a rectangle are equal

$\therefore PQ = SR$  and  $PS = QR$

**Construction:** Let  $PQ = SR = 4$  cm and  $PS = QR = 3$  cm.

**Step I:** Draw  $PQ = 4$  cm



**Step II:** Draw an angle of  $90^\circ$  at  $Q$  and cut  $QR = 3$  cm.

**Step III:** Draw an arc with centre  $R$  and radius 4 cm.

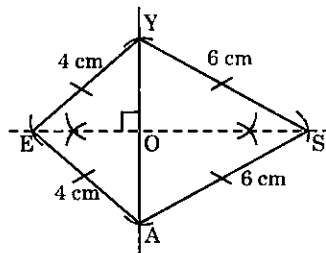
**Step IV:** Draw another arc with centre  $P$  and radius 3 cm to meet the previous arc at  $S$ .

**Step V:** Join  $PS$  and  $RS$ .

Thus,  $PQRS$  is the required rectangle.

**Q2.** Construct the kite  $EASY$  if  $AY = 8$  cm,  $EY = 4$  cm and  $SY = 6$  cm. Which properties of the kite did you use in the process?

**Sol. Construction:**



**Step I:** Draw  $AY = 8$  cm.

**Step II:** Draw a right bisector of  $AY$  at  $O$ .

**Step III:** Cut  $YE$  of 4 cm on the right bisector of  $AY$ .

**Step IV:** Cut  $YS$  of 6 cm on the right bisector of  $AY$ .

**Step V:** Join  $YE$ ,  $AE$ ,  $YS$  and  $AS$ .

Thus,  $EASY$  is the required quadrilateral (kite).

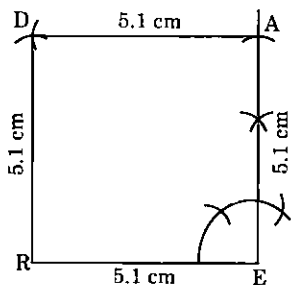
**Property:** One diagonal of kite is right bisected by the other diagonal.

### EXERCISE 4.5

**Draw the following:**

**Q1.** The square  $READ$  with  $RE = 5.1$  cm.

**Sol. Construction:**



**Step I:** Draw  $RE = 5.1$  cm.

**Step II:** Draw an angle of  $90^\circ$  at  $E$  and cut  $EA = 5.1$  cm.

**Step III:** Draw two arcs from  $A$  and  $R$  with radius 5.1 cm to cut each other at  $D$ .

**Step IV:** Join  $RD$  and  $AD$ .

Thus,  $READ$  is the required square.

**Q2.** A rhombus whose diagonals are 5.2 cm and 6.4 cm long.

**Sol. Construction:**

**Step I:** Draw  $AC = 6.4$  cm.

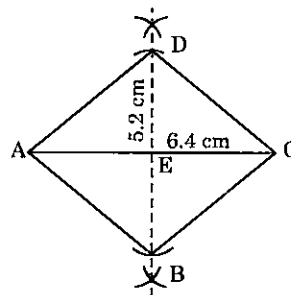
**Step II:** Draw the right bisector of  $AC$  at  $E$ .

**Step III:** Draw two arcs with centre  $E$  and

radius  $\frac{5.2}{2} = 2.6$  cm to cut the previous diagonal at  $B$  and  $D$ .

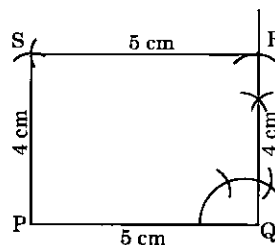
**Step IV:** Join  $AD$ ,  $AB$ ,  $BC$  and  $DC$ .

Thus  $ABCD$  is the required rhombus.



**Q3.** A rectangle with adjacent sides of lengths 5 cm and 4 cm.

**Sol. Construction:** Let the two adjacent sides of a rectangle  $PQRS$  be  $PQ = 5$  cm and  $QR = 4$  cm.



**Step I:** Draw  $PQ = 5$  cm.

**Step II:** Draw an angle of  $90^\circ$  at Q and cut  $QR = 4$  cm.

**Step III:** Draw an arc with centre R and radius 5 cm.

**Step IV:** Draw another arc with centre P and radius 4 cm to meet the previous arc at S.

**Step V:** Join RS and PS.

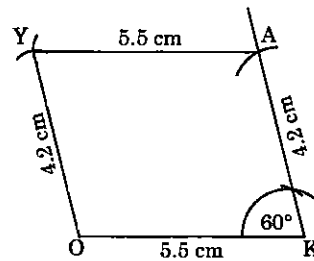
Thus, PQRS is the required rectangle.

**Q4.** A parallelogram OKAY where  $OK = 5.5$  cm and  $KA = 4.2$  cm. Is it unique?

**Sol. Construction:**

**Step I:** Draw  $OK = 5.5$  cm.

**Step II:** Draw an angle of any measure (say  $60^\circ$ ) at K and cut  $KA = 4.2$  cm.



**Step III:** Draw an arc with centre A and radius 5.5 cm.

**Step IV:** Draw another arc with centre O and radius 4.2 cm to cut the previous arc at Y.

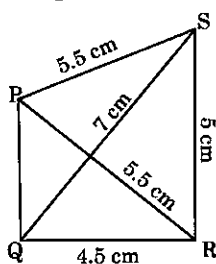
**Step V:** Join AY and OY.

Thus, OKAY is the required parallelogram.

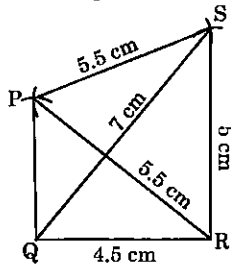
No, it is not a unique parallelogram. Angle at K can be of measure other than  $60^\circ$ .

## Learning More Q & A

**Q1.** Construct a quadrilateral PQRS, given that  $QR = 4.5$  cm,  $PS = 5.5$  cm,  $RS = 5$  cm and the diagonal  $PR = 5.5$  cm and diagonal  $SQ = 7$  cm.



(Rough sketch)



(Fair figure)

**Sol. Construction:**

**Step I:** Draw  $QR = 4.5$  cm.

**Step II:** Draw an arc with centre R and radius 5 cm.

**Step III:** Draw another arc with centre Q and radius 7 cm to meet the previous arc at S.

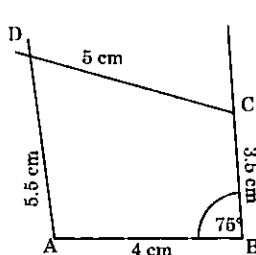
**Step IV:** Join RS and QS.

**Step V:** Draw two arcs with centre S and R and radius 5.5 cm each to meet each other at P.

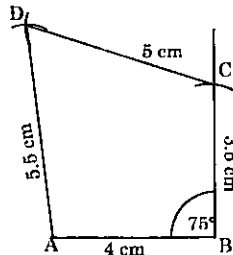
**Step VI:** Join RP, SP and PQ.

Thus PQRS is the required quadrilateral.

**Q2.** Construct a quadrilateral ABCD in which  $AB = 4$  cm,  $BC = 3.5$  cm,  $CD = 5$  cm,  $AD = 5.5$  cm and  $\angle B = 75^\circ$ .



(Rough sketch)



(Fair figure)

**Sol. Construction:**

**Step I:** Draw  $AB = 4$  cm.

**Step II:** Draw an angle of  $75^\circ$  at B and cut  $BC = 3.5$  cm.

**Step III:** Draw an arc with centre C and radius 5 cm.

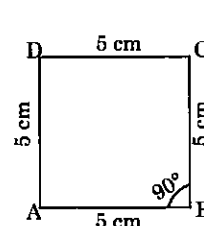
**Step IV:** Draw another arc with centre A and radius 5.5 cm to meet the previous arc at D.

**Step V:** Join CD and AD.

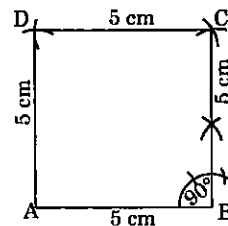
Thus ABCD is the required quadrilateral.

**Q3.** Construct a square whose side is 5 cm.

**Sol.**



(Rough sketch)



(Fair figure)

**Construction:**

**Step I:** Draw  $AB = 5$  cm.

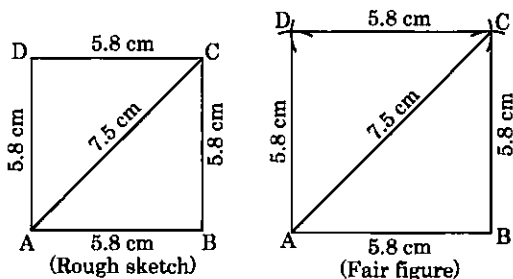
**Step II:** Draw an angle of  $90^\circ$  at B and cut  $BC = 5$  cm.

**Step III:** Draw two arcs with centre A and C and same radii of 5 cm which meet each other at D.

**Step IV:** Join AD and CD.

Thus, ABCD is the required square.

**Q4.** Construct a rhombus ABCD in which  $AB = 5.8$  cm and  $AC = 7.5$  cm.



**Construction:**

**Step I:** Draw  $AB = 5.8$  cm.

**Step II:** Draw an arc with centre B and radius 5.8 cm.

**Step III:** Draw another arc with centre A and radius 7.5 cm to meet the previous arc at C.

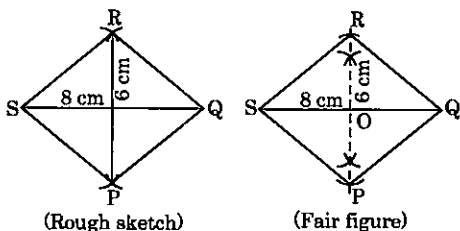
**Step IV:** Draw two arcs with centres A and C and of same radius 5.8 cm to meet each other at D.

**Step V:** Join BC, AC, CD and AD.

Thus ABCD is the required rhombus.

**Q5.** Construct a rhombus whose diagonals are 6 cm and 8 cm.

Sol.



**Construction:**

**Step I:** Draw  $SQ = 8$  cm.

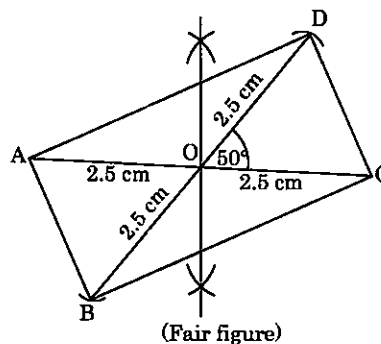
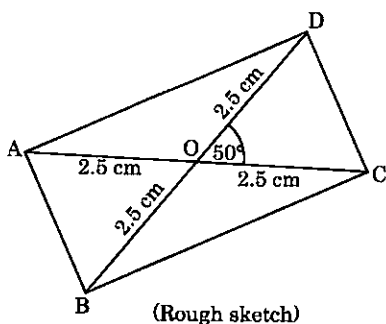
**Step II:** Draw a right bisector of SQ at O.

**Step III:** Draw two arcs with centre O and radius 3 cm each to cut the right bisector at P and R.

**Step IV:** Join PQ, QR, RS and SP.

Thus PQRS is the required rhombus.

**Q6.** Construct a rectangle whose diagonal is 5 cm and angle between the diagonal is  $50^\circ$ .



**Sol. Construction:**

**Step I:** Draw  $AC = 5$  cm.

**Step II:** Draw the right bisector of AC at O.

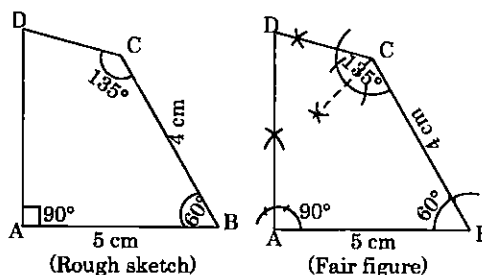
**Step III:** Draw an angle of  $50^\circ$  at O and produce both sides.

**Step IV:** Draw two arcs with centre O and of same radius 2.5 cm to cut at B and D.

**Step V:** Join AB, BC, CD and DA.

Thus, ABCD is the required rectangle.

**Q7.** Construct a quadrilateral ABCD in which  $BC = 4$  cm,  $\angle B = 60^\circ$ ,  $\angle C = 135^\circ$ ,  $AB = 5$  cm and  $\angle A = 90^\circ$ .



**Sol. Construction:**

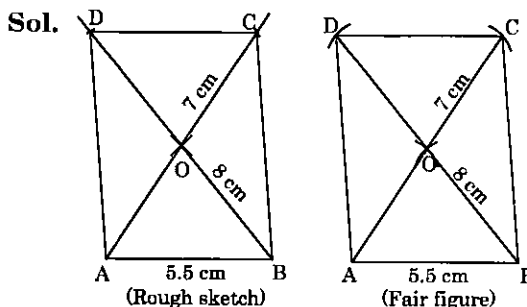
**Step I:** Draw  $AB = 5$  cm.

**Step II:** Draw angle of  $60^\circ$  at B and cut  $BC = 4$  cm.

**Step III:** Draw an angle of  $135^\circ$  at C and angle of  $90^\circ$  at A which meet each other at D.

Thus, ABCD is the required quadrilateral.

**Q8.** Construct a parallelogram ABCD in which  $AB = 5.5$  cm,  $AC = 7$  cm and  $BD = 8$  cm.



**Construction:**

**Step I:** Draw  $AB = 5.5$  cm.

**Step II:** Draw an arc with centre B and radius  $\frac{8}{2}$  cm = 4 cm.

**Step III:** Draw another arc with centre A and radius  $\frac{7}{2}$  cm = 3.5 cm which cuts the previous arc at O.

**Step IV:** Join AO and produce to C such that  $AO = OC$ .

**Step V:** Join BO and produce to D such that  $BO = OD$ .

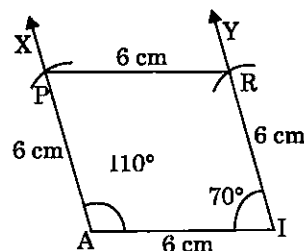
**Step VI:** Join BC, CD and AD.

Thus ABCD is the required parallelogram.

**Q9.** Construct a rhombus PAIR, given that  $PA = 6$  cm and angle  $\angle A = 110^\circ$ .

**Sol.** Since in a rhombus, all sides are equal, so  $PA = AI = IR = RP = 6$  cm

Also, rhombus is a parallelogram  
so, adjacent angle,  $\angle I = 180^\circ - 110^\circ = 70^\circ$



**Steps of construction**

1. Draw  $AI = 6$  cm

2. Draw ray  $\overline{AX}$  such that  $\angle IAX = 110^\circ$  and draw  $\overline{IY}$  such that  $\angle AIY = 70^\circ$ .

3. With A and I as centres and radius 6 cm draw arcs intersecting AX and IY at P and R respectively.

4. Join PR.

Thus, PAIR is the required rhombus.

## Test Yourself

**Q1.** Construct a quadrilateral PQRS in which  $QR = 6$  cm,  $PR = PS = 5$  cm,  $RS = 4$  cm and  $QS = 9$  cm.

**Q2.** Construct a quadrilateral ABCD in which  $AB = 4.5$  cm,  $BC = 4$  cm,  $CD = 5.5$  cm,  $AD = 6$  cm and  $\angle B = 60^\circ$ .

**Q3.** Construct a parallelogram PQRS in which  $PQ = 5$  cm,  $QR = 4$  cm and  $PR = 6$  cm.

**Q4.** Construct a parallelogram ABCD with  $AB = 5$  cm,  $AC = 4.8$  cm and  $BD = 7$  cm.

**Q5.** Construct a rhombus of side 6 cm and  $\angle A = 60^\circ$ .

**Q6.** Construct a rectangle whose perimeter is 20 cm and ratio of its sides is 2 : 3.

**Q7.** Construct a parallelogram PQRS in which  $PQ = 8.2$  cm,  $PR = 9.5$  cm and  $QS = 10.8$  cm.

**Q8.** Construct a rhombus ABCD in which  $AC = 5.8$  cm and  $BD = 6.4$  cm.

**Q9.** Construct a trapezium ABCD in which  $AB \parallel DC$  and  $AB = 8$  cm,  $BC = 4$  cm,  $CD = 3.5$  cm and  $DA = 4.2$  cm.

**Q10.** Construct a square one of whose diagonal is 8.3 cm.

**Q11.** Construct a parallelogram POUR in which,  $PO = 5.5$  cm,  $OU = 7.2$  cm and  $\angle O = 70^\circ$ .

(NCERT Exemplar)

## Internal Assessment

**Q1.** Construct a square whose each side is 4 cm.

**Q2.** Construct a rhombus whose diagonals are 8 cm and 6 cm.

**Q3.** Construct a rectangle whose sides are 4.5 cm and 3.5 cm.

**Q4.** Construct a rectangle whose diagonals is 6.4 cm and one of its sides is 4 cm.

**Q5.** Construct a square whose diagonal is 6 cm.