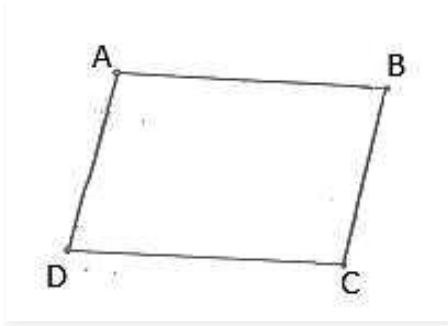


**Q1) In a parallelogram ABCD, determine the sum of angles  $\angle C$  and  $\angle D$ .**

**Solution:**



$\angle C$  and  $\angle D$  are consecutive interior angles on the same side of the transversal CD.

$$\therefore \angle C + \angle D = 180^0$$

**Q2) In a parallelogram ABCD, if  $\angle B = 135^0$ , determine the measures of its other angles.**

**Solution:**

Given  $\angle B = 135^0$

ABCD is a parallelogram

$$\therefore \angle A = \angle C, \angle B = \angle D \text{ and } \angle A + \angle B = 180^0$$

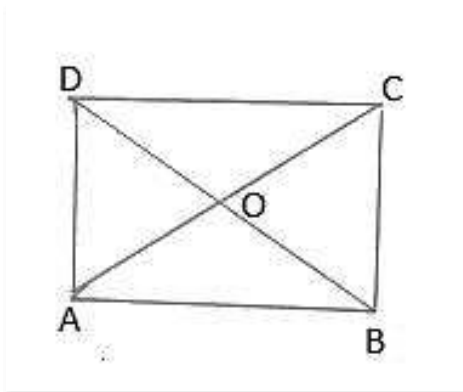
$$\Rightarrow \angle A + 135^0 = 180^0$$

$$\Rightarrow \angle A = 45^0$$

$$\Rightarrow \angle A = \angle C = 45^0 \text{ and } \angle B = \angle D = 135^0$$

**Q3) ABCD is a square. AC and BD intersect at O. State the measure of  $\angle AOB$ .**

**Solution:**

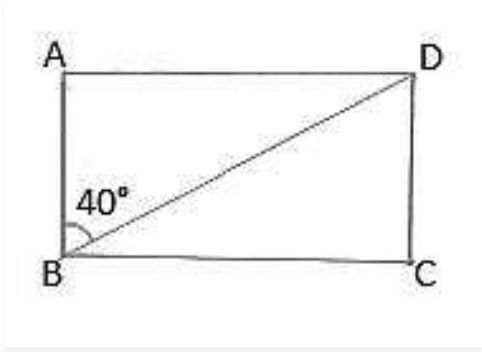


Since, diagonals of a square bisect each other at right angle.

$$\therefore \angle AOB = 90^0$$

**Q4) ABCD is a rectangle with  $\angle ABD = 40^0$ . Determine  $\angle DBC$**

**Solution:**



We have,

$$\angle ABC = 90^0$$

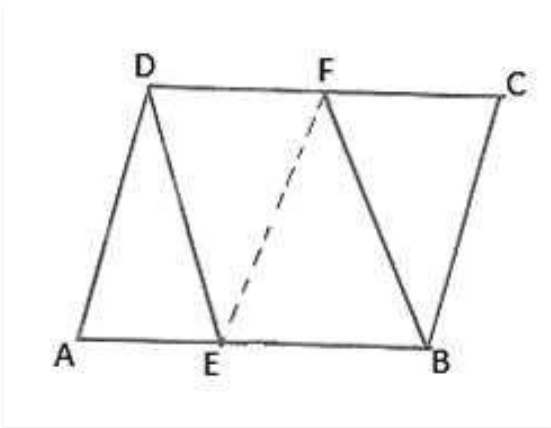
$$\Rightarrow \angle ABD + \angle DBC = 90^0 \quad [\because \angle ABD = 40^0]$$

$$\Rightarrow 40^0 + \angle DBC = 90^0$$

$$\therefore \angle DBC = 50^0$$

**Q5) The sides AB and CD of a parallelogram ABCD are bisected at E and F. Prove that EBFD is a parallelogram.**

**Solution:**



Since ABCD is a parallelogram

$$\therefore AB \parallel DC \text{ and } AB = DC$$

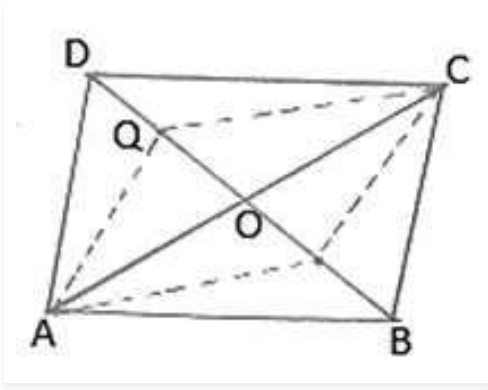
$$\Rightarrow EB \parallel DF \text{ and } \frac{1}{2}AB = \frac{1}{2}DC$$

$$\Rightarrow EB \parallel DF \text{ and } EB = DF$$

EBFD is a parallelogram.

**Q6) P and Q are the points of trisection of the diagonal BD of a parallelogram ABCD. Prove that CQ is parallel to AP. Prove also that AC bisects PQ.**

**Solution:**



We know that,

Diagonals of a parallelogram bisect each other.

Therefore,  $OA = OC$  and  $OB = OD$

Since P and Q are point of intersection of BD.

Therefore,  $BP = PQ = QD$

Now,  $OB = OD$  and  $BP = QD$

$\Rightarrow OB - BP = OD - QD$

$\Rightarrow OP = OQ$

Thus in quadrilateral APCQ, we have

$OA = OC$  and  $OP = OQ$

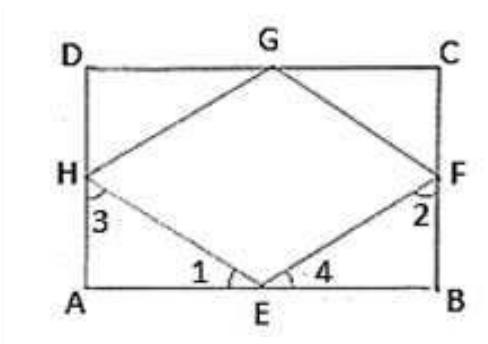
Diagonals of Quadrilateral APCQ bisect each other.

Therefore APCQ is a parallelogram.

Hence  $AP \parallel CQ$ .

***Q7) ABCD is a square. E, F, G and H are points on AB, BC, CD and DA respectively, such that  $AE = BF = CG = DH$ . Prove that EFGH is a square.***

**Solution:**



We have,

$AE = BF = CG = DH = x$  (say)

$BE = CF = DG = AH = y$  (say)

In  $\triangle AEH$  and  $\triangle BEF$ , we have

$AE = BF$

$$\angle A = \angle B$$

$$\text{And } AH = BE$$

So, by SAS congruency criterion, we have

$$\triangle AEH \cong \triangle BFE$$

$$\Rightarrow \angle 1 = \angle 2 \text{ and } \angle 3 = \angle 4$$

$$\text{But } \angle 1 + \angle 3 = 90^\circ \text{ and } \angle 2 + \angle A = 90^\circ$$

$$\Rightarrow \angle 1 + \angle 3 + \angle 2 + \angle A = 90^\circ + 90^\circ$$

$$\Rightarrow \angle 1 + \angle 4 + \angle 1 + \angle 4 = 180^\circ$$

$$\Rightarrow 2(\angle 1 + \angle 4) = 180^\circ$$

$$\Rightarrow \angle 1 + \angle 4 = 90^\circ$$

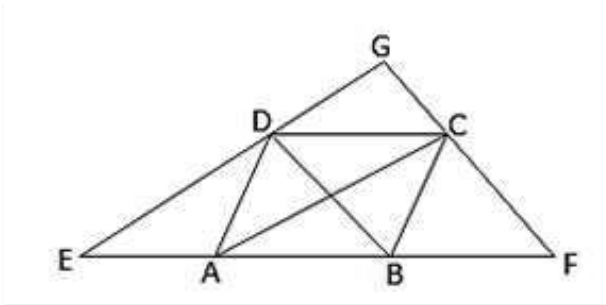
$$\angle HEF = 90^\circ$$

$$\text{Similarly we have } \angle F = \angle G = \angle H = 90^\circ$$

Hence, EFGH is a Square.

**Q8) ABCD is a rhombus, EAFB is a straight line such that EA = AB = BF. Prove that ED and FC when produced meet at right angles.**

**Solution:**



We know that the diagonals of a rhombus are perpendicular bisector of each other.

$$\therefore OA = OC, OB = OD, \text{ and } \angle AOD = \angle COD = 90^\circ$$

$$\text{And } \angle AOB = \angle COB = 90^\circ$$

In  $\triangle BDE$ , A and O are mid-points of BE and BD respectively.

$$OA \parallel DE$$

$$OC \parallel DG$$

In  $\triangle CFA$ , B and O are mid-points of AF and AC respectively.

$$OB \parallel CF$$

$$OD \parallel GC$$

Thus, in quadrilateral DOGC, we have

$OC \parallel DG$  and  $OD \parallel GC$

$\Rightarrow DOCG$  is a parallelogram

$$\angle DGC = \angle DOC$$

$$\angle DGC = 90^\circ$$

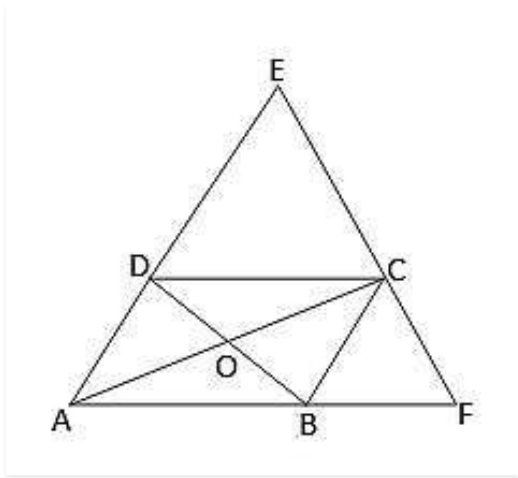
**Q9)  $ABCD$  is a parallelogram,  $AD$  is produced to  $E$  so that  $DE = DC$  and  $EC$  produced meets  $AB$  produced in  $F$ . Prove that  $BF = BC$ .**

**Solution:**

Draw a parallelogram  $ABCD$  with  $AC$  and  $BD$  intersecting at  $O$ .

Produce  $AD$  to  $E$  such that  $DE = DC$

Join  $EC$  and produce it to meet  $AB$  produced at  $F$ .



In  $\triangle DCE$ ,

$$\angle DCE = \angle DEC \dots\dots (i) \quad [\text{In a triangle, equal sides have equal angles}]$$

$$AB \parallel CD \quad [\text{Opposite sides of the parallelogram are parallel}]$$

$$\therefore AE \parallel CD \quad [AB \text{ lies on } AF]$$

$AF \parallel CD$  and  $EF$  is the Transversal.

$$\angle DCE = \angle BFC \dots\dots (ii) \quad [\text{Pair of corresponding angles}]$$

From (i) and (ii) we get

$$\angle DEC = \angle BFC$$

In  $\triangle AFE$ ,

$$\angle AFE = \angle AEF \quad [\angle DEC = \angle BFC]$$

Therefore,  $AE = AF$  [In a triangle, equal angles have equal sides opposite to them]

$$\Rightarrow AD + DE = AB + BF$$

$$\Rightarrow BC + AB = AB + BF \quad [\text{Since, } AD = BC, DE = DC \text{ and } CD = AB, AB = DE]$$

$$\Rightarrow BC = BF$$

Hence proved.