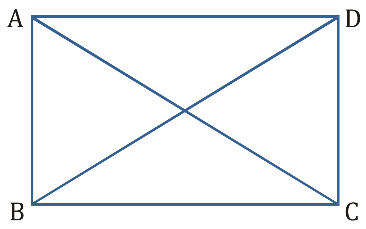
NCERT QUESTIONS WITH SOLUTIONS

EXERCISE : 8.1

1. If the diagonals of a parallelogram are equal, then show that it is a rectangle.



Sol. **Given :** ABCD is a parallelogram with diagonal AC = diagonal BD

To prove : ABCD is a rectangle.

Proof : In triangle ABC and ABD,

AB = AB [Common]

AC = BD [Given]

AD = BC [Opp. Sides of a ||gm]

$\therefore$ $\Delta ABC \cong \Delta BAD$ [By SSS congruency]

$\Rightarrow$ $\angle DAB = \angle CBA$ [By C.P.C.T.] ... (i)

[$\because$ AD||BC and AB cuts them, the sum of the interior angle of the same side of transversal is 180°]

$\angle DAB + \angle CBA = 180°$ ... (ii)

From eq. (i) and (ii), $\angle DAB = \angle CBA = 90°$

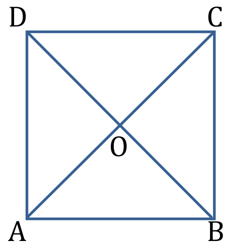
So, ABCD is a parallelogram with one of the angles equal to 90°,

Hence, ABCD is a rectangle.

2. Show that the diagonals of a square are equal and bisect each other at right angles.

Sol. **Given:** ABCD is a square.

To Prove : (i) AC = BD (ii) AC and BD bisect each other at right angles.



Proof: In ΔABC and ΔBAD,

AB = BA [Common]

BC = AD [Opp. sides of square ABCD]

$\angle ABC = \angle BAD$ [Each = 90° ($\because$ ABCD is a square)]

$\therefore$ $\Delta ABC \cong \Delta BAD$ [SAS Rule]

$\therefore$ AC = BD ... (i) [C.P.C.T.]

In ΔAOD and ΔBOC

AD = CB [Opp. sides of square ABCD]

$\angle OAD = \angle OCB$

[Alternate angles as AD||BC and transversal AC intersects them]

$\angle ODA = \angle OBC$

[Alternate angles as AD||BC and transversal BD intersects them]

$\Delta AOD \cong \Delta COB$ [ASA Rule]

$\therefore$ OA = OC and OB = OD ...(ii)[C.P.C.T.]

So, O is the midpoint of AC and BD.

Now, In ΔAOB and ΔCOB

AB = BC [Given]

OA = OC [from (ii)]

OB = OB [Common]

$\therefore$ $\Delta AOB \cong \Delta COB$ [By SSS Rule]

$\therefore$ $\angle AOB = \angle BOC$ [C.P.C.T]

But $\angle AOB + \angle BOC = 180°$ [Linear pair]

$\angle AOB + \angle AOB = 180°$

[$\angle AOB = \angle BOC$ proved earlier]

$\Rightarrow \quad 2\angle AOB = 180°$

$\Rightarrow \quad \angle AOB = \dfrac{180°}{2} = 90°$

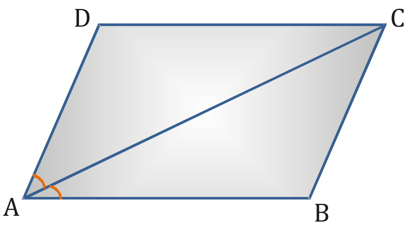
$\therefore \quad \angle AOB = \angle BOC = 90°$

$\therefore$ AC and BD bisect each other at right angles.

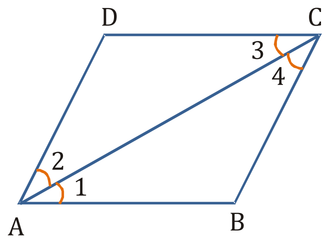
3. Diagonal AC of a parallelogram ABCD bisects $\angle A$. Show that

(i) it bisects $\angle C$ also

(ii) ABCD is a rhombus.



Sol. Given :



Diagonal AC bisects $\angle A$ of the parallelogram ABCD.

To prove :

(i) AC bisects $\angle C$

(ii) ABCD is a rhombus

Proof :

(i) Since AB||DC and AC intersects them.

$\therefore \quad \angle 1 = \angle 3$ [Alternate angles] ...(i)

Similarly, $\angle 2 = \angle 4$ ...(ii)

But $\angle 1 = \angle 2$ [Given] ...(iii)

$\therefore \quad \angle 3 = \angle 4$

[Using eq. (i), (ii) and (iii)]

Thus, AC bisects $\angle C$.

(ii) since $\angle 2 = \angle 3$ (using (i) and (iii))

$\Rightarrow$ AD = CD

[Sides opposite to equal angles]

Also, ABCD is a parallelogram.

$\Rightarrow$ AD = BC and AB = CD

$\therefore$ AB = CD = AD = BC

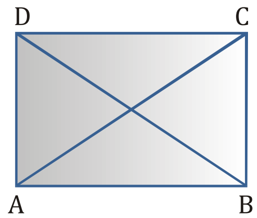
Hence, ABCD is a rhombus.

4. ABCD is a rectangle in which diagonal AC bisects $\angle A$ as well as $\angle C$. Show that

(i) ABCD is a square

(ii) diagonal BD bisects $\angle B$ as well as $\angle D$.

Sol. Given : ABCD is a rectangle in which diagonal AC bisects $\angle A$ as well as $\angle C$.



To prove :

(i) ABCD is a square

(ii) diagonal BD bisects $\angle B$ as well as $\angle D$.

Proof :

(i) $\because$ AB $\parallel$ DC and transversal AC intersects them.

So, $\angle BAC = \angle DCA$ [Alternate angles]

But $\angle BAC = \angle DAC$ [$\because$ AC bisects $\angle A$]

$\therefore \quad \angle DCA = \angle DAC$

$\Rightarrow$ DA = CD

[Sides opposite to equal angles of a triangle are equal]

But AB = CD and DA = BC

[Opposite side of a rectangle]

$\therefore$ AB = BC = CD = DA

Also, $\angle A = \angle B = \angle C = \angle D = 90°$

[$\because$ ABCD is a rectangle]

Hence, ABCD is a square.

(ii) In Δ BAD and Δ BCD,

BA = BC [∵ ABCD is a square]

AD = CD [∵ ABCD is a square]

BD = BD [Common]

∴ $\Delta BAD \cong \Delta BCD$

[By SSS congruence rule]

∴ $\angle ABD = \angle CBD$ [By C.P.C.T.]

$\angle ADB = \angle CDB$ [By C.P.C.T.]

Hence, diagonal BD bisects $\angle B$ as well as $\angle D$

5. In parallelogram ABCD, two points P and Q are taken on diagonal BD such that DP = BQ. Show that :

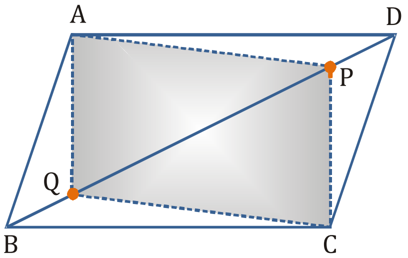
(i) $\Delta APD \cong \Delta CQB$

(ii) AP = CQ

(iii) $\Delta AQB \cong \Delta CPD$

(iv) AQ = CP

(v) APCQ is a parallelogram



Sol. (i) In ΔAPD and ΔCQB, we have

DP = BQ [Given]

AD = CB

[Opposite sides of parallelogram ABCD]

$\angle ADP = \angle CBQ$ [Pair of alternate angles]

⇒ $\Delta APD \cong \Delta CQB$

[SAS congruence criteria]

(ii) Then, by CPCT, we have AP = CQ

(iii) We can prove

$\Delta AQB \cong \Delta CPD$

[as we have done in (i)]

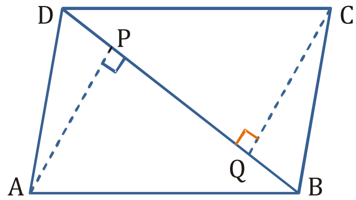
(iv) By CPCT, we have AQ = CP

(v) Now, we have AP = CQ and AQ = CP

Hence, APCQ is a parallelogram.

6. ABCD is a parallelogram and AP and CQ are perpendiculars from vertices A and C on diagonal BD. Show that

(i) $\Delta APB \cong \Delta CQD$ (ii) AP = CQ



Sol. **Given :** ABCD is a parallelogram and AP and CQ are perpendiculars from vertices A and C on diagonal BD respectively.

To prove : (i) $\Delta APB \cong \Delta CQD$ (ii) AP = CQ

Proof :

(i) In ΔAPB and ΔCQD,

AB = CD [Opposite side of ∥ gm ABCD]

$\angle ABP = \angle CDQ$

[∵ AB ∥ DC and transversal BD intersect them]

$\angle APB = \angle CQD$ [Each = 90°]

∴ $\Delta APB \cong \Delta CQD$ [AAS Rule]

(ii) AP = CQ [C.P.C.T.]

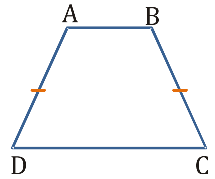
7. ABCD is a trapezium in which AB∥CD and AD = BC. Show that (figure)

(i) $\angle A = \angle B$

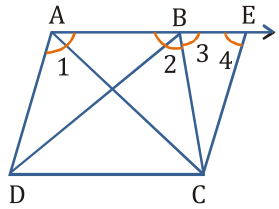
(ii) $\angle C = \angle D$

(iii) $\Delta ABC \cong \Delta BAD$

(iv) diagonal AC = diagonal BD



Sol. **Given :**



ABCD is a trapezium.

AB || CD and AD = BC

To Prove :

(i) $\angle A = \angle B$

(ii) $\angle C = \angle D$

(iii) $\Delta\, ABC \cong \Delta\, BAD$

(iv) Diagonal AC = Diagonal BD

Construction : Draw CE || AD and extend AB to intersect CE at E.

Proof :

(i) As AECD is a parallelogram. [By construction]

$\therefore$ AD = EC

But AD = BC [Given]

$\therefore$ BC = EC

$\Rightarrow$ $\angle 3 = \angle 4$

[Angles opposite to equal sides are equal]

Now, $\angle 1 + \angle 4 = 180°$ [Co-Interior angles]

And $\angle 2 + \angle 3 = 180°$ [Linear pair]

$\Rightarrow$ $\angle 1 + \angle 4 = \angle 2 + \angle 3$

$\Rightarrow$ $\angle 1 = \angle 2$ [$\because \angle 3 = \angle 4$]

$\Rightarrow$ $\angle A = \angle B$

(ii) $\angle 3 = \angle BCD$

[Alternate interior angles]

$\angle ADC = \angle 4$ [Opposite angles of a parallelogram]

But $\angle 3 = \angle 4$ [Δ BCE is an isosceles triangle]

$\therefore$ $\angle BCD = \angle ADC$

$\therefore$ $\angle C = \angle D$

(iii) In ΔABC and ΔBAD,

AB = AB [Common]

$\angle 1 = \angle 2$ [Proved]

AD = BC [Given]

$\therefore$ $\Delta ABC \cong \Delta BAD$ [By SAS congruency]

$\Rightarrow$ AC = BD [By C.P.C.T.]

8. The angles of quadrilateral are in the ratio 3 : 5 : 9 : 13. Find all the angles of the quadrilateral.

Sol. Let the four angles of the quadrilateral be 3x, 5x, 9x and 13x.

$3x + 5x + 9x + 13x = 360°$ [Sum of all the angles of quadrilateral is 360°]

$\Rightarrow$ $30x = 360°$

$\Rightarrow$ $x = 12°$

Hence, the angles of the quadrilateral are $3 \times 12° = 36°$, $5 \times 12° = 60°$, $9 \times 12° = 108°$ and $13 \times 12° = 156°$.

9. Show that if the diagonals of a quadrilateral bisect each other at right angles, then it is a rhombus.

Sol. **Given :** ABCD is a quadrilateral where diagonals AC and BD meet at O, such that AO = OC, OB = OD and $AC \perp BD$

To Prove: Quadrilateral ABCD is a rhombus,

i.e., AB = BC = CD = DA

Proof : In ΔAOB and ΔAOD,

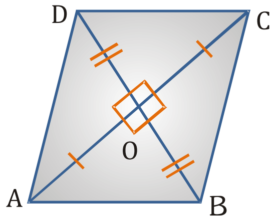
OB = OD [Given]

AO = AO [Common]

$\angle AOB = \angle AOD$ [Each = 90°]

$\therefore$ $\Delta AOB \cong \Delta AOD$ [SAS Rule]

$\therefore$ AB = AD [C.P.C.T.] ... (i)



Similarly, we can prove that

AB = BC ... (ii)

BC = CD ... (iii)

CD = AD ... (iv)

From (i), (ii), (iii) and (iv), we obtain,

AB = BC = CD = DA

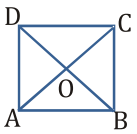
∴ Quadrilateral ABCD is a rhombus.

10. Show that if the diagonals of a quadrilateral are equal and bisect each other at right angles, then it is a square.

Sol. **Given :** The diagonals AC and BD of a quadrilateral ABCD are equal and bisect each other at right angles.

To prove : Quadrilateral ABCD is a square.

Proof :



In ΔAOD and ΔBOC,

OA = OC [Given]

OD = OB [Given]

$\angle AOD = \angle COB$ [Vertically Opposite Angles]

∴ $\Delta AOD \cong \Delta COB$ [SAS Rule]

∴ AD = BC [C.P.C.T.]

$\angle ODA = \angle OBC$ [C.P.C.T.]

∴ AD||BC

Now, AD = CB and AD||CB

∴ Quadrilateral ABCD is a ||gm.

In ΔAOB and ΔAOD,

AO = AO [Common]

OB = OD [Given]

$\angle AOB = \angle AOD$ [Each = 90° (Given)]

∴ $\Delta AOB \cong \Delta AOD$ [SAS Rule]

∴ AB =AD

Now,

∴ ABCD is a parallelogram and AB = AD

Again, in ΔABC and ΔBAD,

AC = BD [Given]

BC = AD [∵ ABCD is a ||gm]

AB = BA [Common]

∴ $\Delta ABC \cong \Delta BAD$ [SSS rule]

∴ $\angle ABC = \angle BAD$ [C.P.C.T.]

∵ AD||BC [Opposite sides of ||gm ABCD]

and transversal AB intersects them.

∴ $\angle ABC + \angle BAD = 180°$

[Sum of consecutive interior angles on the same side of the transversal is 180°]

∴ $\angle ABC = \angle BAD = 90°$

Similarly, $\angle BCD = \angle ADC = 90°$

∴ ABCD is a square.

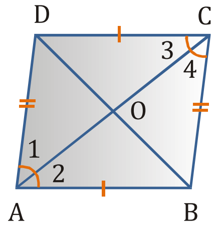
11. ABCD is a rhombus. Show that diagonal AC bisects ∠A as well as ∠C and diagonal BD bisects ∠B as well as ∠D.

Sol **Given :** ABCD is a rhombus and AC and BD are its diagonals.

To prove :

(i) Diagonal AC bisects ∠A as well as ∠C.

(ii) Diagonal BD bisects ∠B as well as ∠D.



Proof :

(i) In ΔABC

AB = BC (sides of Rhombus)

So, $\angle 2 = \angle 4$

(Angle opposite to equal sides are equal)

But $\angle 2 = \angle 3$ (Alternate angles as AB $\parallel$ CD)

So,$\angle 2 = \angle 3 = \angle 4$

But $\angle 1 = \angle 4$(Alternate angles as AD $\parallel$ BC)

So,$\angle 1 = \angle 2 = \angle 3 = \angle 4$ ... (1)

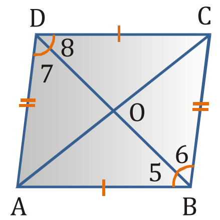
$\angle 1 = \angle 2$ by (1)

So, AC bisect $\angle A$

$\angle 3 = \angle 4$ by (1)

So, AC bisect $\angle C$

(ii) In ΔABD



AB = AD (Sides of Rhombus)

So,$\angle 5 = \angle 7$

(Angle opposite to equal sides are equal)

But $\angle 7 = \angle 6$ (Alternate angles as AD $\parallel$ BC)

So,$\angle 5 = \angle 6 = \angle 7$

$\angle 5 = \angle 8$ (Alternate angles as AB $\parallel$ CD)

So,$\angle 5 = \angle 6 = \angle 7 = \angle 8$ ... (2)

$\angle 5 = \angle 6$ by (2)

So, BD bisect $\angle B$

$\angle 7 = \angle 8$ by (2)

So, BD bisect $\angle D$

12. In ΔABC and ΔDEF, AB = DE, AB || DE, BC = EF and BC || EF. Vertices A, B and C are joined to vertices D, E and F respectively. Show that :

(i) quadrilateral ABED is a parallelogram

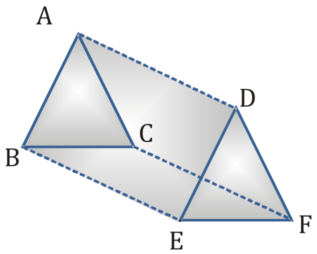
(ii) quadrilateral BEFC is a parallelogram

(iii) AD || CF and AD = CF

(iv) quadrilateral ACFD is a parallelogram

(v) AC = DF

(vi) $\Delta ABC \cong \Delta DEF$



Sol. **Given :** AB = DE, AB || DE, BC = EF & BC || EF

To Prove

(i) ABED is a parallelogram.

(ii) BEFC is a parallelogram.

(iii) AD || CF and AD = CF

(iv) ACFD is a parallelogram

(v) AC = DF

(vi) $\Delta ABC \cong \Delta DEF$

Proof

(i) In quad. ABED

AB = DE [Given]

And AB || DE [Given]

$\therefore$ ABED is a parallelogram

(ii) In quad. BEFC

BC = EF [Given]

And BC||EF [Given]

$\therefore$ BEFC is a parallelogram.

(iii) As ABED is a parallelogram.

∴ AD || BE and AD = BE ....(i)

Also, BEFC is a parallelogram

∴ CF || BE and CF = BE ....(ii)

From (i) and (ii), we get

∴ AD || CF and AD = CF

(iv) As AD || CF and AD = CF

⇒ ACFD is a parallelogram.

(v) As ACFD is a parallelogram.

∴ AC = DF

(vi) In Δ ABC and Δ DEF,

AB = DE [Given]

BC = EF [Given]

AC = DF [Proved]

∴ ΔABC ≅ ΔDEF [By SSS congruency]

EXERCISE : 8.2

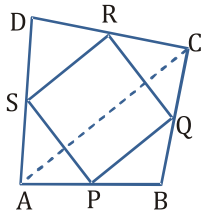
1. ABCD is a quadrilateral in which P, Q, R and S are mid points of the sides AB, BC, CD and DA (fig.) and AC is a diagonal. Show that

(i) SR||AC and

$SR = \frac{1}{2}AC$

(ii) PQ = SR

(iii) PQRS is a parallelogram.



Sol. **Given :** ABCD is a quadrilateral in which P, Q, R and S are mid-points of AB, BC, CD and DA. AC is a diagonal.

To prove :

(i) SR || AC and $SR = \frac{1}{2}AC$

(ii) PQ = SR

(iii) PQRS is a parallelogram.

Proof :

(i) In ΔDAC,

∵ S is the mid-point of DA and R is the mid-point of DC

∴ SR || AC and $SR = \frac{1}{2}AC$

[By Mid-point theorem]

(ii) In ΔBAC,

∵ P is the mid-point of AB and Q is the mid-point of BC

∴ PQ || AC and $PQ = \frac{1}{2}AC$

[By Mid-point theorem]

But from (i) $SR = \frac{1}{2}AC$ & (ii)

$PQ = \frac{1}{2}AC$

⇒ PQ = SR

(iii) PQ || AC [From (ii)]

SR || AC [From (i)]

∴ PQ || SR

[Two lines parallel to the same line are parallel to each other]

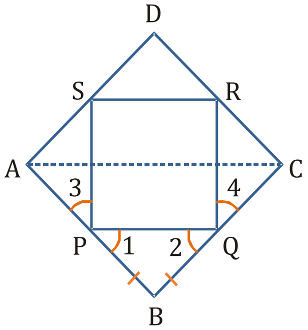
Also, PQ = SR [From (ii)]

∴ PQRS is a parallelogram.

[A quadrilateral is a parallelogram if a pair of opposite sides is parallel and is of equal length]

2. ABCD is a rhombus and P, Q, R and S are the mid points of sides AB, BC, CD and DA respectively. Show that the quadrilateral PQRS is a rectangle.

Sol.



Given : P, Q, R and S are the mid-points of respective sides AB, BC, CD and DA of rhombus. PQ, QR, RS and SP are joined.

To prove : PQRS is a rectangle.

Construction : Join A and C.

Proof : In ΔABC, P is the mid-point of AB and Q is the mid-point of BC.

$\therefore$ $PQ \parallel AC$ and $PQ = \frac{1}{2}AC$ .....(i)

(By midpoint theorem)

In ΔADC, R is the mid-point of CD and S is the mid-point of AD.

$\therefore$ $SR \parallel AC$ and $SR = \frac{1}{2}AC$ ....(ii)

(By midpoint theorem)

From eq. (i) and (ii), $PQ \parallel SR$ and $PQ = SR$

$\therefore$ PQRS is a parallelogram.

Now ABCD is a rhombus [Given]

$\therefore$ $AB = BC$

$\Rightarrow$ $\frac{1}{2}AB = \frac{1}{2}BC \Rightarrow PB = BQ$

$\therefore$ $\angle 1 = \angle 2$

[Angles opposite to equal sides are equal]

Now in triangles APS and CQR, we have,

$AP = CQ$

[P and Q are the mid-points of AB and BC and $AB = BC$]

Similarly, $AS = CR$ and $PS = QR$

[Opposite sides of a parallelogram]

$\therefore$ $\Delta APS \cong \Delta CQR$ [By SSS congruency]

$\Rightarrow$ $\angle 3 = \angle 4$ [By C.P.C.T.]

Now, we have $\angle 1 + \angle SPQ + \angle 3 = 180°$

And $\angle 2 + \angle PQR + \angle 4 = 180°$

$\therefore$ $\angle 1 + \angle SPQ + \angle 3 = \angle 2 + \angle PQR + \angle 4$

Since $\angle 1 = \angle 2$ and $\angle 3 = \angle 4$ [Proved above]

$\therefore$ $\angle SPQ = \angle PQR$ .....(iii)

Now PQRS is a parallelogram [Proved above]

$\therefore$ $\angle SPQ + \angle PQR = 180°$ .....(iv)

[Co-Interior angles]

Using eq. (iii) and (iv),

$\angle SPQ + \angle SPQ = 180°$

$\Rightarrow$ $2\angle SPQ = 180°$

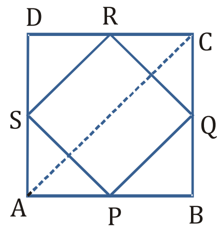
$\Rightarrow$ $\angle SPQ = 90°$

Hence, PQRS is a rectangle.

3. ABCD is a rectangle and P,Q,R and S are mid-points of the sides AB, BC, CD and DA respectively. Show that the quadrilateral PQRS is a rhombus.

Sol. **Given :** A rectangle ABCD in which P, Q, R and S are the mid-points of the sides AB, BC, CD and DA respectively. PQ, QR, RS and SP are joined.

To prove : PQRS is a rhombus.



Construction : Join AC.

Proof : In Δ ABC, P and Q are the mid-points of sides AB, BC respectively.

$\therefore$ PQ || AC and PQ = $\frac{1}{2}$AC ....(i)

[Mid- Point Theorem]

In Δ ADC, R and S are the mid-points of sides CD, AD respectively.

$\therefore$ SR || AC and SR = $\frac{1}{2}$ AC ...(ii)

[Mid- Point Theorem]

From eq.(i) and (ii), PQ || SR and

PQ = SR ...(iii)

$\therefore$ PQRS is a parallelogram.

Now ABCD is a rectangle. [Given]

$\therefore$ AD = BC

$\Rightarrow$ $\frac{1}{2}$AD = $\frac{1}{2}$BC

$\Rightarrow$ AS = BQ ...(iv)

In triangles APS and BPQ,

AP = BP [P is the mid-point of AB]

$\angle$PAS = $\angle$PBQ [Each 90°]

And AS = BQ [From eq. (iv)]

$\therefore$ $\Delta APS \cong \Delta BPQ$

[By SAS congruency]

$\Rightarrow$ PS = PQ [By C.P.C.T.] ... (v)

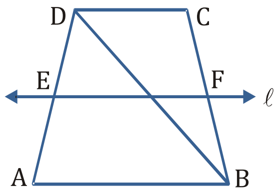
From eq.(iii) and (v), we get that PQRS is a parallelogram.

$\Rightarrow$ PS = PQ

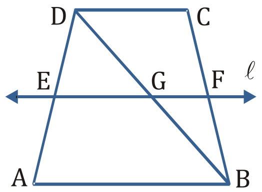
$\Rightarrow$ Two adjacent sides are equal.

Hence, PQRS is a rhombus.

4. ABCD is a trapezium in which AB||DC, BD is a diagonal and E is the mid-point of AD. A line is drawn through E parallel to AB intersecting BC at F (fig.). Show that F is the mid-point of BC.



Sol. Line ℓ || AB and passes through E.



Line ℓ meets BC at F and BD at G.

In ΔABD, E is mid-point of AD and EG || AB.

$\Rightarrow$ G is mid-point of BD.

[Converse of Mid Point Theorem]

Also, ℓ || AB and AB || CD

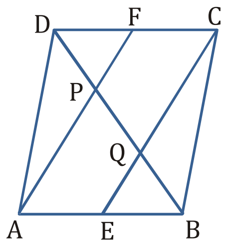
$\Rightarrow$ ℓ || CD

$\Rightarrow$ F is mid-point of BC.

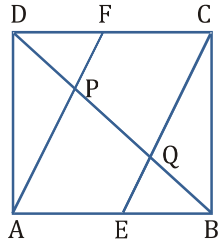
[$\because$ G is mid-point of BD]

[Converse of Mid Point Theorem]

5. In a parallelogram ABCD, E and F are the mid-points of sides AB and CD respectively (fig.). Show that the line segments AF and EC trisect the diagonal BD.



Sol. **Given :** ABCD is a parallelogram. E and F are midpoints of AB and DC respectively.



To prove : DP = PQ = QB

Proof : Since E and F are the mid-points of AB and CD respectively.

$\therefore$ AE = $\frac{1}{2}$AB and CF = $\frac{1}{2}$CD ...(i)

But ABCD is a parallelogram.

$\therefore$ AB = CD and AB || DC

$\Rightarrow$ $\frac{1}{2}$AB = $\frac{1}{2}$CD and AB || DC

$\Rightarrow$ AE = FC and AE || FC [From eq. (i)]

$\therefore$ AECF is a parallelogram.

$\Rightarrow$ FA || CE

$\Rightarrow$ FP || CQ

[FP is a part of FA and CQ is a part of CE] ... (ii)

Since the line segment drawn through the mid-point of one side of a triangle and parallel to the other side bisects the third side.

In ΔDCQ, F is the mid-point of CD and

$\Rightarrow$ FP || CQ

$\therefore$ P is the mid-point of DQ.

$\Rightarrow$ DP = PQ ... (iii)

Similarly, In ΔABP, E is the mid-point of AB and

$\Rightarrow$ EQ || AP

$\therefore$ Q is the mid-point of BP.

$\Rightarrow$ BQ = PQ ... (iv)

From eq.(iii) and (iv),

DP = PQ = BQ ... (v)

Now,

BD = BQ + PQ + DP = BQ + BQ + BQ = 3BQ

$\Rightarrow$ BQ = $\frac{1}{3}$BD ... (vi)

From eq (v) and (vi),

DP = PQ = BQ = $\frac{1}{3}$BD

$\Rightarrow$ Points P and Q trisects BD. So, AF and CE trisects BD.

Hence, AF and CE trisect the diagonal BO.

6. ABC is a triangle right angled at C. A line through the mid-point M of hypotenuse AB and parallel to BC intersects AC at D. Show that

(i) D is the mid-point of AC

(ii) MD $\perp$ AC

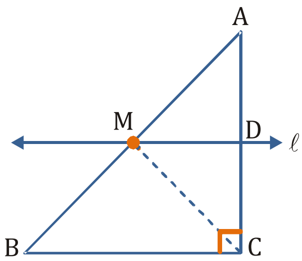
(iii) CM = MA = $\frac{1}{2}$AB

Sol. (i) Through M, we draw line ℓ || BC. ℓ intersects AC at D.

M is a midpoint of AB

$\Rightarrow$ D is mid-point of AC.

[By converse of mid-point theorem]



(ii) $\angle$ADM = $\angle$ACB = 90°

[Corresponding angles]

$\Rightarrow$ $\angle$ADM = 90°

$\Rightarrow$ MD $\perp$ AC.

(iii) In ΔCMD and ΔAMD;

CD = AD, MD = MD

and $\angle CDM = \angle ADM$

[Each = 90°]

Therefore, $\Delta CMD \cong \Delta AMD$

[SAS congruence rule]

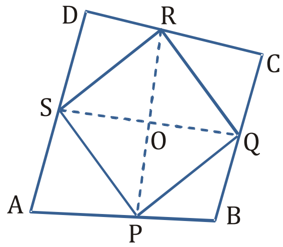
$\Rightarrow$ CM = AM; Also $AM = \frac{1}{2}AB$

So, $CM = \frac{1}{2}AB$

$AM = CM = \frac{1}{2}AB$

7. Show that the line segments joining the mid-points of the opposite sides of a quadrilateral bisect each other.

Sol. P,Q,R and S are the mid-points of the sides AB, BC, CD and AD of the quadrilateral ABCD.



We have to prove that, PR and QS bisects each other. Now, join PQ, QR, RS and PS. Here, we can prove that PQRS is a parallelogram (as in solution 1).

Now, PR and QS are the diagonals of the parallelogram PQRS.

$\therefore$ PR and QS bisect each other as diagonals of parallelogram bisect each other.