07

Quadrilateral

1. Types of Quadrilateral and their properties

1.1 Parallelogram : If opposite sides of a quadrilateral are parallel, it is called a parallelogram. Its opposite sides are also equal in length and its diagonals bisect each other. In the adjacent figure ABCD is a parallelogram where $AB \parallel DC$ and $AD \parallel BC$, Hence

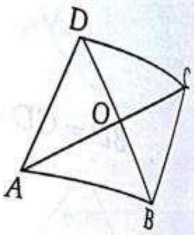
1.1.1. $AB = CD$ and $AD = BC$

1.1.2. $AO = OC$ and $BO = OD$

1.1.3. $\angle A + \angle D = 180°$, $\angle B + \angle C = 180°$ etc.

1.1.4. $\Delta AOB \cong \Delta COD$ and $\Delta AOD \cong \Delta COB$

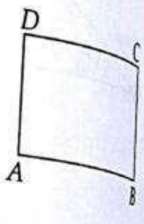
1.1.5. $\Delta ABC \cong \Delta CDA$



1.1.6. area of ΔAOB, ΔBOC, ΔCOD and ΔAOD are equal.

1.2. Rectangle : A parallelogram is called a rectangle if its all angles are 90°. Hence every rectangle is a parallelogram but every parallelogram is not a rectangle.

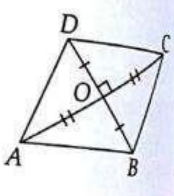
If diagonals of a parallelogram are equal (i.e. $AC = BD$) then it is a rectangle.



1.3. Rhombus : If all the sides of a parallelogram are equal it is a rhombus. Diagonals of a rhombus bisect each other at right angle. i.e.

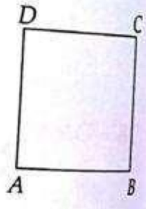
(a) $AO = OC$ and $OB = OD$

(b) $\angle AOB = \angle BOC = \angle COD = \angle DOA = 90°$

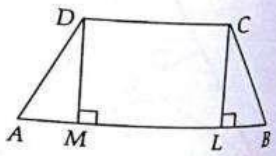


1.4. Square : If all the sides of a parallelogram are equal and all its angle are 90° then it is a square, or if all sides of a rectangle are equal then it is a square, or if all the angles of a rhombus are 90° then it is a square.

So every square is a rhombus but every rhombus is not a square.



1.5. Trapezium : If two sides of a quadrilateral are parallel and other two sides are non parallel then if is called a trapezium. In a trapezium two altitudes DM and CL (see figure) are equal.

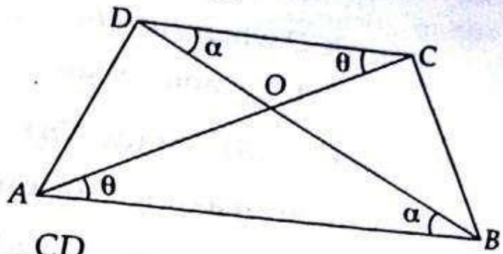


1.6. If midpoints of sides of a quadrilateral are joined, it is a parallelogram.

2. Important properties of a trapezium :

2.1. **Diagonals of a trapezium intersect each other in the same ratio. Thus in trapezium $ABCD$, where $AB \parallel CD$, $\frac{DO}{OB} = \frac{CO}{OA}$**

Explanation : See the figure



$\because \; AB \parallel DC$

$\therefore \; \angle CAB = \angle ACD = \theta$

and $\angle DBA = \angle BDC = \alpha$

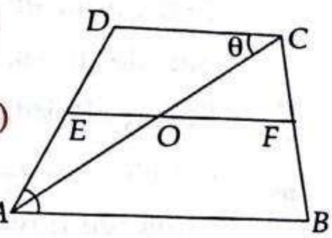
$\therefore \; \Delta OCD \sim \Delta OAB \Rightarrow \frac{OC}{OA} = \frac{OD}{OB} = \frac{CD}{AB}$

2.2. If diagonal of a quadrilateral intersect each other in the same ratio, then at least on opposite pair of the quadrilateral are parallel and hence it is a trapezium

Explanation : This statement is converse of above statement. If the ratio is 1 : 1, it is a parallelogram

2.3. If a line is drawn parallel to parallel sides of a trapezium, it intersects the non parallel sides in same ratio. Thus in a trapezium $ABCD$ with $AB \parallel CD$, if EF is drawn parallel to AB and CD then $\frac{DE}{EA} = \frac{CF}{FB}$

Explanation : Join A-C



$\Delta AOE \sim \Delta ACD \Rightarrow \frac{AO}{OC} = \frac{AE}{ED} = \frac{OE}{CD}$ ... (i)

$\Delta ACF \sim \Delta OCF \Rightarrow \frac{OC}{CA} = \frac{CF}{CB} = \frac{OF}{AB}$ ... (ii)

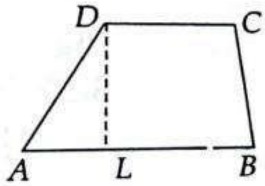
dividing (i) by (ii)

$\frac{AO}{OC} = \frac{AE}{ED}$ or, $\frac{OC}{OA} = \frac{CF}{FB}$

or, $\frac{AE}{ED} = \frac{FB}{CF}$ (It can also be proved by Thale's Theorem)

2.4. Area of trapezium $ABCD = \frac{1}{2}(AB + DC) \times DL$

Where DL is the distance between parallel lines AB and CD



3. Important properties of a rhombus :

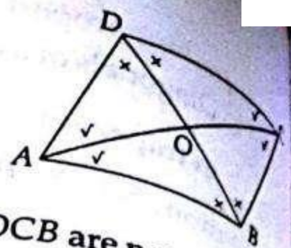
Suppose $ABCD$ is a rhombus whose diagonals AC and BD intersect at O, then

3.1. $AO = OC$ and $BO = OD$

3.2. $\angle AOB = \angle BOC = \angle COD = \angle DOA = 90°$

3.3. diagonal AC is bisector of $\angle A$ and $\angle C$

3.4. diagonal BD is bisector of $\angle B$ and $\angle D$



3.5. $\Delta OAB \cong \Delta OCB \cong \Delta OCD \cong \Delta OAD$

(It must be noted that in a parallelogram $ABCD$ when $AB \neq BC$, diagonal AC doesnot bisect $\angle A$ and $\angle C$ and hence ΔOAB and ΔOCB are not congruent)

3.6. ar (ΔOAB) = ar (ΔOCB) = ar (ΔOCD) = ar (ΔOAD)

(These areas are also equal when $ABCD$ is a parallelogram)

3.7. $\because$ Area of rhombus $ABCD = \frac{1}{2} \times BD \times AC = \frac{1}{2} \cdot d_1 d_2$

(where $d_1 = BD$ and $d_2 = AC$ are diagonals)

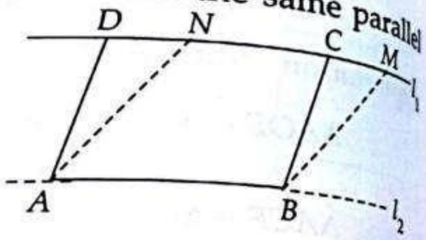
$\therefore$ Area of $\Delta OAB = \frac{1}{4} \cdot \frac{1}{2} \cdot d_1 d_2 = \frac{1}{8} d_1 d_2$

3.8. Sum of squares of sides of a rhombus = Sum of squares of its diagonals.

i.e. $AB^2 + BC^2 + CD^2 + DA^2 = AC^2 + BD^2$ *(see solved example 11)*

4. Some important propertics about Areas of a parallelogram

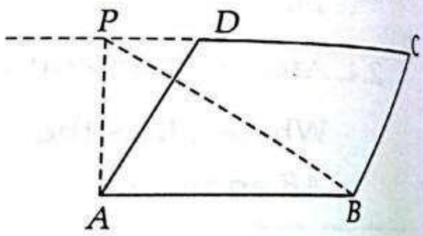
4.1. Parallelograms on the same base and between the same parallel lines are equal in area.



In the adjacent figure l_1 and l_2 are two parallel lines. AB is a base taken on line l_2. Points M, C, N, D lie on line l_1 such that $ABCD$ and $ABMN$ are parallelogram.

Thus we have, area ($\square ABCD$) = area ($\square ABMN$) as their base and height are same.

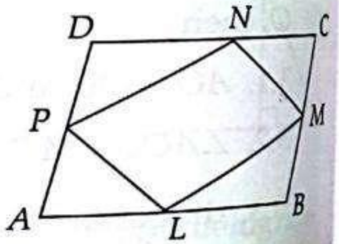
4.2. The area of a triangle is half the area of parallelogram having the same base and between the same parallel lines.



In the figure ΔAPB and parallelogram $ABCD$ have same base and same parallel lines AB and CD (or CP). Thus

Area of $\Delta ABP = \frac{1}{2} \times$ area of parallelogram $ABCD$.

4.3. If a parallelogram is formed by joining midpoints of sides of a given parallelogram then its area is half the area of the original parallelogram.

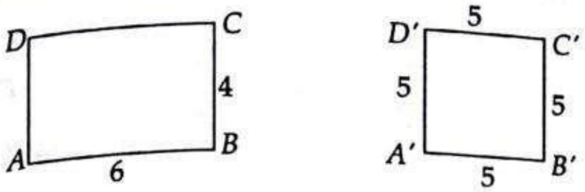


In the adjacent figure L, M, N, P are

respectively mid points of sides AB, BC, CD and DA then

Area of parallelogram $LMNP = \frac{1}{2}$ (Area of parallelogram $ABCD$)

4.4. If a square and a rectangle have equal perimeter then area of the square is greater than area of the rectangle. For example, in the figure given, below.



$ABCD$ is a rectangle whose unequal sides are 6 cm and 4 cm and $A'B'C'D'$ is a square whose each side is 5 cm.

Perimeter of rectangle $ABCD = 2(6 + 4) = 20$ cm

Perimeter of square $A'B'C'D' = 4 \times 5 = 20$ cm

Area of rectangle $ABCD = 6 \times 4 = 24$ cm^2

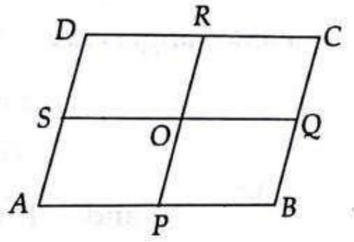
Area of square $ABCD = 5 \times 5 = 25$ cm^2

Clearly area of square > area of rectangle. It can be verified for other rectangles of the same perimeter.

4.5. If a square and a rectangle have equal area then perimeter of square is less than perimeter of rectangles

4.6. Lines joining midpoints of opposite sides of a parallelogram divide the parallelogram in four equal Areas.

In the figure P, Q, R, S are respectively midpoint of sides AB, BC, CD and DA of a parallelogram $ABCD$. Thus we have



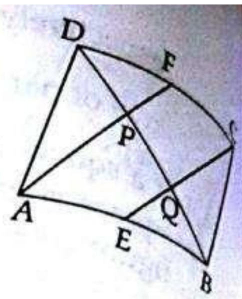
$\text{ar}(\square APOS) = \text{ar}(\square PBQO) = \text{ar}(\square OQCR) = \text{ar}(\square ORDS)$

Types of quadrilateral formed by joining midpoints of a given quadrilateral.

5.1. When midpoints of sides of a quadrilateral taken in order are joined, a parallelogram is formed. For different types of quadrilateral, the shape of resultant quadrilateral will be as follows.

Original quadrilateral	Quadrilateral formed by joining midpoints of sides
Parallelogram	Parallelogram
Rectangle	Rhombus
Rhombus	Rectangle
Square	Square
Trapezium	Parallelogram

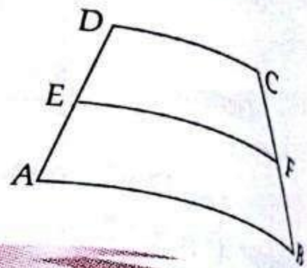
5.2. Suppose $ABCD$ is a parallelogram. E and F are respectively midpoints of sides AB and CD. If BD intersect diagonal AF and EC respectively at P and Q then



(i) $DP = PQ = QB$ (ii) $AF \parallel EC$

(iii) $\Delta ADF \cong \Delta CBE$

6. If $ABCD$ is a trapezium with $AB \parallel DC$ and E and F are respectively midpoint of AD and BC then,



$$EF \parallel DC \parallel AB \text{ and } EF = \frac{1}{2}(AB + DC)$$

Solved Examples

1. If angles of a quadrilateral are in the ratio 3 : 5 : 9 : 13 then find all the angles of the quadrilateral.

Solution : Let angles be $3x$, $5x$, $9x$ and $13x$

$\because$ Sum of angles of a quadrilateral is $360°$

$\therefore \quad 3x + 5x + 9x + 13x = 360°$

or, $30x = 360°$ or, $x = \frac{360°}{30} = 12°$

Hence angles are $3x = 3 \times 12° = 36°$

$5x = 5 \times 12° = 60°$

$9x = 9 \times 12° = 108°$

and $13x = 13 \times 12° = 156°$

2. One of the angle of a parallelogram is $\frac{4}{5}$ of its adjacent angle. Find the measure of both angles.

Solution : Let $\angle A$ and $\angle B$ be adjacent angles of a parallelogram $ABCD$.

According to question $\angle A = \frac{4}{5} \angle B$ ... (i)

$\because$ Sum of adjacent angles of a parallelogram is $180°$

$\therefore \quad \angle A + \angle B = 180°$

or, $\frac{4}{5} \angle B + \angle B = 180°$ (from (i))

or, $\frac{9}{5} \angle B = 180°$

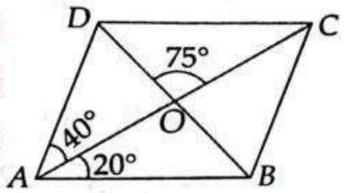
or, $\angle B = \frac{5 \times 180°}{9} = 100°$ $\quad \therefore \quad \angle A = \frac{4}{5} \times 100° = 80°$

Hence two angles are respectively $100°$ and $80°$.

3. The diagonals AC and BD of a parallelogram intersects at O. If $\angle OAD = 40°$, $\angle OAB = 20°$ and $\angle COD = 75°$, then evaluate the following,

(i) $\angle ABD$ (ii) $\angle BDC$ (iii) $\angle ACB$ (iv) $\angle DBC$ (v) $\angle ADC$

Solution : As per question $ABCD$ is a parallelogram with $\angle COD = 75°$, $\angle OAD = 40°$ and $\angle OAB = 20°$



(i) $\therefore \angle ABD = 180° - (\angle OAB + \angle AOB) = 180° - (20° + 75°)$

($\because \angle OAB = 20°$ and $\angle COD = \angle AOB = 75°$ vertically opposite angle)

$= 180° - 95° = 85°$

(ii) $\angle BDC = \angle ABD = 85°$ *(alternate angle)*

(iii) $\angle ACB = \angle CAD = 40°$ *(alternate angle)*

(iv) $\because \angle DAB + \angle ABC = 180°$ *(adjacent angle)*

or, $40° + 20° + 85° + \angle DBC = 180°$

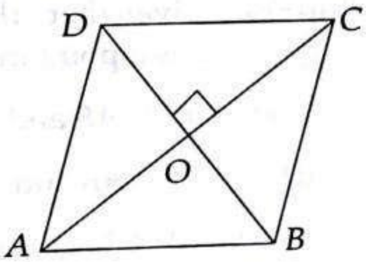
or, $145° + \angle DBC = 180°$

$\therefore \angle DBC = 180° - 145° = 35°$

(v) $\angle ADC = 180° - \angle DAB = 180° - 60° = 120°$ *(adjacent angle)*

4. If length of each side of a rhombus is 5 cm and length of one of its diagonal is 8 cm, find the length of other diagonal.

Solution : Let $ABCD$ is a rhombus with



$AB = BC = CD = DA = 5$ cm

and $AC = 8$ cm

$\therefore OC = \frac{1}{2} AC = 4$ cm

Now, $OD = \sqrt{CD^2 - OC^2} = \sqrt{5^2 - 4^2}$ ($\because \Delta OCD$ is right angle)

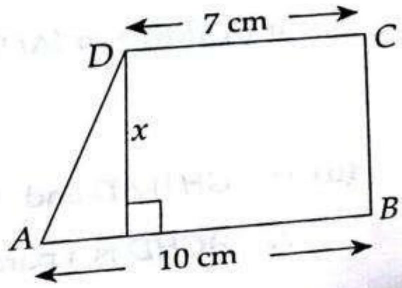
$= \sqrt{25 - 16}$

$= \sqrt{9} = 3$

$\therefore BD = 2 \cdot OD = 2 \times 3 = 6$ cm.

5. $ABCD$ is a trapezium with $AB \parallel CD$. If $AB = 10$ cm, $CD = 7$ cm and area of trapezium $= 102\ cm^2$, then find the height of trapezium.

Solution : ar (trapezium $ABCD$)

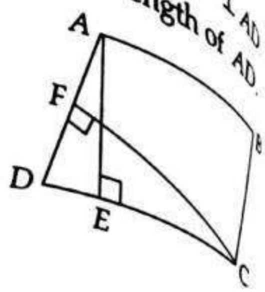


$= \frac{1}{2}(10 + 7) \times x$, where x is its height

$\therefore \frac{1}{2} \times 17 \times x = 102$, (given)

$\therefore x = \frac{102 \times 2}{17} = 12$ cm $=$ height

6. In the given figure $ABCD$ is a parallelogram, $AE \perp DC$ and $CF \perp AD$. If $AB = 16$ cm, $AE = 8$ cm and $CF = 10$ cm then find the length of AD.



Solution : Since, $ABCD$ is a parallelogram

$\therefore$ $AB = CD$ or, $CD = 16$ cm

Now, ar $(\square ABCD) = (CD) \times (AE)$

$= 16 \times 8 \text{ cm}^2$

$= 128 \text{ cm}^2$ ... (i)

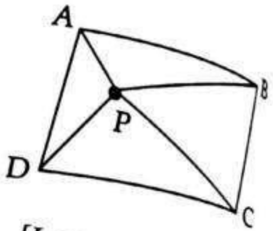
Again, ar $(\square ABCD) = (AD) \times (CF)$

$= (AD) \times 10$ cm ... (ii)

$\therefore$ from (i) and (ii) $AD \times 10 = 128$

$\therefore$ $AD = \frac{128}{10} = 12.8$ cm

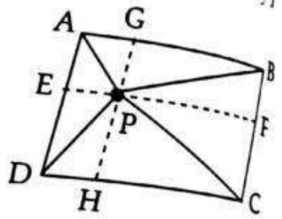
7. In the adjacent figure P is a point inside the parallelogram $ABCD$. Prove that



(i) ar (APB) + ar $(PCD) = \frac{1}{2}$ ar $(ABCD)$

(ii) ar (APD) + ar (PBC) = ar (APB) + ar (PCD) [Learn the property]

Solution : Given that $ABCD$ is a parallelogram and P is a point inside it.



Draw : $EF \parallel AB$ and $GH \parallel AD$

(i) $\because$ $EF \parallel AB$ and $AE \parallel BF$ $(\because AD \parallel BC)$

$\therefore$ $AEFB$ is a parallelogram

Now, ar $(\Delta APB) = \frac{1}{2}(AB) \times (\text{height}) = \frac{1}{2}$ ar $(\square AEFB)$

$(\because \text{ar } \square AEFB = AB) \times \text{height})$ ... (i)

(Here base and height of $\square AEFB$ and ΔAPB are same)

Again ar $(\Delta DPC) = \frac{1}{2}(DC) \times (\text{height})$

$= \frac{1}{2}$ ar $(\square DEFC)$ ... (ii)

adding (i) and (ii)

ar (ΔAPB) + ar $(\Delta DPC) = \frac{1}{2}$ {ar $(\square AEFB)$ + ar $(\square DEFC)$}

$= \frac{1}{2}$ ar $(\square ABCD)$; Proved

(ii) $\because$ $GH \parallel AD$ and $AG \parallel DH$ $(\because AB \parallel DC)$

$\therefore$ $AGHD$ is a parallelogram

$= \frac{1}{2}$ (□AGHD)

and ar (ΔBPC) $= \frac{1}{2}$ (BC) × (height) ... (iii)

$= \frac{1}{2}$ (□BGHC)

adding (iii) and (iv) ... (iv)

ar (ΔAPD) + ar (ΔBPC) $= \frac{1}{2}$ {ar (□AGHD) + ar (□BGHC)}

$= \frac{1}{2}$ ar (□ABCD)

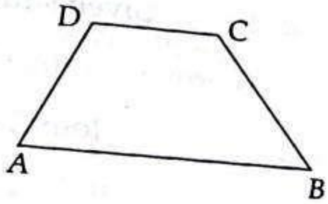
∴ from (i) ar (ΔAPD) + ar (ΔBPC) = ar (ΔAPB) + ar (ΔPCD); Proved

8. In the given figure $ABCD$ is a trapezium with $AB \parallel DC$ and $AD = BC$ prove that

(i) $\angle A = \angle B$ (ii) $\angle C = \angle D$

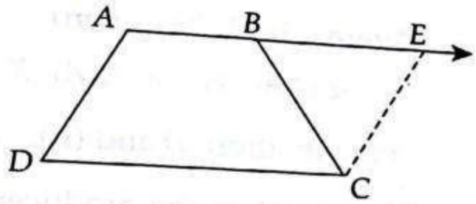
(iii) $\Delta ABC \cong \Delta BAD$

(iv) diagonal AC = diagonal BD



Solution : Given that $ABCD$ is a trapezium with $AB \parallel DC$ and $AD = BC$

Produce : AB to E and draw $CE \parallel AD$



(i) ∵ $AB \parallel DC$ (given)

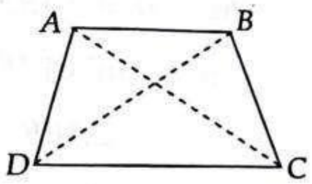
and $CE \parallel AD$ (by construction)

Hence, $AECD$ is a parallelogram

∴ $AD = CE$

or, $BC = CE$ (∵ $BC = AD$ given)

∴ $\angle CBE = \angle CEB$ ... (i)



Now, $\angle A + \angle CEB = 180°$

or, $\angle A = 180° - \angle CEB$

or, $\angle A = 180° - \angle CBE$ (∵ from (i) $\angle CBE = \angle CEB$)

or, $\angle A = \angle ABC$ (linear pair of angles)

or, $\angle A = \angle B$ ... (ii)

(ii) ∵ $AB \parallel DC$ and AD is a transverse line

∴ $\angle A + \angle D = 180°$ ... (iii)

∵ $AB \parallel DC$ and BC is a transverse line

∴ $\angle B + \angle C = 180°$ ... (iv)

Hence, $\angle A + \angle D = \angle B + \angle C$

or, $\angle C = \angle D$ ($\because$ $\angle A = \angle B$)

(iii) In ΔABC and ΔBAD

$AB = AB$ (common)

$AD = BC$ (given)

and $\angle A = \angle B$ (already proved)

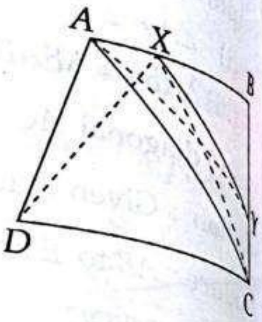
$\therefore$ From S-A-S, $\Delta ABC \cong \Delta BAD$

(iv) $\because$ $\Delta ABC \cong \Delta BAD$ $\therefore$ $AC = BD$

($\because$ corresponding part of congruent triangle are equal); Proved

9. $ABCD$ is a trapezium with $AB \parallel DC$. A line parallel to AC cuts the line AB at X and BC at Y. Prove that ar (ADX) = ar (ACY)

Solution : Given situation is shown in the adjacent figure



To prove : ar (ΔADX) = ar (ΔACY)

Join C and X.

$\because$ $AC \parallel XY$ ((given)

$\therefore$ (ΔACX) = ar (ΔACY) ... (i)

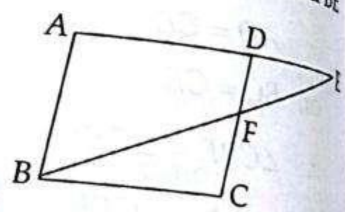
Again, $AB \parallel CD$ (given)

$\therefore$ ar (ΔACX) = ar (ΔADX) ... (ii)

from equation (i) and (ii), ar (ΔADX) = ar (ΔACY); Proved.

10. E is a point on the produced part AD of parallelogram $ABCD$ and BE intersects side CD at F.

Prove that $\Delta ABE \sim \Delta CFB$



Solution : In ΔABE and ΔCFB

$\angle AEB = \angle CBF$ (alternate angle)

and $\angle A = \angle C$ (opposite angle of parallelogram)

$\therefore$ from A-A criterion of similar triangle $\Delta ABE \sim \Delta CFB$.

11. From a point P inside the triangle ABC, perpendiculars PQ, PR and PS are respectively drawn to sides BC, CA and AB.

Prove that $AS^2 + BQ^2 + CR^2 = BS^2 + CQ^2 + AR^2$

Solution : See the figure, $PQ \perp BC$, $PR \perp CA$ and $PS \perp AB$, Join PA, PB and PC

In right angled triangle PQB and PQC

$$PB^2 = PQ^2 + QB^2$$

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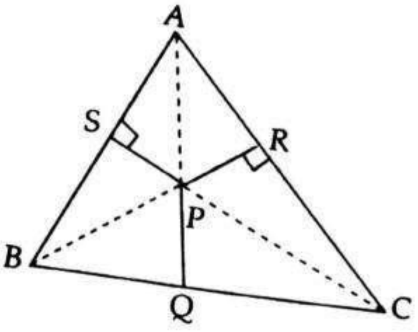
and $PC^2 = PQ^2 + QC^2$

$\therefore \quad PB^2 - PC^2 = QB^2 - QC^2 \qquad \ldots \text{(i)}$



Similarly in right angled ΔPRC and ΔPRA

$$PC^2 - PA^2 = CR^2 - AR^2 \qquad \ldots \text{(ii)}$$

And in right angled ΔPSA and ΔPSB

$$PA^2 - PB^2 = AS^2 - SB^2 \qquad \ldots \text{(iii)}$$

Adding equation (i), (ii) and (iii)

$$QB^2 - QC^2 + CR^2 - AR^2 + AS^2 - SB^2 = 0$$

or, $AS^2 + BQ^2 + CR^2 = BS^2 + CQ^2 + AR^2$

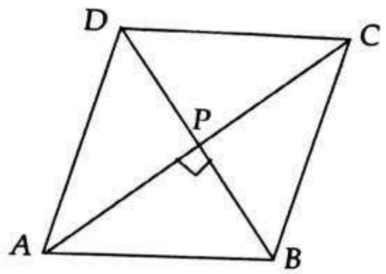
2. In a rhombus prove that sum of squares of sides is equal to sum of square of diagonals or, In a rhombus $ABCD$ prove that

$$AB^2 + BC^2 + CD^2 + DA^2 = AC^2 + BD^2$$

Solution : We know that diagonals of a rhombus bisect each other at right angle.

Let diagonals AC and BD of a rhombus $ABCD$ intersect at P, then

$$\angle APB = \angle BPC = \angle CPD = \angle DPA = 90^\circ$$



and $\quad AP = PC = \dfrac{AC}{2}$

$$BP = PD = \frac{BD}{2}$$

In right angled triangle APB

$$AB^2 = AP^2 + BP^2 = \left(\frac{BD}{2}\right)^2 + \left(\frac{AC}{2}\right)^2$$

or, $AB^2 = \dfrac{BD^2}{4} + \dfrac{AC^2}{4} \qquad \ldots \text{(i)}$

In right angled triangle BPC,

$$BC^2 = BP^2 + PC^2 = \frac{1}{4}BD^2 + \frac{1}{4}AC^2 \qquad \ldots \text{(ii)}$$

In right angled triangle CPD

$$CD^2 = PD^2 + PC^2 = \frac{1}{4}BD^2 + \frac{1}{4}AC^2 \qquad \ldots \text{(iii)}$$

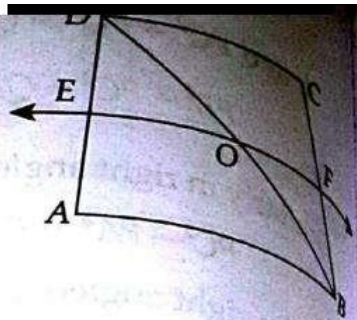
In right angled triangle ΔAPD

$$DA^2 = DP^2 + AP^2 = \frac{BD^2}{4} + \frac{AC^2}{4} \qquad \ldots \text{(iv)}$$

Adding (i), (ii), (iii) and (iv)

$$AB^2 + BC^2 + CD^2 + DA^2 = 4\left(\frac{1}{4}BD^2 + \frac{1}{4}AC^2\right) = BD^2 + AC^2$$

13. *ABCD* is a trapezium with $AB \parallel DC$. *E* is midpoint of side *AD*. From point *E* a line is drawn parallel to *AB* that intersects *BC* at *F*. Show that *F* is midpoint of *BC*.



Solution : Let *EF* intersects diagonal *BD* at *O*

$\therefore$ In ΔADB

$OE \parallel AB$

Thus *O* is the midpoint of *BD*

Now $AB \parallel DC$ (given)

and $AB \parallel EF$ (as given in question)

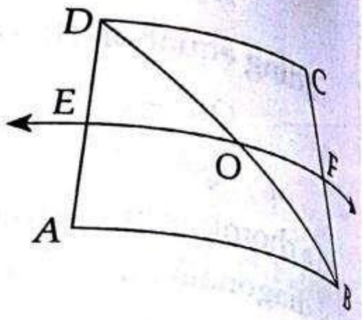
$\therefore$ $DC \parallel EF$

or, $DC \parallel OF$

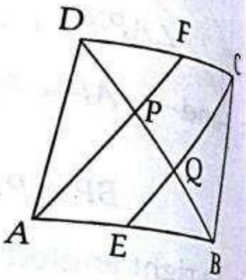
In ΔDBC,

DC is parallel to *OF* and *O* is midpoint of *BD*.

Hence *F* is midpoint of *BC*



14. In a parallelogram *ABCD*, points *E* and *F* are respectively midpoint of sides *AB* and *CD* (see the adjacent figure). Prove that line segment *AF* and *EC* trisect diagonal *BD*. *[Learn the property]*



Solution : In ΔADF and ΔCBE

$AD = BC$ *(parallel sides of parallelogram)*

$\frac{1}{2}DC = \frac{1}{2}AB$ *(parallel sides of parallelogram)*

or, $DF = BE$

and $\angle ADF = \angle CBE$ *(opposite angles of parallelogram)*

Hence, $\Delta ADF \cong \Delta CBE$ *(from S-A-S)*

or, $\angle ADP = \angle CBQ$ *(alternate angle)* ...(i)

and $\angle DAP = \angle BCQ$ *(from CPCT)* ...(ii)

Now in ΔDAP and ΔBCQ

$AD = BC,$ *(opposite sides of a parallelogram)*

$\angle ADP = \angle CBQ$ (from (i))

$\angle DAP = \angle BCQ$ (from (ii))

$\therefore$ $\Delta DAP \cong \Delta BCQ$

$\therefore\ DP = BQ$ (by CPCT) ... (iii)

Again, $DC = AB$ (opposite sides of a parallelogram)

or, $\frac{1}{2}DC = \frac{1}{2}AB$ or, $FC = AE$

and $FC \parallel AE$ (given)

$\therefore\ AFCE$ is a parallelogram

Hence, $AF \parallel CE$

or, $PF \parallel CQ$ ... (iv)

Now in ΔDCQ

$CQ \parallel PF$ (from (iii))

and F is midpoint of DC

$\therefore\ P$ is also the midpoint of DQ

$\therefore\ DP = PQ$ ... (v)

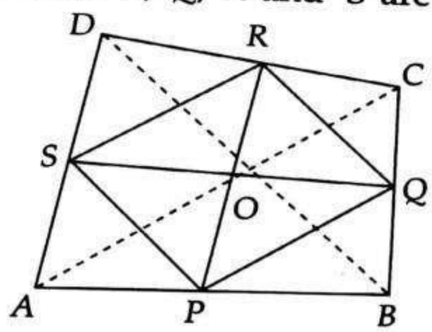
Hence from (iii) and (v)

$$DP = PQ = QB = \left(\frac{1}{3}BD\right)$$

15. Prove that lines joining the midpoints of opposite sides of a quadrilateral bisect each other.

Solution : Suppose $ABCD$ is a quadrilateral. Points P, Q, R and S are respectively midpoints of sides AB, BC, CD and AD. Let PR and QS intersect at O.

[Learn the property]



To prove : $PO = OR$ and $OS = OQ$

Join AC and BD

In ΔABC

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

Similarly in ΔADC

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

Hence $PQ \parallel SR$ and $SR = PQ$ *(from (i) and (ii))*

$\because$ Opposite sides of the quadrilateral are equal and parallel,

$\therefore\ ABCD$ is a parallelogram

We know that diagonals of a parallelogram bisect each other

Hence, $PO = OR$ and $OS = OQ$; Proved.

16. In the given figure $ABCD$ is a trapezium with $AB \parallel DC$. E and F are respectively midpoint of AD and BC. Prove that, $EF = \frac{1}{2}(AB + CD)$

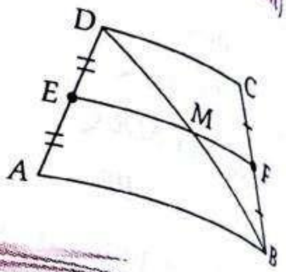
Solution : Join B and D

In ΔABD

$EM = \frac{1}{2} AB$ (since E and M are midpoint)

In ΔBCD

$MF = \frac{1}{2} DC$



adding $EM + MF = \frac{1}{2} AB + \frac{1}{2} DC$

or, $EF = \frac{1}{2} (AB + DC)$

Exercise 7A

1. $ABCD$ is a trapezium length of whose parallel sides AB and CD are respectively 10 cm and 12 cm. If midpoint of AD and BC are respectively E and F then length of EF is.

(a) 11 cm (b) more then 11 cm

(c) less than 11 cm (d) nothing can be said

2. $ABCD$ is a rectangle length of whose two consecutive sides are respectively 9 cm and 40 cm. E and F are respectively midpoints of sides AB and CD. A is joined of F and E is joined to C. They respectively intersect BD at P and Q. Length of PQ is—

(a) $\frac{31}{3}$ cm (b) $\frac{41}{3}$ cm (c) $\frac{49}{3}$ cm (d) $\frac{47}{3}$ cm

3. Length of parallel sides AB and CD of a trapezium are respectively 10 cm and 14 cm. If its diagonals AC and BD intersect at O then $AO : OC$ is

(a) $5:7$ (b) $12:7$ (c) $7:5$ (d) $7:12$

4. A line EF is drawn parallel to the parallel sides AB and CD of a trapezium $ABCD$ where E lies on AD and F lies on BC. If $AE : ED = 2:1$ then what is $BF : BC$?

(a) $2:3$ (b) $3:2$ (c) $2:1$ (d) $1:2$

5. If each side of a rhombus is 10 cm then what is the square root of sum of square of its diagonals ?

(a) $10\sqrt{10}$ cm (b) 20 cm (c) $10\sqrt{20}$ cm (d) $20\sqrt{10}$ cm

6. $ABCD$ is a parallelogram with base $AB = 12$ cm and height 5 cm. If E and F are respectively midpoint of AB and CD and diagonal BD intersects AF and CE respectively at P and Q then area of quadrilateral $PQCF$ is

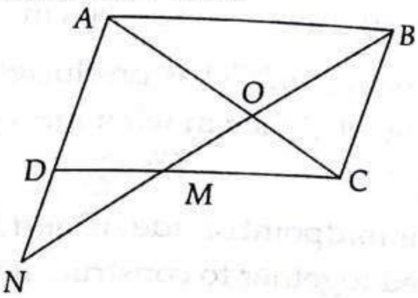
(a) 12 cm^2 (b) 18 cm^2 (c) 20 cm^2 (d) 15 cm^2

7. Select the wrong statement among following.
(a) Join of midpoints of sides of a rectangle taken in order form a rhombus
(b) Join of midpoints of sides of a rhombus taken in order form a rectangle
(c) Join of midpoints of sides of a square taken in order form a rhombus
(d) Join of midpoints of sides of trapezium form a rhombus

8. If $ABCD$ is a trapezium with $AB \parallel DC$ then which of the following is ratio of area of ΔABC and area of ΔBCD.
(a) $AB : CD$ (b) $CD : AB$ (c) $AD : BC$ (d) $BC : AD$

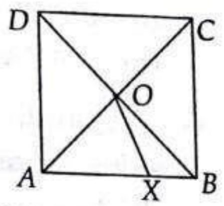
9. $ABCD$ is a trapezium with $AB \parallel DC$ whose diagonals meet at O. If $AB = 2CD$ then ratio of area of ΔAOB and ΔCOD is.
(a) $1 : 4$ (b) $4 : 1$ (c) $1 : \sqrt{2}$ (d) $\sqrt{2} : 1$

10. In the figure given below M is the midpoint of side CD of the parallelogram $ABCD$. What is $ON : OB$?



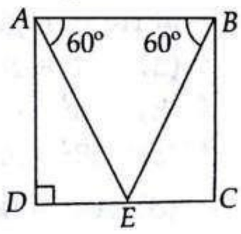
(a) $3 : 2$ (b) $2 : 1$ (c) $3 : 1$ (d) $5 : 2$

11. In the adjacent figure $ABCD$ is a square with $AO = AX$. $\angle XOB$ is equal to
(a) 22.5° (b) 25°
(c) 30° (d) 45°



12. The quadrilateral formed by joining midpoints of sides AB, BC, CD, DA of quadrilateral $ABCD$ is
(a) a trapezium but not a parallelogram
(b) a quadrilateral but not a trapezium
(c) a parallelogram
(d) a rhombus

13. In the adjacent figure $ABCD$ is a quadrilateral. AB, DC are parallel and AD, BC are parallel. ADC is a right angle. If perimeter of ΔABE is 6 unit, then what is the area of the quadrilateral ?
(a) $2\sqrt{3}$ sq. unit (b) 4 sq. unit
(c) 3 sq. unit (d) $4\sqrt{3}$ sq. unit



14. Suppose LMNP is a ... to NR. If area of parallelogram is 6 times area of ΔRNP and $RP = 6$ cm, then L... is equal to

(a) 15 cm (b) 12 cm (c) 9 cm (d) 8 cm

15. If a transversal line cuts two parallel lines then bisector of internal angle formed a

(a) rectangle (b) square
(c) rhombus (d) parallelogram

16. In a parallelogram $ABCD$, M is the midpoint of BD and BM is bisector of $\angle B$. The measure of $\angle AMB$ is.

(a) 45° (b) 60° (c) 90° (d) 120°

17. The angle subtended by side of a parallelogram with pair of other parallel lines is 150°. If distance between parallel sides PQ and SR is 20 cm then what is the length of side RQ ?

(a) 40 cm (b) 50 cm (c) 60 cm (d) 70 cm

18. Side AB of a parallelogram $ABCD$ is produced to E such that $BE = AB$. If DE intersects side BC at Q then in what ratio point Q divides side BC.

(a) 1 : 2 (b) 1 : 1 (c) 2 : 3 (d) 2 : 1

19. $ABCD$ is a square. M is midpoint of side AB and N is midpoint of side BC. DM and AN are joined together to construct new sides which intersect at O. Which of the following is true ?

(a) $OA : OM = 1 : 2$ (b) $AN = MD$
(c) $\angle ADM = \angle ANB$ (d) $\angle AMD = \angle BAN$

20. In a parallelogram $ABCD$, $AB = 24$ cm and $AD = 16$ cm. Distance between sides AB and DC is 10 cm. What is the distance between sides AB and BC ?

(a) 16 cm (b) 18 cm (c) 15 cm (d) 26 cm

21. $ABCD$ is a rhombus. A straight line passing through point C meets the produced part of AD at P and produced part of AB at Q. If $DP = \frac{1}{2} AD$ then what is the ratio of length of BQ and AB ?

(a) 2 : 1 (b) 1 : 2 (c) 1 : 1 (d) 3 : 1

22. In a quadrilateral with distinct sides, if diagonals AC and BD intersects at right angle, then which of the following is true—

(a) $AB^2 + BC^2 = CD^2 + DA^2$
(b) $AB^2 + CD^2 = BC^2 + DA^2$
(c) $AB^2 + AD^2 = BC^2 + CD^2$
(d) $AB^2 + BC^2 = 2(CD^2 + DA)^2$

23. Length of diagonal BD of a parallelogram $ABCD$ is 18 cm. If P and Q are respectively centroid of their ΔABC and ΔADC, then what is the length of line segment PQ ?
(a) 4 cm (b) 6 cm (c) 9 cm (d) 12 cm

24. $ABCD$ is a cyclic trapezium in which sides AD and BC are parallel. If $\angle ABC = 72^\circ$, then what is the measure of $\angle BCD$?
(a) 162° (b) 18° (c) 108° (d) 72°

25. Ratio of $\angle A$ and $\angle B$ of a non square rhombus is $4:5$, the measure of $\angle C$ is—
(a) 50° (b) 45° (c) 80° (d) 95°

26. The external angle of a cyclic quadrilateral is 50°. What is the measure of its internal opposite angle ?
(a) 130° (b) 40° (c) 50° (d) 90°

27. $ABCD$ is a cyclic trapezium with $AD \parallel BC$. If $\angle ABC = 70^\circ$, then measure of $\angle BCD$ is—
(a) 60° (b) 70° (c) 40° (d) 80°

28. Each side of a rhombus is 10 cm, the sum of square of its diagonal is
(a) $20\ cm^2$ (b) $200\ cm^2$ (c) $400\ cm^2$ (d) $100\ cm^2$

29. In a trapezium $ABCD$, AB is parallel to CD. If E is midpoint of side AD and a line drawn from point E, parallel to the parallel sides cuts BC at F then
(a) $BF = CF$ if $AD = BC$
(b) $BF = CF$ is always true
(c) $BF : CF$ is less than 1 if $AD < BC$
(d) $BF : CF$ is greater than 1 if $AD > BC$

30. Points E and F are respectively midpoints of sides AB and CD of a rectangle $ABCD$. If line segment AF and EC respectively intersect diagonal BD at P and Q, then what is the length of PQ if sides of rectangle are respectively 10 cm and 24 cm ?
(a) 10 cm (b) 17 cm (c) $\frac{32}{3}$ cm (d) $\frac{26}{3}$ cm

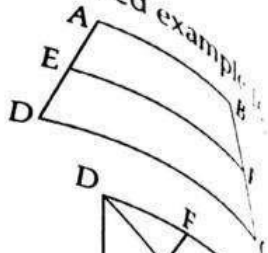
31. The area of a parallelogram $ABCD$ is equal to that right angled isosceles triangle whose hypotenuse is l cm. If O is a point inside the parallelogram $ABCD$ then sum of areas of ΔAOB and ΔCOD is.
(a) $\frac{l^2}{2}\ cm^2$ (b) $\frac{l^2}{4}\ cm^2$ (c) $\frac{l^2}{8}\ cm^2$ (d) $\frac{l^2}{16}\ cm^2$

Answers 7A

1. (a)	2. (b)	3. (a)	4. (a)	5. (b)	6. (d)	7. (d)	8. (a)
9. (b)	10. (b)	11. (a)	12. (c)	13. (a)	14. (b)	15. (a)	16. (c)
17. (a)	18. (b)	19. (b)	20. (c)	21. (a)	22. (b)	23. (b)	24. (d)
25. (c)	26. (c)	27. (b)	28. (c)	29. (b)	30. (d)	31. (c)	

1. (a) Recall that $EF = \frac{1}{2}(AB + CD)$ [see solved exampl

$= \frac{1}{2}(10 + 12) = 11$ cm

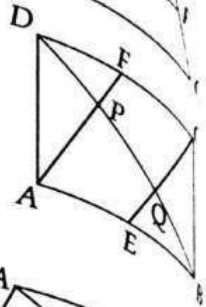


2. (b) See solved example 14

Here $DP = PQ = QB = \frac{1}{3} BD$

$= \frac{1}{3}\sqrt{40^2 + 9^2}$

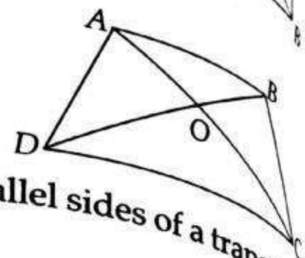
$= \frac{1}{3} \times 41$ cm



3. (a) $\Delta AOB \sim \Delta COD$

$\Rightarrow \frac{AO}{CO} = \frac{AB}{CD}$

$= \frac{10}{14} = 5:7$



4. (a) We know that a line drawn parallel to parallel sides of a trapezium cuts non parallel sides in the same ratio.

$\because \frac{BF}{FC} = \frac{AE}{ED} = \frac{2}{1}$

or, $BF = 2FC = 2(BC - BF)$

or, $3BF = 2BC$ $\quad \therefore \frac{BF}{BC} = \frac{2}{3}$

5. (b) As in solved example 11, for a rhombus, sum of square of diagonals = sum of square of its sides

$= 10^2 + 10^2 + 10^2 + 10^2 = 400$

$\therefore$ Required square root $= \sqrt{400} = 20$

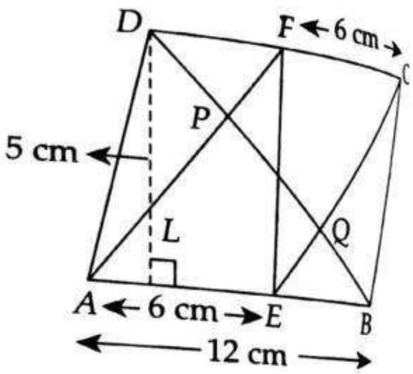
6. (d) area of quadrilateral $PQCF$

$= \frac{1}{2}$ (area of quadrilateral $AECF$)

$= \frac{1}{2}$ (2 × area of ΔAEF)

$= \frac{1}{4}$ × area of quadrilateral $ABCD$

$= \frac{1}{4} \times 12 \times 5 = 15 \text{ cm}^2$



2nd Method :

Area of quadrilateral $PQCF$ $\frac{1}{2}$ (area AECF)

$= \frac{1}{2} \times FC \times DL$

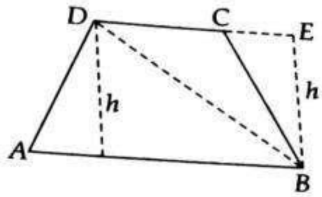
$= \frac{1}{2} \times \frac{1}{2} \times DC \times DL = \frac{1}{4} \times 12 \times 5 = 15 \text{ cm}^2$

7. (d) Statement (c) is correct. When we join midpoints of a square it is a square which is also a rhombus.

When midpoints of a trapezium is joined, a parallelogram is formed. So, statement (d) is wrong.

8. (a) $\dfrac{\text{area of } \Delta ABC}{\text{area of } \Delta BCD} = \dfrac{\frac{1}{2} \cdot AB \cdot h}{\frac{1}{2} \cdot CD \cdot h}$

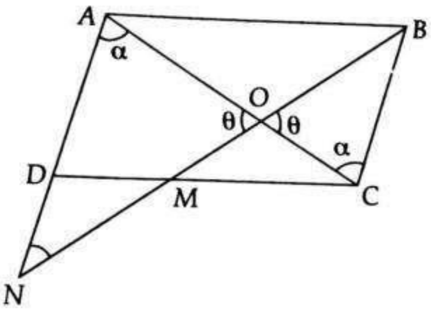
$= AB : CD$



9. (b) $\Delta AOB \sim \Delta COD$

$\dfrac{ar(\Delta AOB)}{ar(COD)} = \dfrac{AB^2}{CD^2} = \dfrac{(2CD)^2}{CD^2} = \dfrac{4CD^2}{CD^2} = 4 : 1$

10. (b) $\angle DMN = \angle CMB$



$\angle DNM = \angle CBM$ *(alternate angle)*

$DM = CM$

$\Delta NDM \cong \Delta BCM$

$\therefore\ DN = CB$

$AD = BC = DN$

$\therefore\ AN = AD + DN = AD + AD = 2AD$

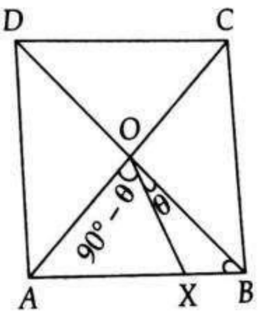
In ΔOBC and ΔONA

$\angle BOC = \angle AON$ *(vertically opposite angle)*

$\angle OCB = \angle OAN$ *(alternate angle)*

$\therefore\ \Delta OBC \sim \Delta ONA \quad \therefore\ \dfrac{ON}{OB} = \dfrac{NA}{BC} = \dfrac{2}{1}$

11. (a) Let $\angle XOB = \theta$ then $\angle AOX = 90° - \theta$



$\because\ AO = AX$

$\therefore\ \angle AXO = \angle AOX = 90° - \theta$

In ΔAOX, $\angle OAX + \angle AOX + \angle AXO = 180°$

or, $45° + (90° - \theta) + (90° - \theta) = 180°$

or, $2\theta = 45°$

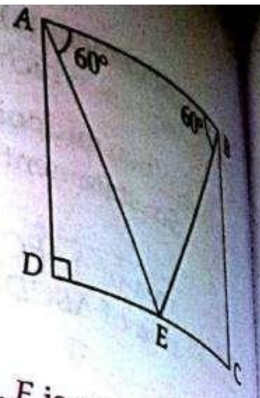
or, $\theta = \dfrac{45°}{2}$

12. (c) When midpoints of a quadrilateral are joined, a parallelograms is formed.

13. (a) $\because\ AB \parallel DC$ and $AD \parallel BC$

In ΔABE, $\angle EAB = \angle ABE = 60°$

$\Rightarrow\ \angle AEB = 60°$



$\Rightarrow\ \Delta ABE$ is an equilateral triangle

Now, perimeter of $\Delta ABE = 6$

$\Rightarrow\ AB + BE + EA = 6 \ \Rightarrow\ \ AB = 2$ unit

and In $\Delta ADE,\ AE^2 = AD^2 + ED^2$

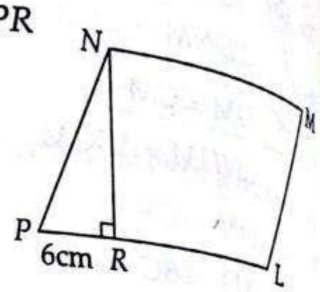
$\Rightarrow\ 4 = AD^2 + 1 \quad \Rightarrow\ \ AD = \sqrt{3}$ unit $\quad$ ($\because$ E is mid point of CD)

Hence, area of quadrilateral $ABCD = AB \times AD = 2 \times \sqrt{3}$

$= 2\sqrt{3}$ square unit

14. **(b)** According to question,

area of parallelogram $= 6 \times$ area of ΔNPR

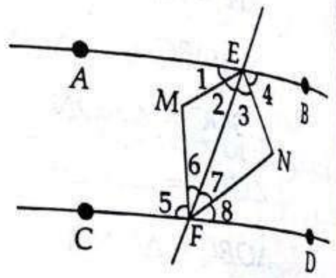


$\Rightarrow\ NR \times PL = 6 \times \frac{1}{2} \times NR \times PR$

$\Rightarrow\ PL = 3PR = 3 \times 6 = 18$ cm

$RL = PL - PR = 18 - 6 = 12$ cm

15. **(a)** Given $\angle 1 = \angle 2,\ \angle 3 = \angle 4,\ \angle 5 = \angle 6,\ \angle 7 = \angle 8$



$\because\ \ \angle 1 + \angle 2 = \angle 7 + \angle 8$ *(alternate angle)*

$\therefore\ \ 2\angle 2 = 2\angle 7 \Rightarrow \angle 2 = \angle 7 \quad$ ... (i)

Similarly $\ \angle 3 = \angle 6 \quad$ ... (ii)

from (i) and (ii)

$\angle 2 + \angle 3 = \angle 6 + \angle 7 \quad$ ... (iii)

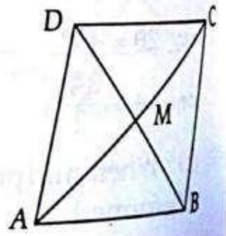
But, $\angle 1 + \angle 2 + \angle 3 + \angle 4 = 180°$

$\Rightarrow\ 2(\angle 2 + \angle 3) = 180° \quad$ (from (iii))

$\Rightarrow\ \angle MEN = 90°$ and $\angle 2 = \angle 7,\ \angle 3 = \angle 6 \Rightarrow EM \parallel NF,\ EN \parallel MF$

$\therefore\ \ \square MFNE$ is a rectangle.

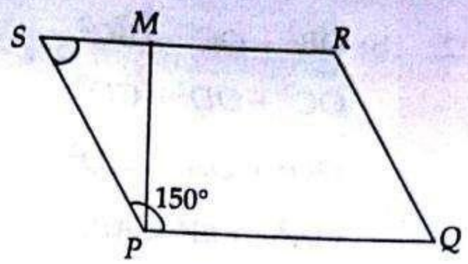
16. **(c)** Here midpoint of diagonal BD is M and it also bisects $\angle B$, so parallelogram is a rhombus.



$\therefore\ \ \angle AMB = 90°$

17. **(a)** Given $\angle SPQ = 150°$ and $PM = 20$ cm

In parallelogram $PQRS$,



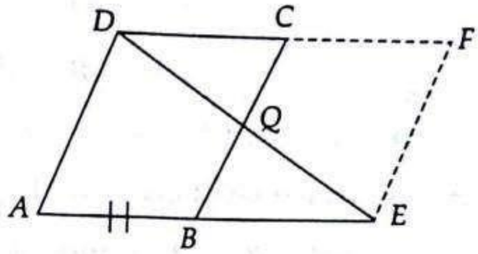
$\angle RSP + \angle SPQ = 180°$

$\Rightarrow \angle RSP = 180° - 150° = 30°$

$\Rightarrow \theta = 30°$

In ΔPSM, $\sin 30° = \frac{PM}{SP}$

$\Rightarrow \frac{1}{2} = \frac{20}{SP} \Rightarrow SP = 40$ cm



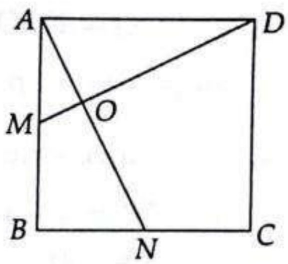
18. (b) See the figure,

In ΔCDQ and BEQ

$DQ = QE$ and $CD = BE$

$\therefore \; BQ = QC$

Hence, $BQ : QC = 1 : 1$



19. (b) Let each side of square is a

$\because$ M, N are midpoints

$\therefore \; AM = BN = \frac{a}{2}$

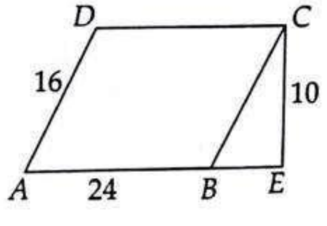
In right angled ΔDAM,

$$MD^2 = AD^2 + AM^2 = a^2 + \left(\frac{a}{2}\right)^2 = \frac{5a^2}{4} \quad \text{... (i)}$$

Similarly in ΔABN

$$AN^2 = AB^2 + BN^2 = a^2 + \left(\frac{a}{2}\right)^2 = \frac{5a^2}{4} \quad \text{... (ii)}$$

from (i) and (ii) $AN = MD$

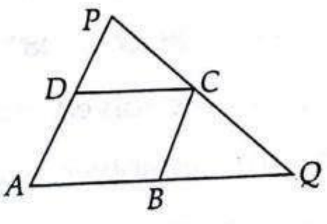


). (c) Area of parallelogram = base × height

$= 24 \times 10 = 240 \text{ cm}^2$

If required distance is x cm then $240 = 16 \times x$

$\therefore \; x = \frac{240}{16} = 15$ cm



(a) From Thale's Theorem,

$\because \; AB \parallel CD$

$\therefore$ In ΔAPQ

$$\frac{PC}{QC} = \frac{PD}{DA} = \frac{1}{2} \quad \text{... (i)}$$

But, $BC \parallel AD$

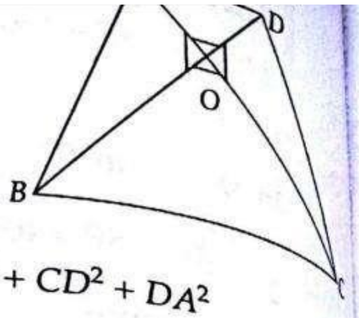
$\therefore$ Using Thale's theorem in ΔAQP, $\frac{BQ}{AB} = \frac{QC}{CP} = \frac{2}{1}$

22. (b)

$OC^2 + OD^2 = CD^2$

$OD^2 + OA^2 = AD^2$

$OA^2 + OB^2 = AB^2$



Adding,

$\therefore \quad 2(OB^2 + OA^2 + OD^2 + OC^2) = AB^2 + BC^2 + CD^2 + DA^2$

$\Rightarrow \quad 2(AB^2 + CD^2) = AB^2 + BC^2 + CD^2 + DA^2$

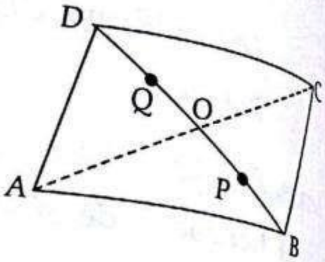
$\Rightarrow \quad AB^2 + CD^2 = BC^2 + DA^2$

23. **(b)** Since $DQ : QO = 2 : 1$,

$BP : PO = 2 : 1$ and $BO = DO$

$\therefore \quad DQ = 2k, QO = k, BP = 2k, PO = k$

Hence $PQ = PO + OQ = 2k = \frac{2k}{6k} \times 18 = 6$ cm

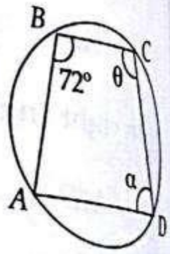


24. **(d)** Since sum of opposite angles of a cyclic quadrilateral = 180°

$\because \quad 72^\circ + \alpha = 180^\circ$

$\therefore \quad \alpha = 180^\circ - 72^\circ = 108^\circ$

$\therefore \quad \theta = 180^\circ - 108^\circ = 72^\circ$

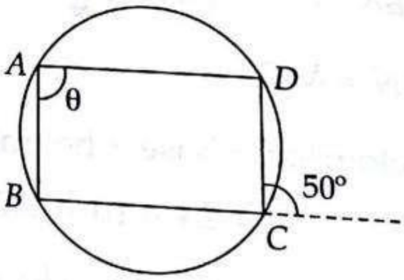


25. **(c)** $\because \quad 4x + 5x = 180^\circ$

$\Rightarrow \quad 9x = 180^\circ \Rightarrow x = 20^\circ$

$\therefore \quad \angle C = 4x = 80^\circ$

26. **(c)** External angle is equal to internal opposite angle.



27. **(b)** $\angle ADC = 108^\circ - 70^\circ = 110^\circ$ and $\angle ADC + \angle BCD = 180^\circ$

$\Rightarrow \quad \angle BCD = 108^\circ - 110^\circ = 70^\circ$

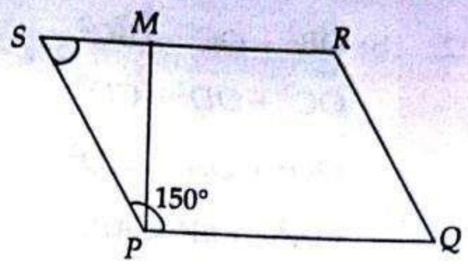
28. **(c)** see solved example 12

29. **(b)** see solved example 13

30. **(d)** see solved example 14 $PQ = \frac{1}{3} \times \sqrt[2]{10^2 + 24^2} = \frac{26}{3}$

31. **(c)** If perpendicular sides of right angled isosceles triangle are x then

$x^2 + x^2 = l^2 \Rightarrow x^2 = \frac{l^2}{2}$



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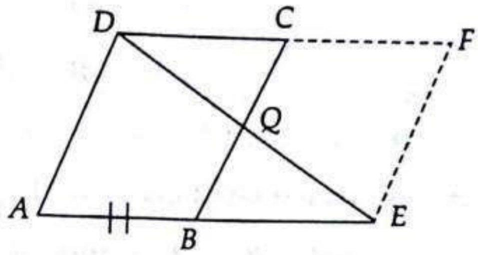
$\Rightarrow \frac{1}{2} = \frac{20}{SP} \Rightarrow SP = 40$ cm



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In ΔCDQ and BEQ

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$\therefore \; BQ = QC$

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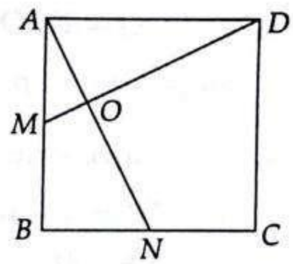

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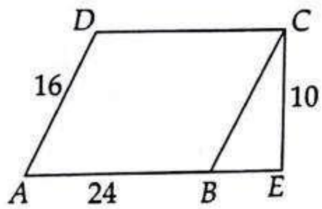
Similarly in ΔABN

$$AN^2 = AB^2 + BN^2 = a^2 + \left(\frac{a}{2}\right)^2 = \frac{5a^2}{4} \qquad \ldots \text{(ii)}$$

from (i) and (ii) $AN = MD$

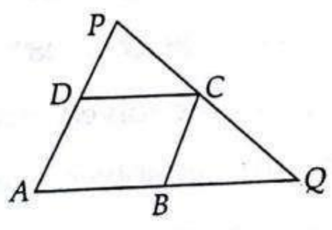


20. (c) Area of parallelogram = base × height

$= 24 \times 10 = 240 \text{ cm}^2$

If required distance is x cm then $240 = 16 \times x$

$\therefore \; x = \frac{240}{16} = 15$ cm



21. (a) From Thale's Theorem,

$\because \; AB \parallel CD$

$\therefore$ In ΔAPQ

$$\frac{PC}{QC} = \frac{PD}{DA} = \frac{1}{2} \qquad \ldots \text{(i)}$$

But, $BC \parallel AD$

$\therefore$ Using Thale's theorem in ΔAQP, $\frac{BQ}{AB} = \frac{QC}{CP} = \frac{2}{1}$

$\therefore$ Area of triangle $= \frac{1}{2} \cdot x \cdot x = \frac{1}{2} \cdot \frac{l^2}{2} = \frac{l^2}{4}$ = area of parallelogram $ABCD$

As in solved example 7.

area of ΔAOB + area of ΔCOD

$$= \frac{1}{2} \text{ (area of quadrilateral } ABCD = \frac{1}{2} \cdot \frac{l^2}{4} = \frac{l^2}{8}$$

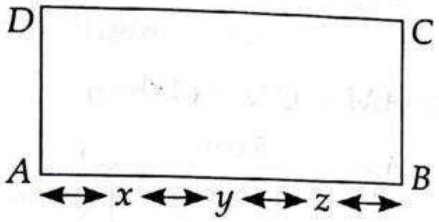
Exercise—7B

1. If the length of the side PQ of the rhombus $PQRS$ is 6 cm and $\angle PQR = 120°$, then the length of QS, in cm, is

(a) 3 (b) 5 (c) 4 (d) 6

[SSC Tier-I 2012]

2. Side AB of rectangle $ABCD$ is divided into four equal parts by points x, y, z. Then ratio of the $\frac{\text{area } (\Delta XYC)}{\text{Area (Rectangle } ABCD)}$ is



(a) $\frac{1}{7}$ (b) $\frac{1}{6}$ (c) $\frac{1}{9}$ (d) $\frac{1}{8}$

[SSC Tier-I 2012]

3. $ABCD$ is a trapezium, such that $AB = CD$ and $AD \parallel BC$. $AD = 5$ cm, $BC = 9$ cm. If area of $ABCD$ is 35 sq. cm, their CD is

(a) $\sqrt{29}$ cm (b) 5 cm (c) 6 cm (d) $\sqrt{21}$ cm

[SSC Tier-I 2012]

4. The area, perimeter and diagonal of a square are a, b, c respectively. Then the value of $\frac{bc}{a}$ is.

(a) 4 (b) 2 (c) $4\sqrt{2}$ (d) $2\sqrt{2}$

5. The length of the side of a square is 14 cm. Find out the ratio of the radii of the inscribed and circumscribed circle of the square.

(a) $\sqrt{2} : 1$ (b) $1 : \sqrt{2}$ (c) $\sqrt{2} : 3$ (d) $2 : 1$

[SSC Tier-I 2012]

6. If P, R, T are the area of a parallelogram, a rhombus and a triangle standing on the same base and between the same parallels, which of the following is true ?

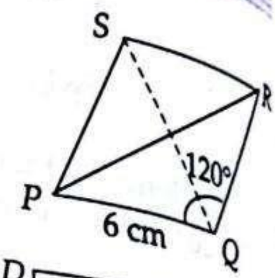
(a) $R < P < T$ (b) $P > R > T$ (c) $R = P = T$ (d) $R = P = 2T$

[SSC Tier-I 2012]

Answers—7B

1. (d) 2. (d) 3. (a) 4. (c) 5. (b) 6. (d)

Explanation



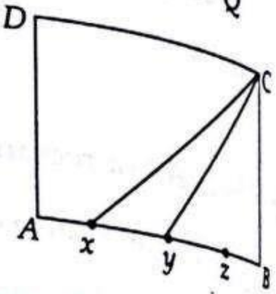
1. (d) $\angle SPQ = 180° - 120° = 60°$

$\angle SQP = \frac{1}{2} \times 120° = 60°$

and $\angle PSQ = 180° - 60° - 60° = 60°$

$\therefore$ ΔPSQ is an equilateral triangle

Hence, $SQ = PQ = 6$ cm

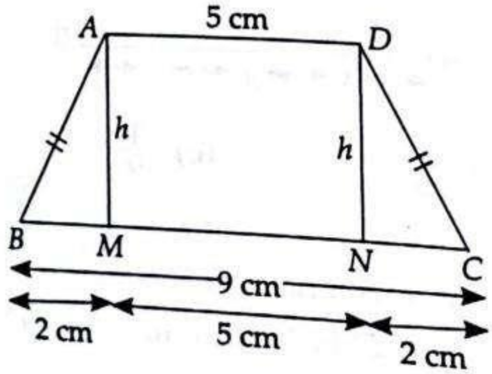


2. (d) $\frac{\text{area }(\Delta xyc)}{\text{area }(\square ABCD)} = \frac{\frac{1}{2}\cdot xy\cdot height}{AB\cdot BC}$

$= \frac{\frac{1}{2}\cdot xy\cdot BC}{4\,xy\,BC} = \frac{1}{8}$

($\because$ height of triangle = height of rectangle and $AB = 4xy$)

3. (a) See the figure, Let $AM = DN = G$ then

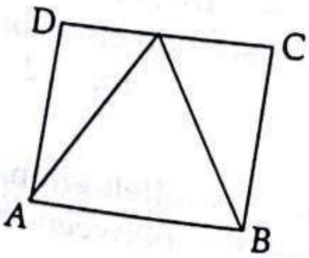


area $(\Delta ABM + \square AMND + \Delta CND) = 35$ cm^2

or, $\frac{1}{2}\cdot 2\cdot h + 5\cdot h + \frac{1}{2}\cdot 2\cdot h = 35$

or, $7h = 35$ or, $h = 5$ $\therefore CD = \sqrt{h^2 + CN^2} = \sqrt{5^2 + 2^2} = \sqrt{29}$

6. (d) Both parallelogram and rhombus are same as base are same.



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