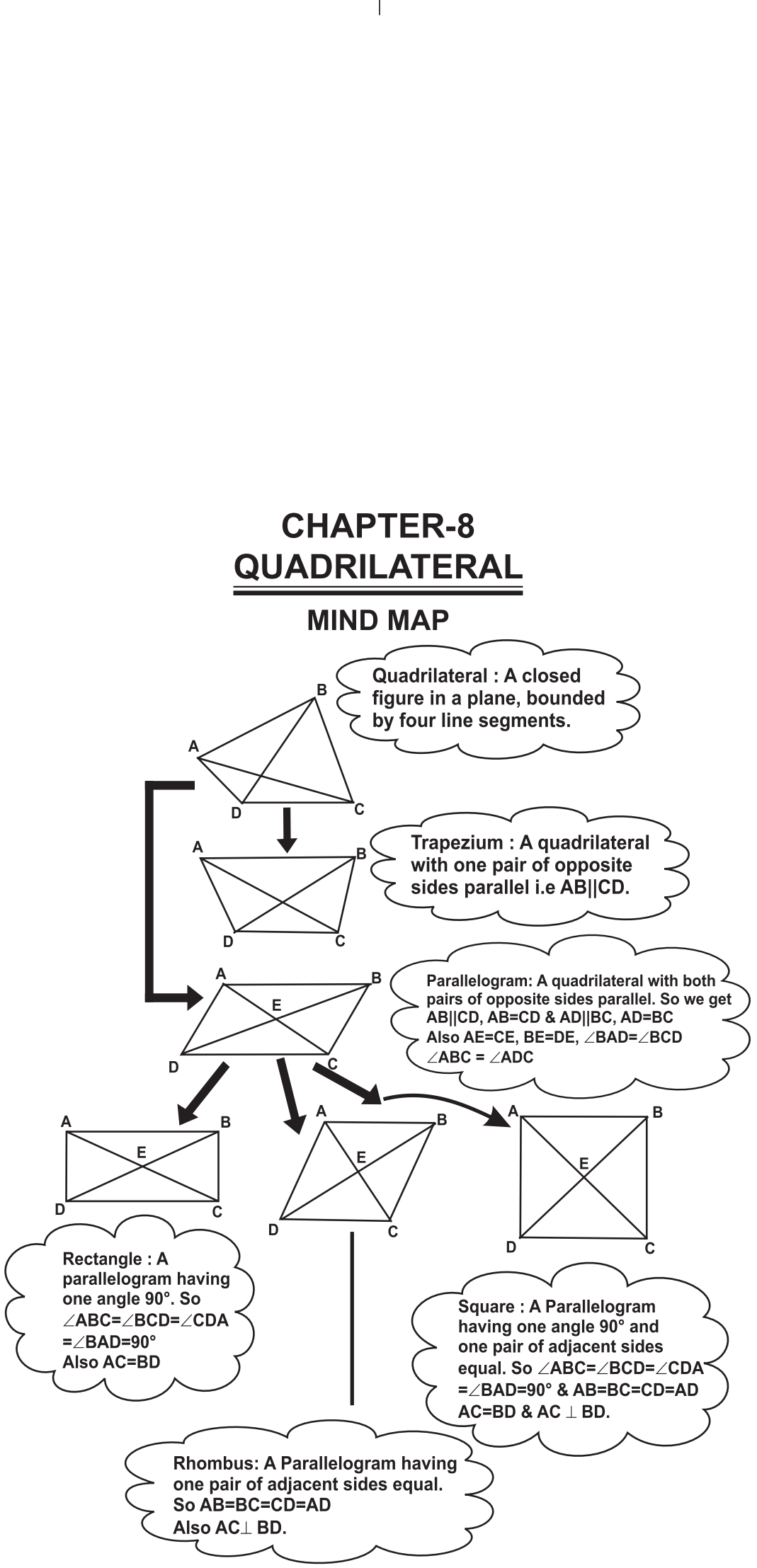
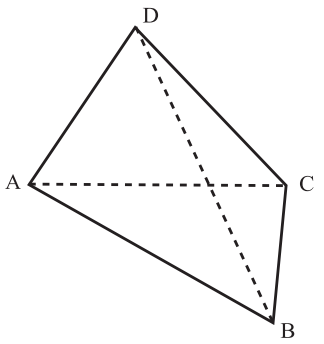
CHAPTER-8
QUADRILATERAL

MIND MAP



Key points

1. **Quadrilateral:** It is a closed figure bounded by four line segments. In a quadrilateral there are.



   (i) Two pairs of opposite sides (no common point).

   e.g., *AB* & *CD*, *BC* & *AD*

   (ii) Two pairs of opposite angles $\angle A$ & $\angle C$ and $\angle B$ & $\angle D$.

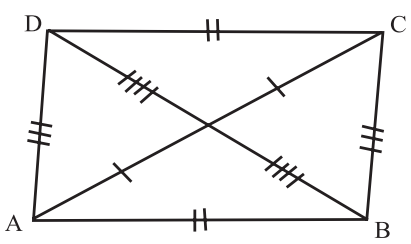
   (iii) Four pairs of adjacent sides *AB* & *BC*,*BC* & *CD*, *CD* & *AD* and *AD* & *AB* (one common Point)

   (iv) Four pairs of adjacent angles (one common side)$\angle A$ & $\angle B$, $\angle B$ & $\angle C$, $\angle C$ & $\angle D$, $\angle D$ & $\angle A$.

   (v) Line segment joining opposite vertices is called diagonal of quadrilateral e.g., *AC* & *BD*.

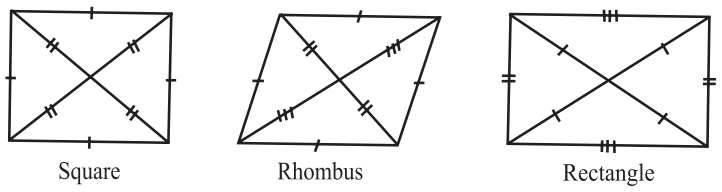
   (vi) Sum of the angles of a quadrilateral is 360°, $\angle A + \angle B + \angle C + \angle D = 360°$.

2. **Parallelogram:** A quadrilateral is a parallelogram if.



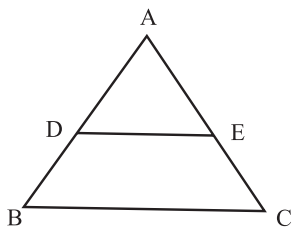
- Both the pairs of opposite sides are equal/parallel or
- Both the pairs of opposite angles are equal or
- Diagonals bisects each other or
- One pair of opposite sides is equal and parallel

3. A diagonal of a parallelogram divides it into two congruent triangles. Other examples of parallelogram.



Square Rhombus Rectangle

4. Theorem: A line segment joining the mid point of two sides of a triangles is parallel to the third side and is half of it. If D & E are mid points then $DE \parallel BC$ and $DE = \frac{1}{2} BC$.



5. Converse of mid point theorem.

The line drawn through the mid point of one side of a triangle, parallel to another side bisects the third side. So, if D is mid point of AB and $DE \parallel BC$ then E will be mid point of AC.

Very Short Answer type Questions (1 Marks)

1. Three angles of a quadrilateral are 75°, 90°, 75° the fourth angle is

(a) 90° (b) 95°

(c) 105° (d) 120°

2. $ABCD$ is a rhombus such that $\angle ACB = 40°$ then $\angle ABD$ is

(a) 40° (b) 45°

(c) 50° (d) 60°

3. The bisectors of the angles of a parallelogram enclose a

(a) Parallelogram (b) Square

(c) Rhombus (d) Rectangle

4. The figure obtained by joining the midpoint of the sides of a quadrilateral taken in order is a

(a) Square (b) Parallelogram

(c) Rectangle (d) Rhombus

5. The diagonals AC and BD of a parallelogram $ABCD$ intersect each other at point "O" If $\angle DAC = 32°$ and $\angle AOB = 70°$ then $\angle DBC$ is equal to

(a) 24° (b) 86°

(c) 38° (d) 32°

6. The angles of quadrilateral are in the ratio 3 : 4 : 5 : 6 The respective angles of the quadrilateral are

(a) 60°, 80°, 100°, 120° (b) 120°, 100°, 80°, 60°

(c) 120°, 60°, 80°, 100° (d) 80°, 120°, 100°, 60°

7. Line segment joining the mid points of two sides of a triangles is parallel to the third side and is _____ of it.

(a) Trisect (b) Bisect

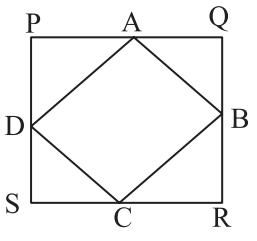
(c) Half (d) One Fourth

8. The diagonals of a rhombus are 12 cm and 16 cm. The length of that side of rhombus is :-

(a) 12 cm (b) 16 cm

(c) 8 cm (d) 10 cm

9. Points A, B, C and $D$are midpoints of the sides of square $PQRS$. If the area of $PQRS$ is 36 Sq. cm, the area of $ABCD$ is _____ Sq. cm.



(a) $9\sqrt{2}$ (b) $18\sqrt{2}$

(c) 9 (d) 18

10. The perimeter of a rhombus is 60 cm. If the length of its longer diagonal measures 24 cm, the length of the shorter diagonal is _____ cm.

(a) 20 (b) 18

(c) 15 (d) 9

11. Which statements is true about all parallelogram

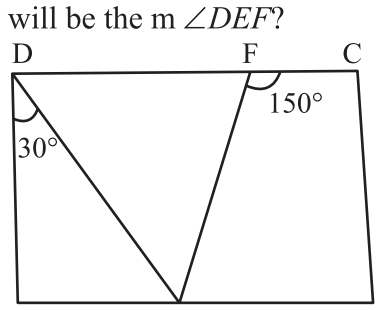
(a) The diagonals are congruent.

(b) The area is the product of two adjacent sides

(c) the opposite angles are congruent

(d) The diagonals are perpendicular to each other.

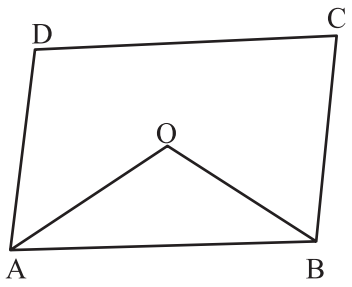
12. In the given figure $ABCD$ is a rectangle. If $m\angle ADE = 30°$ and $m\angle CFE = 150°$. What will be the m $\angle DEF$?



13. Given four points *A, B, C, D* such that three points *A, B* and *C* are collinear. Name the closed figure obtained by joining these point in order.

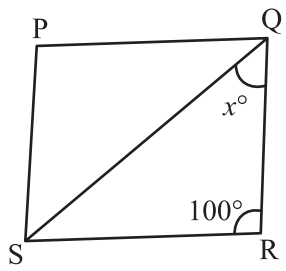
14. What is the sum of any two consecutive angles of parallelogram?

15. In parallelogram *ABCD*, bisectors of angles *A* and *B* intersect each other at " *O*". Find the value of angles *AOB*.



16. If an angle of a parallelogram is two-third of its adjacent angle then find the smallest angle of the parallelogram.

17. In the given figures *PQRS* is a rhombus. Find the value of *x*.



18. Two adjacent angles in a parallelogram are in the ratio 2 : 4. Find the values of these two angles.

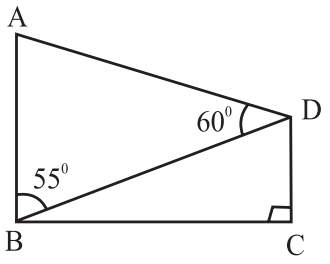
19. In a rhombus $ABCD$, if $\angle A = 60°$ find $\angle B$, $\angle C$ & $\angle D$.

20. The angles of a quadrilateral are in the ratio 1 : 2 : 4 : 5. Find the measure of each angle.

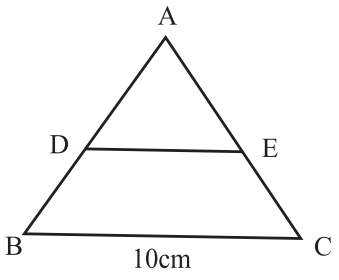
21. If in parallelogram $ABCD$, $\angle A = (2x + 15)°$, $\angle B = (3x - 25)°$ then find the value of x?

22. In a parallelogram if all the four angles are in the ratio 1 : 1 : 1 : 1 then, what type of parallelogram is this?

23. In the figure, $AB \parallel CD$, what will be the measure of $\angle ADC$?

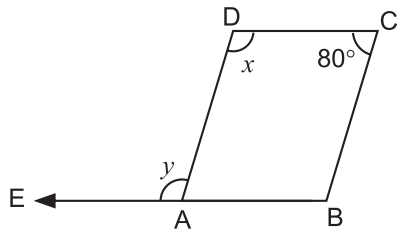


24. In the figure, if D & E are respectively the mid point of AB & AC, what will be the length of ED?

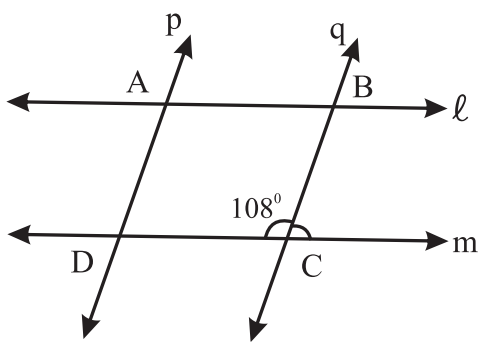


25. $ABCD$ is a rhombus in which $\angle ACB = 40°$, then what will be value of $\angle ADB$?

26. In the figure, $ABCD$ is a parallelogram find value of $(x + y)$.



27. In the figure line $l \parallel m$ and $p \parallel q$, $\angle BCD = 108°$ find all four angles of quadrilateral $ABCD$.



28. Which of the following statements are true (t) and which are false (f)?

(a) In a parallelogram, the diagonals are equal ( )

(b) If all the angles of a quadrilateral are equal it is a parallelogram ( )

(c) The diagonals of parallelogram bisect each other ( )

(d) The diagonals of rhombus are equal ( )

(e) All the angles of parallelogram are acute angles ( )

(f) In a trapezium both pairs of opposite sides are parallel. ( )

29. Opposite angles of a parallelogram are _____.

30. Diagonals of a rectangle _____ each other and are_____.

31. If in a rectangle $ABCD$, diagonal AC bisects $\angle A$ as well as $\angle C$ then $ABCD$ is a _____.

32. A quadrilateral is a parallelogram if its both the pairs of opposite sides are _____.

33. Diagonals of a rhombus _____ each other and are _____.

34. Diagonals of a square are _____, _____ and _____.

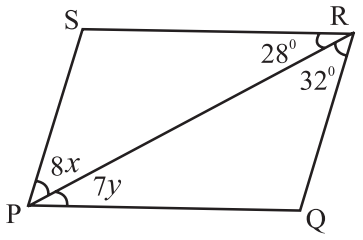
Short Answer type-I Question (2 Marks)

35. Prove that the sum of all the four angles of a quadrilateral is 360^0.

36. Show that opposite angles of a parallelogram are equal.

37. In a parallelogram $ABCD$ $\angle B$=110° determine the measure of $\angle A$ and $\angle D$.

38. In the figure if *PQRS* is a parallelogram, then find the value of x and y.



39. The diagonals of a parallelogram *ABCD* interest at *O*. *A* line through *O* intersects *AB* at *X* and *DC* at *Y*. Prove that $OX = OY$.

40. In a parallelogram *ABCD* diagonals *AC* and *BD* intersect at *O* and $AC = 7.4$ cm and $BD = 6.2$ cm. Find the length of *AO* and *BO*.

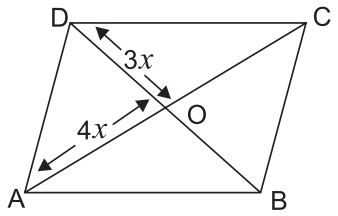
41. Two opposite angles of a parallelogram are $(5x - 3)$ and $(4x + 12)$. Find the measure of each angle of the parallelogram.

42. Diagonals of a quadrilateral *ABCD* bisect each other if $\angle A = 35°$ determine $\angle B$.

43. The perimeter of a parallelogram is 30 cm. If longer side is 9.5 cm then find the length of shorter side.

44. In a parallelogram *ABCD* diagonals *AC* and *BD* intersects at *O* and $AC = 12.6$ cm and $BD = 9.4$ cm. Find the measures of *OC* and *OD*.

45. *ABCD* is a rhombus in which $DO = 3x$ and $AO = 4x$, find perimeter of quadrilateral *ABCD*.

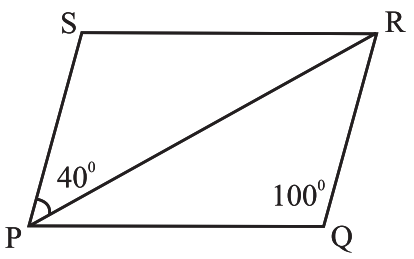


46. The angles of a quadrilateral are $(x + 20)°$, $(x - 20)°$, $(2x + 5)°$, $(2x - 5)°$. Find the value of x.

Short Answer type-II Questions (3 Marks)

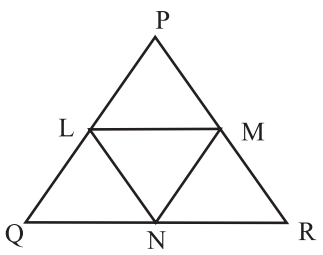
47. If *ABCD* in a rhombus with $\angle ABC = 50°$ then find $\angle ACD$.

48. In the adjoining figure if $PQRS$ is a parallelogram where $\angle PQR = 100°$ and $\angle SPR = 40$. Find $\angle PRQ$ and $\angle SRQ$.



49. Prove that the line segment joining the mid points of two sides of a triangle is parallel to the third side.

50. In the given figure L, M and N are mid point of the sides PQ, PR and QR respectively of ΔPQR. If $PQ = 4.4$ cm, $QR = 5.6$ cm and $PR = 4.8$ cm then find the perimeter of ΔLMN.



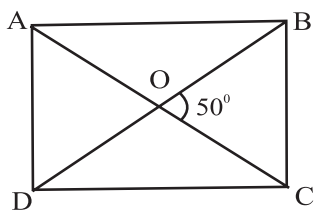
51. A quadrilateral is a parallelogram if one pair of opposite sides are equal and parallel. Prove it.

52. If the diagonals of a quadrilateral bisect each other then quadrilateral is a parallelograms. Prove it.

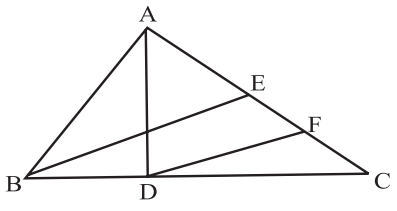
53. In a parallelograms $PQRS$, M and N are points on PQ and RS such that $PM = RN$. Prove that $MS \parallel NQ$.

54. In a parallelogram $ABCD$, AP and CQ are drawn perpendiculars from vertices A and C on diagonal BD. Prove that $\Delta APB \cong \Delta CQD$.

55. The diagonals of a rectangle $ABCD$ meet at O. If $\angle BOC = 50°$ then find $\angle ODA$

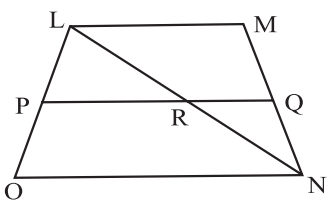


56. In the given figure AD and BE are the medians of ΔABC and $BE \parallel DF$ prove that $CF = 1/4\ AC$.

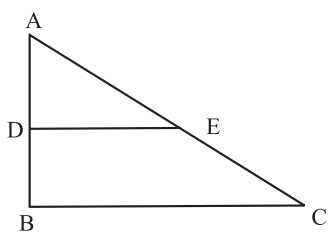


Long Answer type Questions (5 Marks)

57. In the figure $LMNO$, is a trapezium in which LM is parallel to side ON and P is the mid point of side LO. If Q is a point on the side MN such that segment PQ is parallel to side ON Prove that Q is the mid point of MN and $PQ = \frac{1}{2}(LM + ON)$.



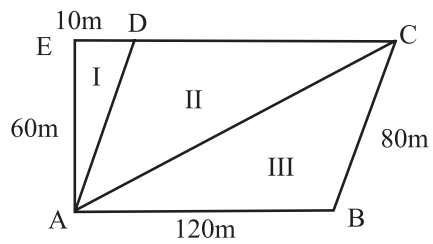
58. In the figure, ΔABC is right angles at B. If $AB = 9$ cm, $AC = 15$ cm. and D and E are the mid points of AB and AC respectively calculate



(i) The length of BC

(ii) The area of trapezium $BCED$

59. A farmer has divided his field into three parts as in the figure. First part is used to take care of his cattle. While II and III are used to grow two different crops.



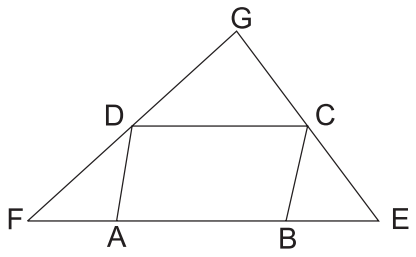
Answer the following:

(i) How much area has been used to take care for cattles?

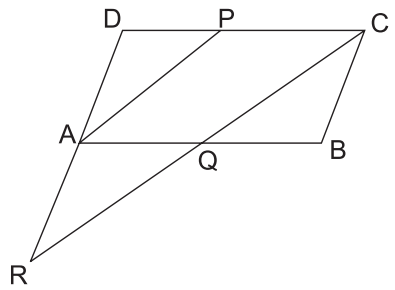
(ii) Are the two areas part II and part III equal? Justify.

(iii) What is the total area of the field?

60. *ABCD* is a parallelogram. Side *AB* is produced on both sides to *E* & *F* as in figure such that *BE* = *BC* & *AF* = *AD*. Show that *EC* & *FD* when produced meets at right angle.



61. *P* is mid point of side *CD* of a parallelogram *ABCD*. A line through *C* parallel to *PA* intersects *AB* at Q & DA produced at*R*. Prove that *DA* = *AR* & *CQ* = *QR*.



Chapter - 8

QUADRILATERAL

Answers

1. (d) 120°

2. (c) 50°

3. (d) Rectangle

4. (b) Parallelogram

5. (c) 38°

6. (a) 60°, 80°, 100°, 120°

7. (c) Half

8. (d) 10 cm

9. (d) 18

10. (b) 18

11. (c) The opposite angles are congruent

12. 90°

13. A triangle

14. 180°

15. 90°

16. 72°

17. 40°

18. 60°, 120°

19. 120°, 60°, 120°

20. 30°, 60°, 120°, 150°

21. 38°

22. Rectangle

23. 115°

24. 5 cm

25. 50°

26. 200°

27. 108°, 72°, 108°, 72°

28. (a) *F* (b) *F* (c) *T* (d) *F* (e) *F* (f) *F*

29. Equal

30. Bisect, equal

31. square

32. parallel or equal

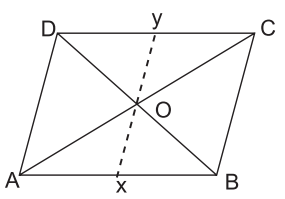
33. Bisect, Perpendicular to each other

34. Equal, bisect each other, perpendicular to each other.

37. 70°, 110°

38. $x = y = 4$

39.



In ΔAOX & ΔCOY

$OA = OC$

$\angle AOX = \angle COY$ (vertically opposite)

$\angle OAX = \angle OCY$ (Aleternate interior angles)

$\Delta AOX \cong \Delta COY$ (*ASA*)

$OX = OY$ (*CPCT*)

40. $OA = \frac{1}{2} AC$ (Diagonals of a parallelogram bisect each other)

$= \frac{1}{2} \times 7.4 = 3.7$ cm

Similarly $OB = \frac{1}{2} BD = 3.1$ cm.

41. $5x - 3 = 4x + 12$

$x = 15°$

So angles are $5x - 3 = 5 \times 15 - 3 = 72°$

Other angles will be 108°, 72°, 108°

42. 145°

43. Let longer side be $a = 9.5$ cm and shorter side be 'b'

Perimeter $= 2a + 2b = 30$

$$2 \times 9.5 + 2b = 30$$
$$2b = 11$$
$$b = 5.5\text{cm}$$

44. $OC = \frac{1}{2} AC = 6.3$ cm

$$OD = \frac{1}{2} BD = 4.7 \text{ cm}$$

45. In right ΔOAD

$$AD^2 = (3x)^2 + (4x)^2$$
$$AD^2 = 9x^2 + 16x^2$$
$$AD = 5x$$

Perimeter $= 20x$ units

46. Sum of all the angles of a quadrilateral is 360°

$$x = 60$$

47. $ABCD$ is a rhombus.

$\Rightarrow ABCD$ is a parallelogram

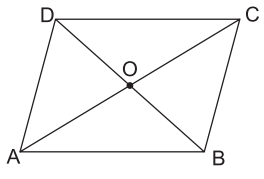
$\angle ABC = \angle ADC$

$\angle ODC = 25^0$

in ΔOCD

$\angle OCD + \angle ODC + \angle COD = 180°$

$\Rightarrow \angle ACD = 65^0$



48. Consider $PS \| RQ$ and PR as transversal then consider $PQ \| RS$ and PR as transversal

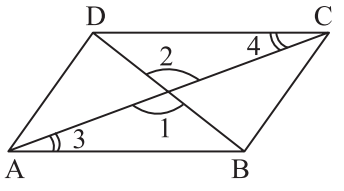
$\angle PRQ = 40°, \angle SRQ = 80°$

50. $MN = \frac{1}{2} PQ = 2.2$ cm

Similarly $LM = 2.8$ cm. $LN = 2.4$ cm

Perimeter = 7.4 cm

52.



Proof: $OA = OC$ (given)

$OB = OD$

$\angle 1 = \angle 2$ (V.O.A)

$\Rightarrow$ $\Delta AOB \cong \Delta COD$ (why?)

$\Rightarrow$ $AB = CD$ --- (1) (*CPCD*)

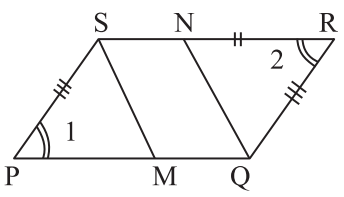
& $\angle 3 = \angle 4$ (*CPCD*)

$AB \parallel CD$ --- (2) (Why ?)

from (1) & (2)

ABCD is a || gm

53.



Proof: In ΔPMS & ΔRNQ

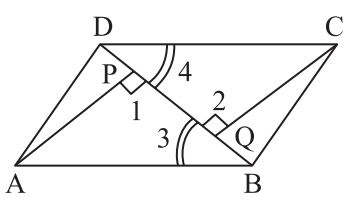
$= QR$ PS (opp. sides of a || gm)

$PM = RN$ (given)

$\angle 1 = \angle 2$ (opp angles of a || gm)

$\Delta PMS \cong \Delta RNQ$

54.



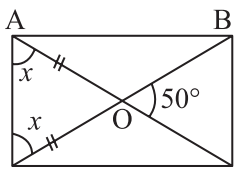
In ΔAPB & ΔCQD

$\angle 1 = \angle 2$ and $\angle 3 = \angle 4$

$$AB = CD$$

$\Rightarrow$ $\Delta APB = \Delta CQD$ [By AAS]

55.



D C

$$\angle BOC = \angle AOD = 50°$$

In ΔAOD

$$x + x + 50 = 180° \text{ [Angle sum property of triangle]}$$
$$2x = 180 - 50$$
$$x = 65° = \angle ODA$$

56. Hint- In ΔABC

$$EC = \frac{1}{2} AC \text{ [BE is median]}$$

In ΔBEC

$$CF = \frac{1}{2} EC$$

58. 12 cm, 40.5 cm^2

59. Hint:

(iii) Area of Trapezium $ABCE = \frac{1}{2} (130 + 120) \times 60$

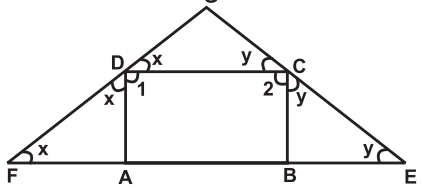
Ans. (i) 300 m^2

(ii) Yes

(iii) 7500m^2

60. In parallelogram $ABCD$

G



$$\angle 1 + \angle 2 = 180° \quad \text{--- (1)}$$

$$x + x + \angle 1 = 180°$$

$$x = 90 - \frac{1}{2}(\angle 1) \qquad \text{---- (2)}$$

similarly $$y = 90° - \frac{1}{2}(\angle 2) \qquad \text{---- (3)}$$

In ΔDGC, $\angle DGC + x + y = 180^{o}$

61. $APCQ$ is a parallelogram

Q is mid point of AB

in ΔAQR & ΔBQC

$$\angle AQR = \angle BQC$$
$$\angle QAR = \angle QBC$$
$$AQ = BQ$$
$$\Delta AQR \cong \Delta BQC$$

Practice Test

QUADRILATERALS

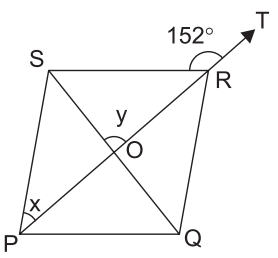
Time: 1 Hr. **M.M. 20**

1. The angles of quadrilateral *ABCD* are in the ratio 2 : 3 : 5 : 8. Find the measure of smallest angle. (1)

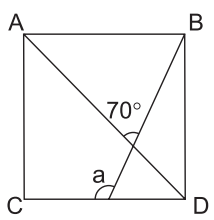
2. Two opposite angles of a Parallelogram are $(5x - 3)°$ and $(4x + 12)°$. Find the measure of each angle of the parallelogram. (1)

3. In a ΔPQR, median *PS* is produced to a point *T* such that $PS = ST$. Prove that *PQTR* is a parallelogram. (2)

4. In the fig. *PQRS* is a rhombus in which the diagonal*PR* is produced to *T*. If $\angle SRT = 152°$, find *x* and *y*. (2)



5. *ABCD* is a square. A line *BM* intersects *CD* at *M* and the diagonal *AC* at *O* such that $\angle AOB = 70°$, find *a* (3)



6. *AD* is median of ΔABC &*E* is the mid point of *AD*.*BE* is produced to meet *AC* in *F*. Prove that $AF = 1/3\ AC$. (3)

7. Show that the bisectors of angles of a parallelogram form a rectangle. (3)

8. Show that the quadrilateral formed by joining the mid point of the sides of a square is also a square. (5)