

# Assignments in Mathematics Class IX (Term 2)

## 8. QUADRILATERALS

### IMPORTANT TERMS, DEFINITIONS AND RESULTS

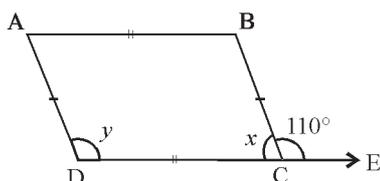
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| <ul style="list-style-type: none"> <li>  Sum of the angles of a quadrilateral is <math>360^\circ</math>.</li> <li>  A diagonal of a parallelogram divides it into two congruent triangles.</li> <li>  In a parallelogram,             <ul style="list-style-type: none"> <li>(i) opposite sides are equal</li> <li>(ii) opposite angles are equal</li> <li>(iii) diagonals bisect each other</li> </ul> </li> <li>  A quadrilateral is a parallelogram, if             <ul style="list-style-type: none"> <li>(i) opposite sides are equal or</li> <li>(ii) opposite angles are equal or</li> <li>(iii) diagonals bisect each other or</li> <li>(iv) a pair of opposite sides is equal and parallel</li> </ul> </li> </ul> | <ul style="list-style-type: none"> <li>  Diagonals of a rectangle bisect each other and are equal and vice-versa.</li> <li>  Diagonals of a rhombus bisect each other at right angles and vice-versa.</li> <li>  Diagonals of a square bisect each other at right angles and are equal, and vice-versa.</li> <li>  The line segment joining the mid-points of any two sides of a triangle is parallel to the third side and is half of it.</li> <li>  A line through the mid-point of a side of a triangle parallel to another side bisects the third side.</li> <li>  The quadrilateral formed by joining the mid-points of the sides of a quadrilateral, in order, is a parallelogram.</li> </ul> |
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**SUMMATIVE ASSESSMENT**

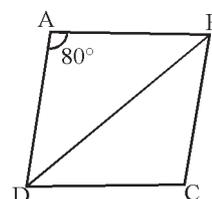
### MULTIPLE CHOICE QUESTIONS

**[1 Mark]**
**A. Important Questions**

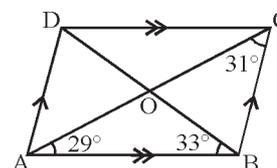
1. Two consecutive angles of a parallelogram are in the ratio 1 : 3. Then the smaller angle is :  
 (a)  $50^\circ$     (b)  $90^\circ$     (c)  $60^\circ$     (d)  $45^\circ$
2. A quadrilateral is a parallelogram if :  
 (a) both pairs of opposite sides are equal  
 (b) both pairs of opposite angles are equal  
 (c) the diagonals bisect each other  
 (d) all of these
3. ABCD is a rhombus. Diagonal AC is equal to one of its sides. Then  $\triangle ABC$  must be :  
 (a) a right angled triangle  
 (b) an equilateral triangle  
 (c) an isosceles triangle  
 (d) none of these
4. In the figure, ABCD is a parallelogram. The values of  $x$  and  $y$  are respectively :



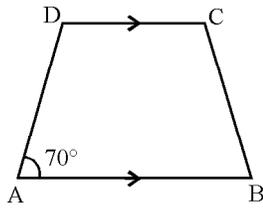
- (a)  $70^\circ, 110^\circ$                       (b)  $70^\circ, 70^\circ$   
 (c)  $110^\circ, 70^\circ$                       (d)  $70^\circ, 40^\circ$
5. In the given figure, ABCD is a rhombus. If  $\angle A = 80^\circ$ , then  $\angle CDB$  is equal to :



- (a)  $80^\circ$     (b)  $90^\circ$     (c)  $50^\circ$     (d)  $100^\circ$
6. The sum of three angles of a quadrilateral is 3 right angles. Then the fourth angle is a/an :  
 (a) right angle                      (b) obtuse angle  
 (c) acute angle                      (d) reflex angle
  7. In the given figure, the measure of  $\angle DOC$  is equal to :

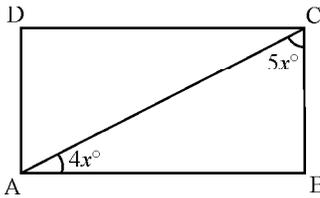


- (a)  $90^\circ$     (b)  $180^\circ$     (c)  $118^\circ$     (d)  $62^\circ$
8. Two adjacent angles of a parallelogram are  $2x + 30^\circ$  and  $3x - 30^\circ$ . Then the value of  $x$  is :  
 (a)  $30^\circ$     (b)  $60^\circ$     (c)  $0^\circ$     (d)  $36^\circ$
  9. In the figure,  $AB \parallel DC$ , then the measure of  $\angle D$  is equal to :



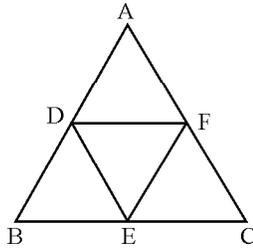
- (a)  $70^\circ$  (b)  $140^\circ$  (c)  $180^\circ$  (d)  $110^\circ$

10. In the rectangle ABCD,  $\angle BAC = 4x^\circ$ , if  $\angle BCA = 5x^\circ$ , then measures of  $\angle ACD$  and  $\angle CAD$  are respectively :



- (a)  $50^\circ, 40^\circ$  (b)  $40^\circ, 50^\circ$   
 (c)  $80^\circ, 100^\circ$  (d) none of these

11. In the figure, D, E and F are the mid-points of the sides AB, BC and CA respectively. If AC = 8.2 cm, then value of DE is :



- (a) 8.2 cm (b) 4.1 cm  
 (c) 2.05 cm (d) none of these

12. In a rectangle ABCD, diagonals AC and BD intersect at O. If AO = 3 cm, then the length of the diagonal BD is equal to :

- (a) 3 cm (b) 9 cm (c) 6 cm (d) 12 cm

13. Three angles of a quadrilateral are  $75^\circ, 90^\circ$  and  $75^\circ$ . The fourth angle is :

- (a)  $90^\circ$  (b)  $95^\circ$  (c)  $105^\circ$  (d)  $120^\circ$

14. Diagonals of a parallelogram ABCD intersect at O. If  $\angle BOC = 90^\circ$  and  $\angle BDC = 50^\circ$ , then  $\angle OAB$  is :

- (a)  $90^\circ$  (b)  $50^\circ$  (c)  $40^\circ$  (d)  $10^\circ$

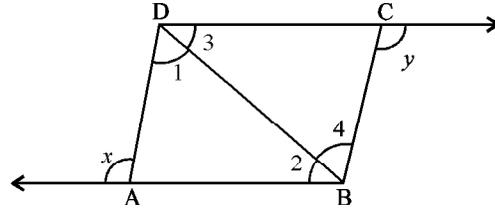
15. If APB and CQD are two parallel lines, then the bisectors of the angles APQ, BPQ, CQP and PQD form :

- (a) a square (b) a rhombus  
 (c) a rectangle (d) any other parallelogram

16. The figure obtained by joining the mid-points of the sides of a rhombus, taken in order, is :

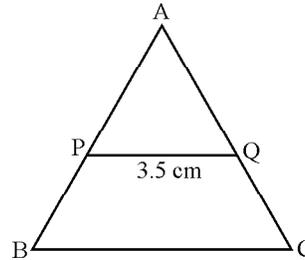
- (a) a rhombus (b) a rectangle  
 (c) a square (d) any parallelogram

17. The sides BA and DC of a quadrilateral ABCD are produced as shown in the figure. Then which of the following relations is true?



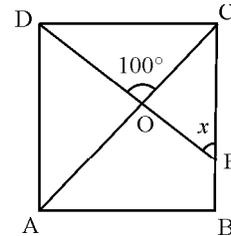
- (a)  $x + y = \angle 1 + \angle 2 + \angle 3 + \angle 4$   
 (b)  $x - y = \angle 1 + \angle 2 + \angle 3 + \angle 4$   
 (c)  $x + y = 2(\angle 1 + \angle 2 + \angle 3 + \angle 4)$   
 (d) none of these

18. In the figure, P and Q are mid-points of sides AB and AC respectively of  $\triangle ABC$ . If PQ = 3.5 cm and AB = AC = 9 cm, then the perimeter of  $\triangle ABC$  is :



- (a) 20 cm (b) 23 cm (c) 25 cm (d) 27 cm

19. In the figure, if ABCD is a square, then value of x is :



- (a)  $50^\circ$  (b)  $55^\circ$  (c)  $80^\circ$  (d)  $60^\circ$

20. In a parallelogram ABCD, bisectors of two adjacent angles A and B meet at O. The measure of the angle AOB is equal to :

- (a)  $90^\circ$  (b)  $180^\circ$  (c)  $60^\circ$  (d)  $360^\circ$

21. Lengths of two adjacent sides of a parallelogram are in the ratio 2 : 7. If its perimeter is 180 cm, then the adjacent sides of the parallelogram are :

- (a) 10 cm, 20 cm (b) 20 cm, 70 cm  
 (c) 41 cm, 140 cm (d) none of these

22. If a, b, c and d are four angles of a quadrilateral such that  $a = 2b$ ,  $b = 2c$  and  $c = 2d$ , then the value of d is :

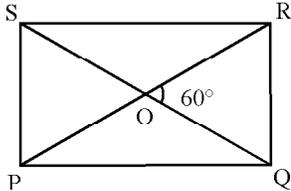
- (a)  $36^\circ$  (b)  $24^\circ$  (c)  $30^\circ$  (d) none of these

23. The triangle formed by joining the mid points of the sides of a right angled triangle is :

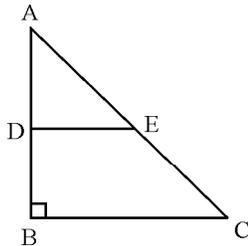
- (a) an acute angled triangle  
 (b) an obtuse angled triangle

- (c) a right angled triangle  
 (d) none of these

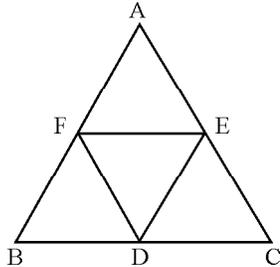
24. The diagonals of a rectangle PQRS intersect at O. If  $\angle ROQ = 60^\circ$ , then  $\angle OSP$  is equal to :



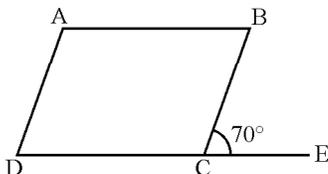
- (a)  $90^\circ$  (b)  $120^\circ$  (c)  $60^\circ$  (d) none of these
25. In the  $\Delta ABC$ ,  $\angle B$  is a right angle, D and E are the mid-points of the sides AB and AC respectively. If  $AB = 6$  cm and  $AC = 10$  cm, then the length of DE is :



- (a) 3 cm (b) 5 cm (c) 4 cm (d) 6 cm
26. In a  $\Delta ABC$ , D, E and F are respectively the mid-points of BC, CA and AB as shown in the figure. The perimeter of  $\Delta DEF$  is :



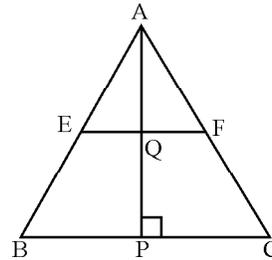
- (a)  $\frac{1}{2}(AB + BC + CA)$  (b)  $AB + BC + CA$   
 (c)  $2(AB + BC + CA)$  (d) none of these
27. In a parallelogram ABCD,  $\angle A = (3x + 15^\circ)$  and  $\angle B = (5x - 35^\circ)$ . The measure of  $\angle D$  is :
- (a)  $125^\circ$  (b)  $90^\circ$   
 (c)  $180^\circ$  (d) cannot be determined
28. In the given figure, if ABCD is a parallelogram, then the value of  $2\angle ABC - \angle ADC$  is :



- (a)  $40^\circ$  (b)  $220^\circ$  (c)  $70^\circ$  (d)  $75^\circ$

29. If one angle of a parallelogram is  $56^\circ$  more than three times of its adjacent angle, then measures of all the angles are :

- (a)  $31^\circ, 149^\circ, 31^\circ, 149^\circ$   
 (b)  $59^\circ, 121^\circ, 59^\circ, 121^\circ$   
 (c)  $37^\circ, 143^\circ, 37^\circ, 143^\circ$   
 (d) none of these
30. In a trapezium ABCD,  $AB \parallel CD$ ,  $\angle A = (2x - 35^\circ)$ ,  $\angle B = y^\circ$ ,  $\angle C = 85^\circ$  and  $\angle D = (3x + 65^\circ)$ . The values of  $x$  and  $y$  are respectively :
- (a)  $30^\circ, 60^\circ$  (b)  $45^\circ, 75^\circ$   
 (c)  $75^\circ, 115^\circ$  (d)  $30^\circ, 95^\circ$
31. In the  $\Delta ABC$ , E and F are the mid-points of AB and AC respectively. The altitude AP intersects EF at Q. The correct relation between AQ and QP is :



- (a)  $AQ > QP$  (b)  $AQ = QP$   
 (c)  $AQ < QP$  (d) none of these
32. The quadrilateral formed by joining the mid-points of the sides of a quadrilateral PQRS, taken in order, is a rectangle, if :
- (a) PQRS is a rectangle  
 (b) PQRS is a parallelogram  
 (c) diagonals of PQRS are perpendicular  
 (d) diagonals of PQRS are equal
33. The quadrilateral formed by joining the mid-points of the sides of a quadrilateral PQRS, taken in order, is a rhombus, if :
- (a) PQRS is a rhombus  
 (b) PQRS is a parallelogram  
 (c) diagonals of PQRS are perpendicular  
 (d) diagonals of PQRS are equal
34. D and E are the mid-points of the sides AB and AC respectively of  $\Delta ABC$ . DE is produced to F. To prove that CF is equal and parallel to DA, we need an additional information which is :
- (a)  $\angle DAE = \angle EFC$  (b)  $AE = EF$   
 (c)  $DE = EF$  (d)  $\angle ADE = \angle ECF$
35. D and E are the mid-points of the sides AB and AC of  $\Delta ABC$  and O is any point on side BC. O is joined to A. If P and Q are the mid-points of OB and OC respectively, then DEQP is :
- (a) a square (b) a rectangle  
 (c) a rhombus (d) a parallelogram

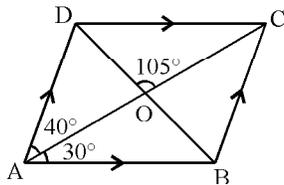
36. The figure formed by joining mid-points of the sides of a quadrilateral ABCD, taken in order, is a square only if :  
 (a) ABCD is a rhombus

- (b) diagonals of ABCD are equal  
 (c) diagonals of ABCD are equal and perpendicular  
 (d) diagonals of ABCD are perpendicular.

### B. Questions From CBSE Examination Papers

1. ABCD is a rhombus such that  $\angle ACB = 40^\circ$ , then  $\angle ADC$  is : [T-II (2011)]  
 (a)  $40^\circ$  (b)  $45^\circ$  (c)  $100^\circ$  (d)  $60^\circ$
2. If the angles of a quadrilateral ABCD, taken in order, are in the ratio 3 : 7 : 6 : 4, then ABCD is a : [T-II (2011)]  
 (a) rhombus (b) kite  
 (c) parallelogram (d) trapezium
3. Two adjacent angles of a rhombus are  $3x - 40^\circ$  and  $2x + 20^\circ$ . The measurement of the greater angle is : [T-II (2011)]  
 (a)  $160^\circ$  (b)  $100^\circ$  (c)  $80^\circ$  (d)  $120^\circ$

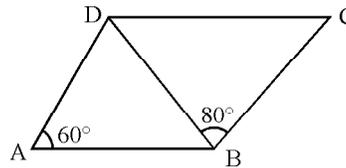
4.



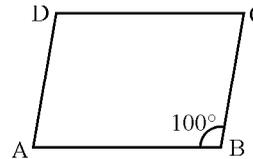
ABCD is a parallelogram in which  $\angle DAC = 40^\circ$ ;  $\angle BAC = 30^\circ$ ;  $\angle DOC = 105^\circ$  then  $\angle CDO$  equals : [T-II (2011)]

- (a)  $75^\circ$  (b)  $70^\circ$  (c)  $45^\circ$  (d)  $85^\circ$
5. Angles of a quadrilateral are in the ratio 3 : 6 : 8 : 13. The largest angle is : [T-II (2011)]  
 (a)  $178^\circ$  (b)  $90^\circ$  (c)  $156^\circ$  (d)  $36^\circ$
6. ABCD is a rhombus such that one of its diagonals is equal to its side. Then the angles of rhombus ABCD are : [T-II (2011)]  
 (a)  $45^\circ, 135^\circ, 45^\circ, 135^\circ$  (b)  $100^\circ, 80^\circ, 100^\circ, 80^\circ$   
 (c)  $120^\circ, 60^\circ, 120^\circ, 60^\circ$  (d)  $60^\circ, 60^\circ, 60^\circ, 60^\circ$
7. D, E, F are midpoints of sides BC, CA and AB of  $\triangle ABC$ . If perimeter of  $\triangle ABC$  is 12.8 cm, then perimeter of  $\triangle DEF$  is : [T-II (2011)]  
 (a) 17 cm (b) 38.4 cm (c) 25.6 cm (d) 6.4 cm
8. In a quadrilateral three angles are in the ratio 3 : 3 : 1 and one of the angles is  $80^\circ$ , then other angles are : [T-II (2011)]  
 (a)  $120^\circ, 120^\circ, 40^\circ$  (b)  $100^\circ, 100^\circ, 80^\circ$   
 (c)  $110^\circ, 110^\circ, 60^\circ$  (d)  $90^\circ, 90^\circ, 30^\circ$
9. Two adjacent angles of a parallelogram are  $(2x + 30)^\circ$  and  $(3x + 30)^\circ$ . The value of  $x$  is : [T-II (2011)]  
 (a)  $30^\circ$  (b)  $60^\circ$  (c)  $24^\circ$  (d)  $36^\circ$
10. In a quadrilateral ABCD,  $AB = BC$  and  $CD = DA$ , then the quadrilateral is a : [T-II (2011)]  
 (a) parallelogram (b) rhombus  
 (c) kite (d) trapezium

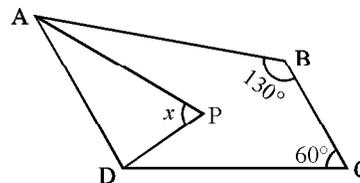
11. In a parallelogram ABCD,  $\angle A = 60^\circ$ , then  $\angle D$  is equal to : [T-II (2011)]  
 (a)  $110^\circ$  (b)  $140^\circ$  (c)  $120^\circ$  (d)  $130^\circ$
12. In the figure, ABCD is a parallelogram. If  $\angle DAB = 60^\circ$  and  $\angle DBC = 80^\circ$ , then  $\angle CDB$  is : [T-II (2011)]



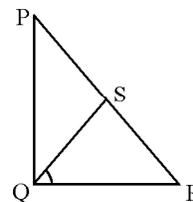
- (a)  $40^\circ$  (b)  $80^\circ$  (c)  $60^\circ$  (d)  $20^\circ$
13. In the figure, ABCD is a parallelogram. If  $\angle B = 100^\circ$ , then  $(\angle A + \angle C)$  is equal to : [T-II (2011)]



- (a)  $360^\circ$  (b)  $200^\circ$  (c)  $180^\circ$  (d)  $160^\circ$
14. All the angles of a convex quadrilateral are congruent. However, not all its sides are congruent. What type of quadrilateral is it? [T-II (2011)]  
 (a) parallelogram (b) square  
 (c) rectangle (d) trapezium
15. ABCD is a quadrilateral and AP and DP are bisectors of  $\angle A$  and  $\angle D$ . The value of  $x$  is : [T-II (2011)]

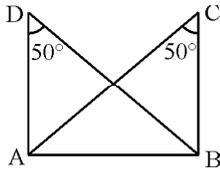


- (a)  $60^\circ$  (b)  $85^\circ$  (c)  $95^\circ$  (d)  $100^\circ$
16. In a  $\triangle PQR$ , right angled at Q,  $PQ = 24$  cm and  $QR = 7$  cm. S is the mid point of PR. Then RS is : [T-II (2011)]



- (a) 3.5 cm (b) 12 cm (c) 25 cm (d) 12.5 cm

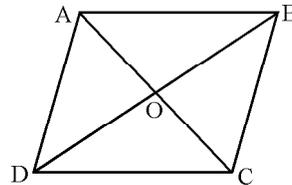
17. If  $\angle C = \angle D = 50^\circ$ , then four points A, B, C, D :  
[T-II (2011)]



- (a) are concyclic  
(b) do not lie on same circle  
(c) are collinear  
(d) A, B, D and A, B, C lie on different circles
18. In parallelogram ABCD, if  $\angle A = 2x + 15^\circ$ ,  $\angle B = 3x - 25^\circ$ , then value of  $x$  is : [T-II (2011)]  
(a)  $91^\circ$  (b)  $89^\circ$  (c)  $34^\circ$  (d)  $38^\circ$
19. Three angles of a quadrilateral are  $70^\circ$ ,  $120^\circ$  and  $65^\circ$ . The fourth angle of the quadrilateral is :  
[T-II (2011)]  
(a)  $95^\circ$  (b)  $75^\circ$  (c)  $105^\circ$  (d)  $90^\circ$
20. If PQRS is a parallelogram, then  $\angle Q - \angle S$  is equal to : [T-II (2011)]  
(a)  $90^\circ$  (b)  $120^\circ$  (c)  $180^\circ$  (d)  $0^\circ$
21. Which of the following is not true for a parallelogram? [T-II (2011)]  
(a) opposite sides are equal  
(b) opposite angles are equal  
(c) opposite angles are bisected by diagonals  
(d) diagonals bisect each other
22. If APB and CQD are parallel lines and a transversal PQ cut them at P and Q, then the bisectors of angles APQ, BPQ, CQP and PQD form a [T-II (2011)]  
(a) rectangle (b) rhombus  
(c) square (d) any other parallelogram
23. ABCD is a rhombus such that  $\angle ACB = 40^\circ$ , then  $\angle ADB$  is : [T-II (2011)]  
(a)  $40^\circ$  (b)  $45^\circ$  (c)  $50^\circ$  (d)  $60^\circ$
24. The figure obtained by joining mid-points of adjacent sides of a rectangle of sides 8 cm and 6 cm is : [T-II (2011)]  
(a) a rectangle of area  $24 \text{ cm}^2$   
(b) a square of area  $25 \text{ cm}^2$   
(c) a trapezium of area  $24 \text{ cm}^2$   
(d) a rhombus of area  $24 \text{ cm}^2$
25. If the diagonals AC and BD of a quadrilateral ABCD bisect each other, then ABCD is a : [T-II (2011)]  
(a) parallelogram (b) rectangle  
(c) rhombus (d) trapezium
26. The diagonals of a parallelogram PQRS intersect at O. If  $\angle QOR = 90^\circ$  and  $\angle QSR = 50^\circ$ , then  $\angle ORS$  is : [T-II (2011)]  
(a)  $90^\circ$  (b)  $40^\circ$  (c)  $70^\circ$  (d)  $50^\circ$

27. If in a quadrilateral ABCD,  $\angle A = 90^\circ$  and  $AB = BC = CD = DA$ , then ABCD is a  
[T-II (2011)]

- (a) a parallelogram (b) rectangle  
(c) square (d) rhombus
28. In quadrilateral PQRS, if  $\angle P = 60^\circ$  and  $\angle Q : \angle R : \angle S = 2 : 3 : 7$ , then  $\angle S$  is : [T-II (2011)]  
(a)  $175^\circ$  (b)  $135^\circ$  (c)  $150^\circ$  (d)  $210^\circ$
29. A quadrilateral whose diagonals are equal and bisect each other at right angles is a :  
[T-II (2011)]  
(a) rhombus (b) square  
(c) trapezium (d) rectangle
30. In a parallelogram ABCD, if  $\angle A = 75^\circ$ , then  $\angle B$  is :  
[T-II (2011)]  
(a)  $75^\circ$  (b)  $105^\circ$  (c)  $15^\circ$  (d)  $95^\circ$
31. In the given figure, ABCD is a rhombus in which diagonals AC and BD intersect at O. Then  $\angle AOB$  is : [T-II (2011)]

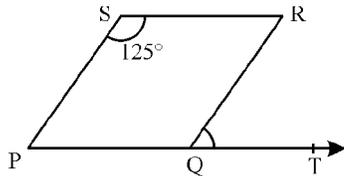


- (a)  $60^\circ$  (b)  $80^\circ$  (c)  $90^\circ$  (d)  $45^\circ$
32. The diagonals AC and BD of a parallelogram ABCD intersect each other at the point O. If  $\angle DAC = 32^\circ$ ,  $\angle AOB = 70^\circ$ , then  $\angle DBC$  is equal to : [T-II (2011)]  
(a)  $24^\circ$  (b)  $88^\circ$  (c)  $38^\circ$  (d)  $32^\circ$
33. Which of the following is not a parallelogram?  
[T-II (2011)]  
(a) rhombus (b) rectangle  
(c) trapezium (d) square
34. Two angles of a quadrilateral are  $50^\circ$  and  $80^\circ$  and other two angles are in the ratio 8 : 15, then the remaining two angles are : [T-II (2011)]  
(a)  $140^\circ, 90^\circ$  (b)  $100^\circ, 130^\circ$   
(c)  $80^\circ, 150^\circ$  (d)  $70^\circ, 160^\circ$
35. In a quadrilateral ABCD, if  $\angle A = 80^\circ$ ,  $\angle B = 70^\circ$ ,  $\angle C = 130^\circ$ , then  $\angle D$  is : [T-II (2011)]  
(a)  $80^\circ$  (b)  $70^\circ$  (c)  $130^\circ$  (d)  $150^\circ$
36. In an equilateral triangle ABC, D and E are the mid points of sides AB and AC respectively. Then length of DE is : [T-II (2011)]  
(a) not possible to find  
(b) 3 cm (c)  $\frac{1}{2}BC$  (d)  $\frac{3}{2}BC$

37. In a quadrilateral ABCD, diagonals bisect each other at right angles. Also,  $AB = BC = AD = 6$  cm, then length of CD is : [T-II (2011)]

- (a) 3 cm (b) 6 cm (c)  $6\sqrt{2}$  cm (d) 12 cm

38. In the figure, PQRS is a parallelogram in which  $\angle PSR = 125^\circ$ ,  $\angle RQT$  is equal to : [T-II (2011)]



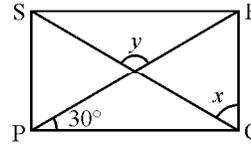
- (a)  $75^\circ$  (b)  $65^\circ$  (c)  $55^\circ$  (d)  $125^\circ$

39. Two consecutive angles of a parallelogram are in

the ratio 1 : 3, then the smaller angle is :

[T-II (2011)]

(a)  $50^\circ$  (b)  $90^\circ$  (c)  $60^\circ$  (d)  $45^\circ$   
 40. In the figure, PQRS is a rectangle. If  $\angle RPK = 30^\circ$ , then the value of  $(x + y)$  is : [T-II (2011)]



(a)  $90^\circ$  (b)  $120^\circ$  (c)  $150^\circ$  (d)  $180^\circ$   
 41. The diagonals of a rhombus are 12 cm and 16 cm. The length of the side of the rhombus is :

[T-II (2011)]

- (a) 10 cm (b) 12 cm (c) 16 cm (d) 8 cm

## SHORT ANSWER TYPE QUESTIONS

[2 Marks]

### A. Important Questions

- Can  $95^\circ$ ,  $70^\circ$ ,  $110^\circ$  and  $80^\circ$  be the angles of a quadrilateral ? Why or why not ?
- Three angles of a quadrilateral are equal. Is it a parallelogram?
- Diagonals of a parallelogram are perpendicular to each other. Is this statement true ? Give reason for your answer.
- Diagonals of a quadrilateral PQRS bisect each other. If  $\angle P = 35^\circ$ , find  $\angle Q$ .
- The angles of a quadrilateral are in the ratio 2 : 4 : 5 : 7. Find the angles.
- The lengths of the diagonals of a rhombus are 24 cm and 18 cm. Find the length of each side of

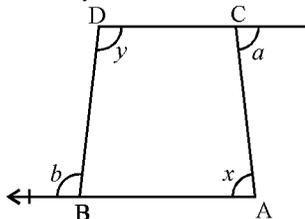
the rhombus.

- Diagonals AC and BD of a parallelogram ABCD intersect each other at O. If  $OA = 3$  cm and  $OD = 2$  cm, find the lengths of AC and BD.
- Can all the angles of a quadrilateral be acute ? Give reason for your answer.
- In  $\triangle ABC$ , P, Q and R are mid-points of sides BC, CA and AB respectively. If  $AC = 21$  cm,  $BC = 29$  cm and  $AB = 30$  cm, find the perimeter of the quadrilateral ARPQ.
- Diagonals of a quadrilateral ABCD bisect each other. If  $\angle A = 35^\circ$ , then  $\angle B = 145^\circ$ . Is it true ? Justify your answer.

### B. Questions From CBSE Examination Papers

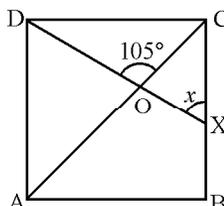
1. The sides BA and DC of quadrilateral ABCD are produced as shown in the figure.

Prove that  $x + y = a + b$ . [T-II (2011)]



2. In the figure, ABCD is a square. A line segment DX cuts the side BC at X and the diagonal AC at O such that  $\angle COD = 105^\circ$ . Find the value of x.

[T-II (2011)]



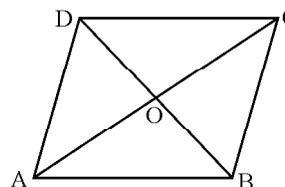
3. In  $\triangle ABC$ , D and E are mid points of AB and AC. If  $AD = 3.5$  cm ;  $AE = 4$  cm ;  $DE = 2.5$  cm, find the perimeter of  $\triangle ABC$ . [T-II (2011)]

4. ABCD is a rhombus in which  $AC = 16$  cm ;  $BC = 10$  cm. Find the length of the diagonal BD. [T-II (2011)]

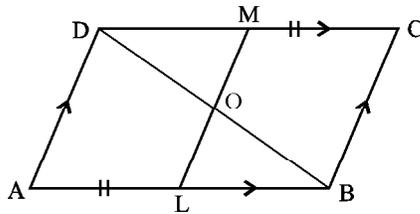
5. In  $\triangle ABC$ ,  $AB = 12$  cm,  $BC = 15$  cm and  $AC = 7$  cm. Find the perimeter of the triangle formed by joining the mid points of the sides of the triangle. [T-II (2011)]

6. ABCD is a rhombus.  $AO = 5$  cm. Area of the rhombus is 25 sq cm. Find the length of BD.

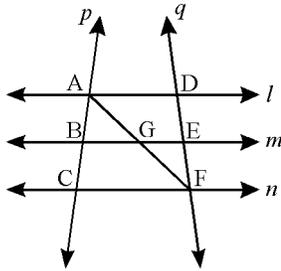
[T-II (2011)]



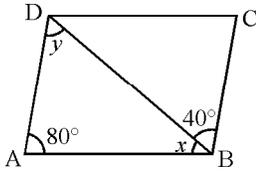
7. ABCD is a parallelogram. L and M are points on AB and DC respectively such that AL = MC. Prove that LM and BD bisect each other. [T-II (2011)]



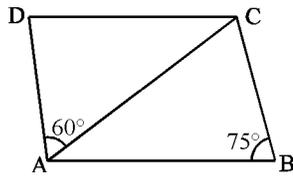
8.  $l, m$  and  $n$  are three parallel lines intersected by transversal  $p$  and  $q$  such that  $l, m$  and  $n$  cut equal intercepts AB and BC on  $p$ . Show that  $l, m, n$  cut off equal intercepts DE and EF on  $q$  also. [T-II (2011)]



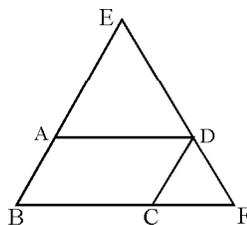
9. In the figure, ABCD is a parallelogram. Find the measure of the angles  $x, y$ . [T-II (2011)]



10. In the figure, ABCD is a parallelogram. Compute  $\angle DCA, \angle ACB$  and  $\angle ADC$ , given  $\angle DAC = 60^\circ$  and  $\angle ABC = 75^\circ$ . [T-II (2011)]



11. Prove that if the diagonals of a quadrilateral bisect each other, then it is a parallelogram. [T-II (2011)]
12. In the figure, ABCD is a parallelogram. BA is produced to E such that AE = AD. ED is produced to meet BC produced at F. Show that CD = CF. [T-II (2011)]



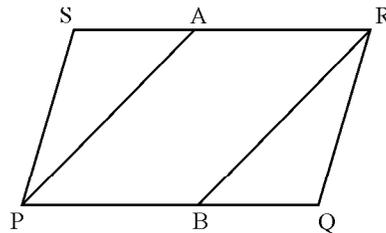
13. In  $\triangle ABC, \angle B = 90^\circ$ , D and E are the mid-points of the sides AB and AC respectively. If AB = 6 cm and AC = 10 cm, then find the length of DE. [T-II (2011)]

14. Angles of a quadrilateral are in the ratio 3 : 4 : 5 : 6. Find the angles of the quadrilateral. [T-II (2011)]

15. In  $\triangle ABC$ , AD is the median. A line through D and parallel to AB, meets AC at E. Prove that BE is the median of triangle ABC. [T-II (2011)]

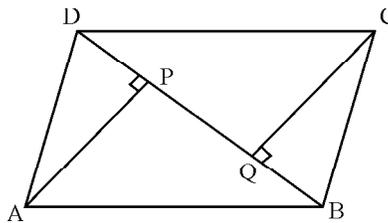
16. ABCD is parallelogram. The angle bisectors of  $\angle A$  and  $\angle D$  intersect at O. Find the measures of  $\angle AOD$ . [T-II (2011)]

17. In the given figure, PQRS is a parallelogram and line segments PA and RB bisect the angles P and R respectively. Show that PA || RB. [T-II (2011)]



18. In  $\triangle ABC$ , D, E and F are mid points of sides AB, BC and CA. Show that  $\triangle ABC$  is divided into four congruent triangles by joining D, E and F. [T-II (2011)]

19. ABCD is a parallelogram and AP and CQ are perpendiculars from vertices A and C on diagonal BD. Show that : [T-II (2011)]
- (i)  $\triangle APB \cong \triangle CQD$       (ii)  $AP = CQ$

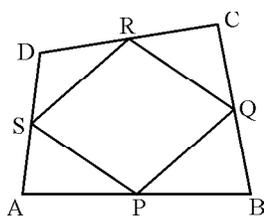


20. If angles of a quadrilateral are in the ratio 1 : 2 : 3 : 4, find measures of all the angles of the quadrilateral. [T-II (2011)]

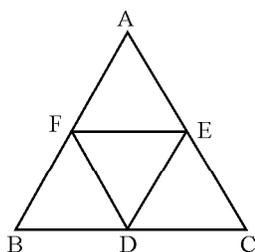
21. Two opposite angles of a parallelogram are  $(3x - 2)^\circ$  and  $(63 - 2x)^\circ$ . Find all the angles of the parallelogram. [T-II (2011)]

22. Prove that diagonal of a parallelogram divides it into two congruent triangles. [T-II (2011)]

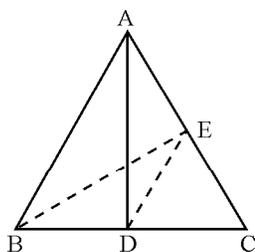
23. ABCD is a quadrilateral in which P, Q, R and S are mid points of AB, BC, CD and DA respectively. Show that PQRS is a parallelogram. [T-II (2011)]



24. If PQRS is a rhombus with  $\angle PQR = 55^\circ$ , find  $\angle PRS$ . [T-II (2011)]
25. D and E are the mid-points of sides AB and AC respectively of triangle ABC. If the perimeter of  $\triangle ABC = 35$  cm, find the perimeter of  $\triangle ADE$ . [T-II (2011)]
26. The vertices of a parallelogram lie on a circle. Prove that its diagonals are equal. [T-II (2011)]
27. The angles of a quadrilateral are in the ratio  $3 : 5 : 7 : 9$ . Find the angles of the quadrilateral. [T-II (2011)]
28. In the figure, it is given that BDEF and FDCE are parallelograms. Show that  $BD = CD$ . [T-II (2011)]

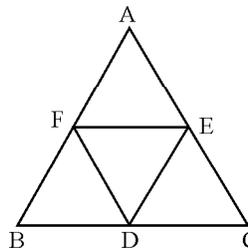


29. In a cyclic quadrilateral PQRS, if  $\angle P - \angle R = 50^\circ$ , then find the measure of  $\angle P$  and  $\angle R$ . [T-II (2011)]
30. In  $\triangle ABC$ , AD is the median and  $DE \parallel AB$ . Prove that BE is another median. [T-II (2011)]

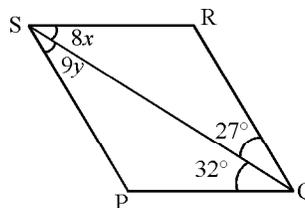


31. Show that diagonals of a square are equal and bisect each other at right angles. [T-II (2011)]
32. ABC is a triangle right angled at C. A line through the mid point M of hypotenuse AB and parallel to BC intersects AC at D. Show that [T-II (2011)]  
 (i) D is the mid point of AC  
 (ii)  $MD \perp AC$
33. The two opposite angles of a parallelogram are  $(3x - 10)^\circ$  and  $(2x + 35)^\circ$ . Find the measure of all the four angles of the parallelogram. [T-II (2011)]

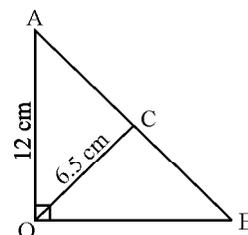
34. In  $\triangle ABC$ ,  $AB = 5$  cm,  $BC = 8$  cm and  $AC = 7$  cm. If D and E are respectively mid-points of AB and BC, determine the length of DE. Give reasons. [T-II (2011)]
35. In the figure, it is given that BDEF and FDCE are parallelograms. If  $BD = 4$  cm, determine CD. [T-II (2011)]



36. In a parallelogram PQRS, if  $\angle P = (3x - 5)^\circ$ ,  $\angle Q = (2x + 15)^\circ$ , find the value of x. [T-II (2011)]
37. In the figure, PQRS is a parallelogram. Find the values of x and y. [T-II (2011)]



38. In the figure,  $\angle AOB = 90^\circ$ ,  $AC = BC$ ,  $OA = 12$  cm and  $OC = 6.5$  cm. Find the measure of OB. [T-II (2011)]

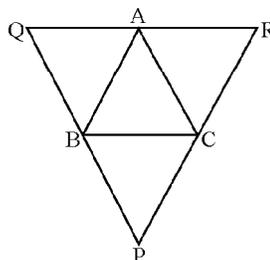


39. The angles of a quadrilateral are in the ratio  $3 : 5 : 9 : 13$ . Find all the angles of the quadrilateral. [T-II (2011)]
40. The angle between the two altitudes of a parallelogram through the vertex of an obtuse angle is  $50^\circ$ . Find the angles of the parallelogram. [T-II (2011)]
41. In a parallelogram, show that the angle bisectors of two adjacent angles intersect at right angle. [T-II (2011)]
42. Find the measure of each angle of a parallelogram, if one of its angles is  $30^\circ$  less than twice the smaller angle. [T-II (2011)]
43. ABCD is a rhombus with  $\angle ABC = 58^\circ$ . Find  $\angle ACD$ . [T-II (2011)]

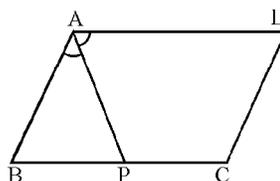
**A. Important Questions**

1. ABCD is a rhombus in which altitude from D on side AB bisects AB. Find the angles of the rhombus.
2. In a parallelogram show that the angle bisectors of two adjacent angles intersect at right angles.
3. One angle of a quadrilateral is  $108^\circ$  and the remaining three angles are equal. Find each of the three equal angles.
4. E and F are points on diagonal AC of a parallelogram ABCD such that  $AE = CF$ . Show that BFDE is a parallelogram.
5. D, E and F are the mid-points of the sides BC, CA and AB respectively of an equilateral  $\Delta ABC$ . Show that  $\Delta DEF$  is also an equilateral triangle.
6. In a triangle ABC, median AD is produced to X such that  $AD = DX$ . Prove that ABXC is a parallelogram.
7. In the figure, through A, B and C lines RQ, PQ and PR have been drawn respectively parallel to sides BC, CA and AB of a  $\Delta ABC$ . Show that

$$BC = \frac{1}{2}QR.$$

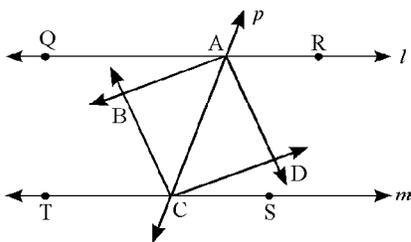


8. Show that the quadrilateral formed by joining the mid-points of sides of a square is also a square.
9. E is the mid-point of the side AD of trapezium ABCD with  $AB \parallel DC$ . A line through E drawn parallel to AB intersects BC at F. Show that F is the mid-point of BC.
10. If one angle of a parallelogram is a right angle, it is a rectangle. Prove.
11. In the figure, P is the mid-point of side BC of a parallelogram ABCD such that  $\angle BAP = \angle DAP$ . Prove that  $AD = 2CD$ .

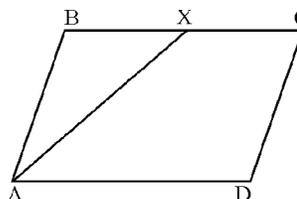


**B. Questions From CBSE Examination Papers**

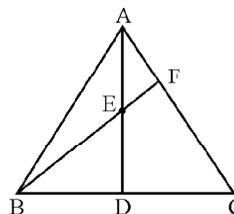
1. Show that bisectors of the angles of a parallelogram form a rectangle. [T-II (2011)]
2. Prove that a parallelogram is a rhombus if its diagonals bisect at right angles. [T-II (2011)]
3. Two parallel lines  $l$  and  $m$  are intersected by a transversal  $p$ . Show that the quadrilateral formed by the bisectors of interior angles is a rectangle. [T-II (2011)]



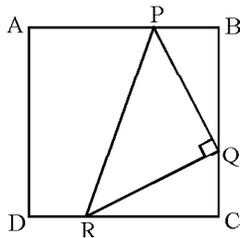
4. In a parallelogram ABCD, bisector of  $\angle A$ , also bisects BC at X. Prove that  $AD = 2 AB$ . [T-II (2011)]



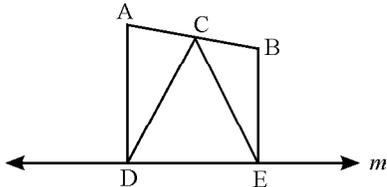
5. AD is the median of  $\Delta ABC$ . E is the midpoint of AD. BE produced meets AC at F. Show that  $AF = \frac{1}{3} AC$ . [T-II (2011)]



6. Prove that line segments joining the mid points of opposite sides of any quadrilateral bisect each other. [T-II (2011)]
7. Prove that the diagonals of a rectangle are equal. [T-II (2011)]
8. Show that if the diagonals of a quadrilateral bisect each other at right angles, then it is a rhombus. [T-II (2011)]
9. In a quadrilateral ABCD, AO and BO are the bisectors of  $\angle A$  and  $\angle B$  respectively. Prove that  $\angle AOB = \frac{1}{2} (\angle C + \angle D)$  [T-II (2011)]
10. In the figure, ABCD is a square, if  $\angle PQR = 90^\circ$  and  $PB = QC = DR$ , prove that  $QB = RC$ ,  $PQ = QR$ ,  $\angle QPR = 45^\circ$ . [T-II (2011)]

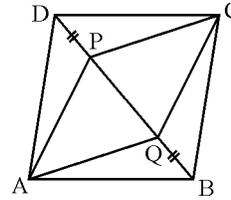


11. In the figure, points A and B are on the same side of a line  $m$ ,  $AD \perp m$  and  $BE \perp m$  and meet  $m$  at D and E respectively. If C is the mid point of AB, prove that  $CD = CE$ . [T-II (2011)]

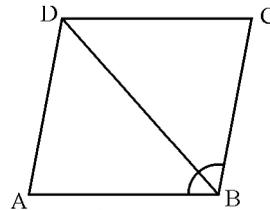


12. ABCD is a parallelogram in which X and Y are the mid-points of AB and CD. AY and DX are joined which intersect each other at P. BY and CX are also joined which intersect each other at Q. Show that PXQY is a parallelogram. [T-II (2011)]
13. ABCD is a rectangle in which diagonal AC bisects  $\angle A$  as well as  $\angle C$ . Show that [T-II (2011)]  
 (i) ABCD is a square  
 (ii) Diagonal BD bisects  $\angle B$  as well as  $\angle D$
14. Diagonal AC of a parallelogram bisects  $\angle A$ . Show that (i) it bisects  $\angle C$  also (ii) ABCD is a rhombus [T-II (2011)]
15. Show that the diagonals of a rhombus are perpendicular to each other. [T-II (2011)]
16. Show that a diagonal of a parallelogram divides it into two congruent triangles and hence prove that the opposite sides of a parallelogram are equal. [T-II (2011)]

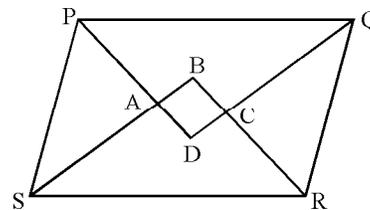
17. ABCD is parallelogram. On diagonal BD are points P and Q such that  $DP = BQ$ . Show that APCQ is a parallelogram. [T-II (2011)]



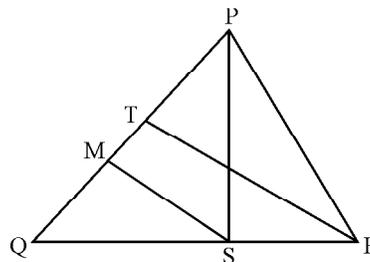
18. In the figure, diagonal BD of parallelogram ABCD bisects  $\angle B$ . Show that it bisects  $\angle D$  also. [T-II (2011)]



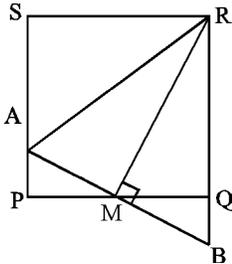
19. PQRS is a parallelogram and  $\angle SPQ = 60^\circ$ . If the bisectors of  $\angle P$  and  $\angle Q$  meet at point A on RS, prove that A is mid-point of RS. [T-II (2011)]
20. Prove that quadrilateral formed by bisectors of the angles of a parallelogram is a rectangle. [T-II (2011)]



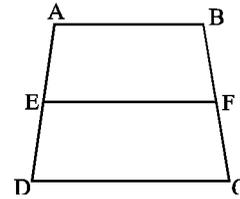
21. Show that the line segments joining the mid-points of opposite sides of quadrilateral bisect each other. [T-II (2011)]
22. In the figure, PS and RT are medians of  $\Delta PQR$  and  $SM \parallel RT$ . Prove that  $QM = \frac{1}{4} PQ$ . [T-II (2011)]



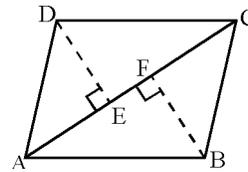
23. In a parallelogram PQRS, the bisectors of adjacent angles R and S intersect each other at the point O. Prove that  $\angle ROS = 90^\circ$ . [T-II (2011)]
24. In the figure, PQRS is a square. M is the midpoint of PQ and  $AB \perp RM$ . Prove that  $RA = RB$ . [T-II (2011)]



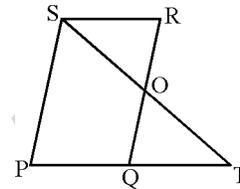
25. ABCD is a rhombus. Show that diagonal AC bisects  $\angle A$  as well as  $\angle C$  and diagonal BD bisects  $\angle B$  as well as  $\angle D$ . [T-II (2011)]
26. Prove that the bisectors of any two consecutive angles of a parallelogram intersect at right angles. [T-II (2011)]
27. In the figure, ABCD is a trapezium in which  $AB \parallel DC$ . E is the mid point of AD and F is a point of BC such that  $EF \parallel DC$ . Prove that F is the mid point of BC. [T-II (2011)]



28. In the figure, DE and BF are perpendiculars to the diagonal AC of a parallelogram ABCD. Prove that  $DE = BF$ . [T-II (2011)]



29. In the figure, PQRS is a parallelogram in which PQ is produced to T such that  $QT = PQ$ . Prove that ST bisects RQ. [T-II (2011)]

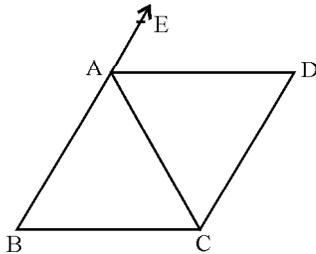


## LONG ANSWER TYPE QUESTIONS

[4 Marks]

### A. Important Questions

1. In the figure, ABC is an isosceles triangle in which  $AB = AC$ ,  $CD \parallel AB$  and AD is bisectors of exterior  $\angle CAE$  of  $\triangle ABC$ . Prove that  $\angle CAD = \angle BCA$  and ABCD is a parallelogram.



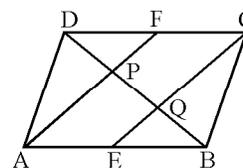
2. PQ and RS are two equal and parallel line segments. Any point M not lying on PQ or RS is joined to Q and S and lines through P parallel to QM and through R parallel to SM meet at N.

Prove that line segments MN and PQ are equal and parallel to each other.

3. A diagonal of a parallelogram bisects one of its angles. Prove that it will bisect its opposite angle also.
4. Prove that the line joining the mid-points of the diagonals of a trapezium is parallel to the parallel sides of the trapezium.
5. ABCD is a rectangle in which diagonal BD bisects  $\angle B$ . Show that ABCD is a square.
6. If ABCD is a trapezium in which  $AB \parallel CD$  and  $AD = BC$ , prove that  $\angle A = \angle B$ .
7. P, Q, R, and S are respectively the mid-points of the sides AB, BC, CD and DA of a quadrilateral ABCD in which  $AD = BC$ . Prove that PQRS is a rhombus.

### B. Questions From CBSE Examination Papers

1. In a parallelogram ABCD, E and F are the mid-points of sides AB and CD respectively. Show that the line segment AF and EC trisects the diagonal BD. [T-II (2011)]



2. 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 [T-II (2011)]

(i)  $MD \perp AC$

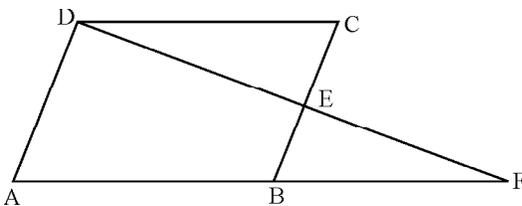
(ii) D is mid-point of AC

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

3. Prove that a line segment joining the mid-points of any two sides of a triangle is parallel and half of its third side. [T-II (2011)]

4. Prove that a line passing through mid-point of one non parallel side of a trapezium parallel to parallel sides bisect the other non parallel side. [T-II (2011)]

5. In the figure, ABCD is a parallelogram. E is the mid-point of BC. DE and AB when produced meet at F. Prove that  $AF = 2AB$ . [T-II (2011)]



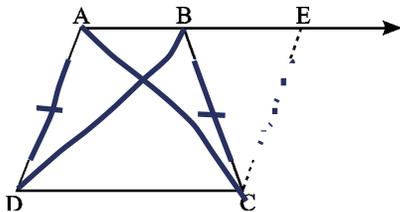
6. If X, Y and Z are the mid-points of sides BC, CA and AB of  $\Delta ABC$  respectively, prove that AZXY is a parallelogram. [T-II (2011)]

7. ABCD is a trapezium in which  $AB \parallel CD$  and  $AD = BC$ . Show that [T-II (2011)]

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

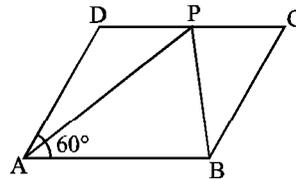
(iii)  $\Delta ABC \cong \Delta BAD$

(iv) Diagonal  $AC =$  diagonal  $BD$



8. ABCD is a parallelogram in which  $\angle A = 60^\circ$ . If

bisectors of  $\angle A$  and  $\angle B$  meet at P, prove that  $AD = DP$ ,  $PC = BC$ ,  $DC = 2AD$ . [T-II (2011)]

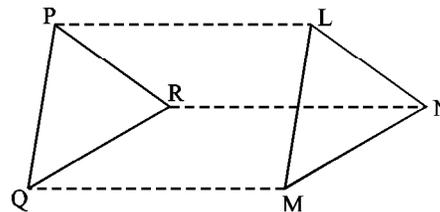


9. Show that the quadrilateral formed by joining the mid-points of the sides of a rectangle is a rhombus. [T-II (2011)]

10. Prove that in a triangle, the line segment joining the mid-points of any two sides is parallel to third side and is half of it.

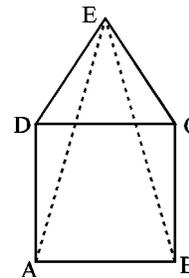
Using the above, if P, Q, R are the mid-points of sides BC, AC and AB of  $\Delta ABC$  respectively and if  $PQ = 2.5$  cm,  $QR = 3$  cm,  $RP = 3.5$  cm, find the lengths of AB, BC and CA. [T-II (2011)]

11. If  $\Delta PQR$  and  $\Delta LMN$  be two triangles given in such a way that  $PQ \parallel LM$ ,  $PQ = LM$ ,  $QR = MN$  and  $QR \parallel MN$ , then show that  $PR \parallel LN$  and  $PR = LN$ . [T-II (2011)]



12. ABCD is a square and on the side DC, an equilateral triangle is constructed. Prove that [T-II (2011)]

(i)  $AE = BE$  and (ii)  $\angle DAE = 15^\circ$



13. The diagonals of a quadrilateral ABCD are perpendicular, show that quadrilateral formed by joining the mid-points of its sides, is rectangle. [T-II (2011)]

## FORMATIVE ASSESSMENT

### Activity-1

**Objective :** To verify the mid-point theorem for a triangle using paper cutting and pasting.

**Materials Required :** White sheets of paper, a pair of scissors, colour pencils, gluestick, geometry box, etc.

**Procedure :**

1. On a white sheet of paper, draw a  $\Delta ABC$  and cut it out.

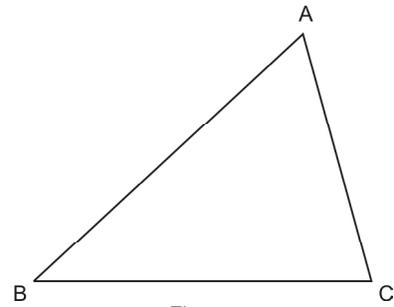


Figure-1

2. Using paper folding method, find the mid-points of AB, AC and BC and mark them as X, Y and Z respectively. Join X to Y.

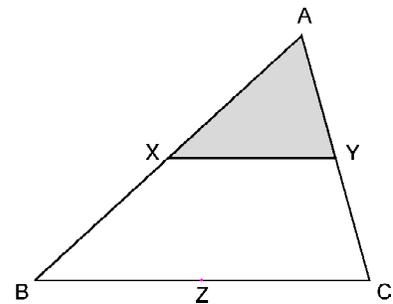


Figure-2

3. Cut out the triangular piece AXY and superimpose AY over YC such that YX falls along CB as shown below.

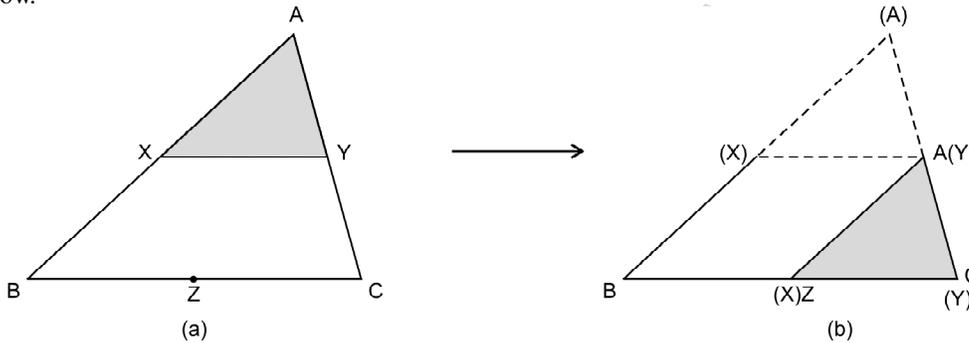


Figure-3

**Observations :**

1. In figure 3(b), we see that  $\angle AYX$  exactly covers  $\angle YCB$  or  $\angle AYX = \angle YCB$   
But,  $\angle AYX$  and  $\angle YCB$  are corresponding angles made on XY and BC by the transversal AC.  
Therefore,  $XY \parallel BC$ .  
But, X and Y are the mid-points of AB and AC respectively.
2. In figure 3(b), we also observe that X and Z coincide. It implies  $XY = CZ$ .  
But, CZ is half of BC.  
Thus, we can say that the line segment joining the mid-points of two sides of a triangle is parallel to the third side and is equal to half of it.

**Conclusion :** From the above activity, the mid-point theorem is verified.

**Do Yourself :** Draw a right triangle, an acute angled triangle and an obtuse angled triangle. Verify the mid-point theorem for each case.

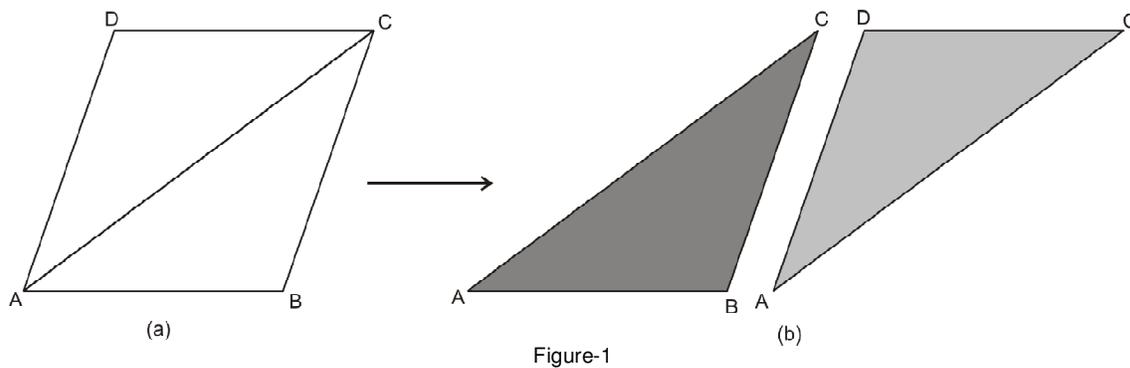
**Activity-2**

**Objective :** To verify that a diagonal of a parallelogram divides it into two congruent triangles.

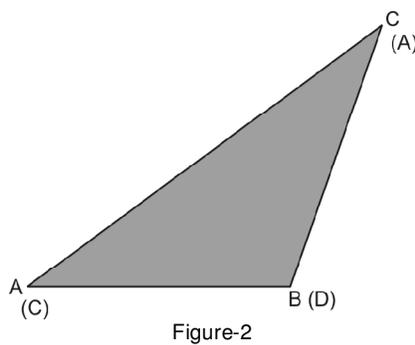
**Materials Required :** White sheets of paper, colour pencils, a pair of scissors, gluestick, geometry box, etc.

**Procedure :**

1. On a white sheet of paper, draw a parallelogram ABCD and cut it out. Draw the diagonal AC of the parallelogram and cut it along AC to get two triangular cut outs.



2. Now, superimpose one triangle over the other as shown below.



**Observations :** In figure 2, we see that the two triangles exactly cover each other. Hence, the triangles are congruent.

**Conclusion :** From the above activity, it is verified that a diagonal of a parallelogram divides it into two congruent triangles.

**Do Yourself :** Draw three different parallelograms and verify the above property by paper cutting and pasting.

### Activity-3

**Objective :** To verify that the diagonals of a parallelogram bisect each other.

**Materials Required :** White sheets of paper, colour pencils, gluestick, a pair of scissors, geometry box, etc.

**Procedure :**

1. On a white sheet of paper, draw a parallelogram ABCD and both its diagonals AC and BD intersecting at O. Cut out the four triangles so formed.

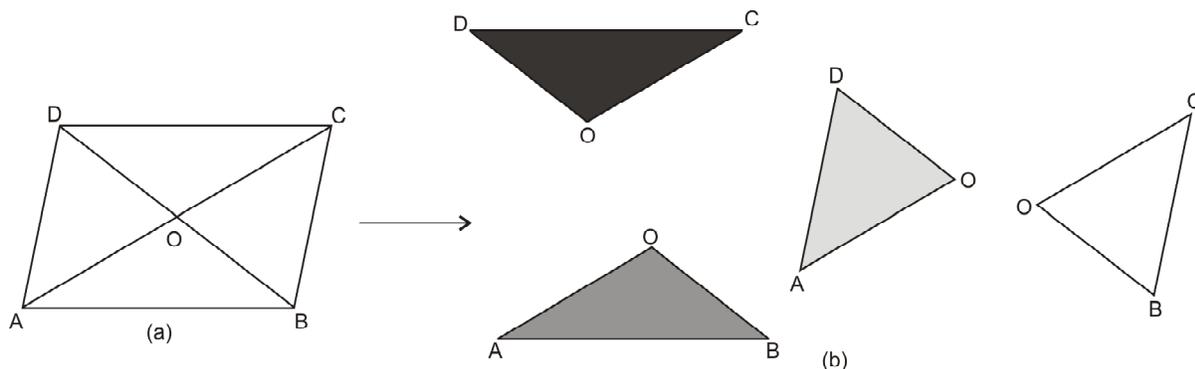


Figure-1

2. Superimpose  $\triangle OAB$  over  $\triangle OCD$  and  $\triangle OBC$  over  $\triangle ODA$  as shown.

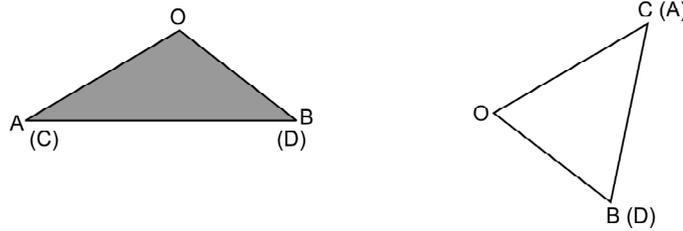


Figure-2

**Observations :** In figure 2, we see that  $\triangle OAB$  exactly covers  $\triangle OCD$  and  $\triangle OBC$  exactly covers  $\triangle ODA$ .

Or  $\triangle OAB \cong \triangle OCD$  and  $\triangle OBC \cong \triangle ODA$ .

So,  $OA = OC$  and  $OB = OD$ .

**Conclusion :** From the above activity, it is verified that the diagonals of a parallelogram bisect each other.

### Activity-4

**Objective :** To show that the figure obtained by joining the mid points of consecutive sides of a quadrilateral is a parallelogram.

**Materials Required :** White sheets of paper, a pair of scissors, colour pencils, gluestick, geometry box, etc.

**Procedure :**

1. On a white sheet of paper, draw a quadrilateral ABCD and cut it out.

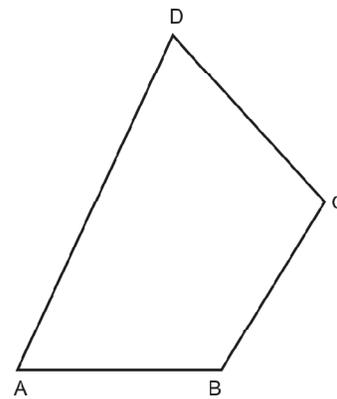


Figure-1

2. By paper folding, find the mid points of AB, BC, CD and DA and mark them as P, Q, R and S respectively. Join P to Q, Q to R, R to S and S to P.

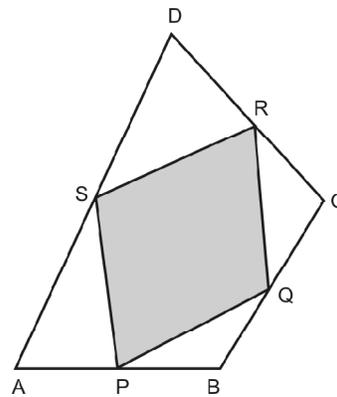


Figure-2

3. Cut out the quadrilateral PQRS. Join PR.

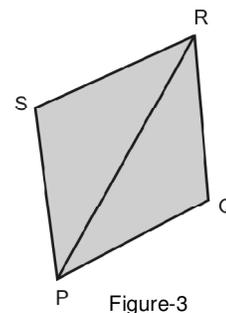


Figure-3

- Cut the quadrilateral PQRS along PR to get two triangles. Superimpose the triangles PQR and PSR such that PQ falls along RS as shown.

**Observations :**

In figure 4(b), we see that  $\Delta PQR$  exactly covers  $\Delta RSP$ .

$\Rightarrow PQ = RS$  and  $QR = SP$

$\Rightarrow PQRS$  is a parallelogram. [ $\because$  Each pair of opposite sides of the quadrilateral are equal.]

**Conclusion :** From the above activity, we can say that the figure obtained by joining the mid-points of consecutive sides of a quadrilateral is a parallelogram.

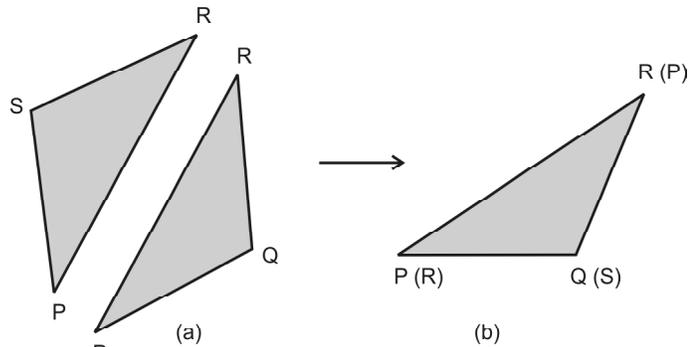


Figure-4

**Do Yourself :** Verify the above property by drawing three different quadrilaterals.