MATHS
WORKSHEET_030325
Chapter-08 QUADRILATERALS (ANSWERS)

SUBJECT: MATHEMATICS **MAX. MARKS : 40**
CLASS : IX **DURATION : 1½ hrs**

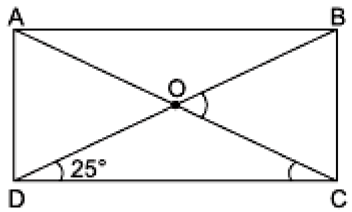
General Instructions:

(i). **All** questions are compulsory.
(ii). This question paper contains 2**0** questions divided into five Sections A, B, C, D and E.
(iii). **Section A** comprises of **10 MCQs** of **1 mark** each. **Section B** comprises of 4 questions of **2 marks** each. **Section C** comprises of 3 questions of **3 marks** each. **Section D** comprises of 1 question of **5 marks** each and **Section E** comprises of 2 Case Study Based Questions of **4 marks** each.
(iv). There is no overall choice.
(v). Use of Calculators is not permitted

SECTION – A

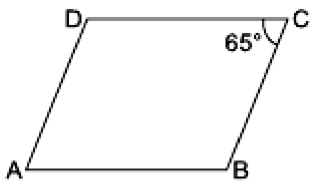
Questions 1 to 10 carry 1 mark each.

1. A diagonal of a rectangle is inclined to one side of the rectangle at 25°. The acute angle between the diagonals is
(a) 55° (b) 50° (c) 40° (d) 25°
Ans: Given, ∠ODC = 25°



Since ABCD is a rectangle, so diagonals are equal.
⇒ AC = BD ⇒ $\frac{1}{2}$AC = $\frac{1}{2}$BD ⇒ OC = OD
⇒ ∠ODC = ∠OCD (∵ Angles opposite to equal sides are equal)
But ∠BOC = ∠ODC + ∠OCD (u2235 Exterior angle property)
⇒ ∠BOC = ∠ODC + ∠ODC ⇒ ∠BOC = 2∠ODC
⇒ ∠BOC = 2 × 25° = 50°
So, the acute angle between the diagonals is 50°.
∴ Correct options is (b).

2. In the given figure, ABCD is a parallelogram. If ∠C = 65°, then (∠B + ∠D) is equal to



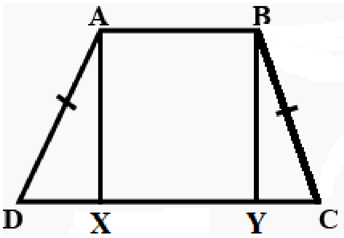
(a) 180° (b) 115° (c) 155° (d) 230°
Ans. (d) 230°
Since ABCD is a parallelogram, so opposite angles are equal. Thus, ∠B = ∠D and ∠A = ∠C = 65°.
Using angle sum property of a quadrilateral, we have
∠A + ∠B + ∠C + ∠D = 360°
⇒ 65° + ∠B + 65° + ∠D = 360°
⇒ ∠B + ∠D = 360° – 130° = 230°

3. Given a quadrilateral ABCD, and diagonals AC and BD bisect each other at P such that AP = CP and BP = DP. Also ∠APD = 90°, then quadrilateral is a

(a) rhombus (b) trapezium (c) parallelogram (d) rectangle
Ans: (a) rhombus

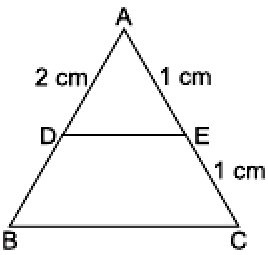
4. Diagonals of a rectangle ABCD intersect at O. If ∠AOB = 70°, then ∠DCO is
(a) 70° (b) 110° (c) 35° (d) 55°
Ans: (d) 55°

5. Given a trapezium ABCD, in which AB || CD and AD = BC. If ∠D = 70°, then ∠C will be
(a) 70° (b) 110° (c) 20° (d) none of these
Ans. (a) 70°
Draw AX ⊥ DC and BY ⊥ DC.



In ΔAXD and ΔBYC, we have
AD = BC (Given)
∠AXD = ∠BYC (Each 90°)
AX = BY (Distance between parallel sides)
So, ΔAXD ≅ ΔBYC (RHS congruence rule)
Thus, ∠D = ∠C (CPCT)
Hence, ∠C = 70°

6. In the given figure, find BD, if DE | | BC.



(a) 2 cm (b) 1 cm (c) 3 cm (d) none of these
Ans. (a) 2 cm
AD = DB by the converse of the Mid-point Theorem

7. Four points A,B,C,D are joined together in order and we noticed AB = CD = 5 cm and also, AB is parallel to CD then the quadrilateral obtained is a
(a) rhombus (b) trapezium (c) parallelogram (d) rectangle
Ans. (c) parallelogram

8. Two angles of a quadrilateral are 60° and 70° and other two angles are in the ratio 8 : 15, then the remaining two angles are
(a) 140°, 90° (b) 100°, 130° (c) 80°, 150° (d) 70°, 160°
Ans: (c) 80°, 150°

In the following questions 9 and 10, a statement of assertion (A) is followed by a statement of Reason (R). Choose the correct answer out of the following choices.
(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true but R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.

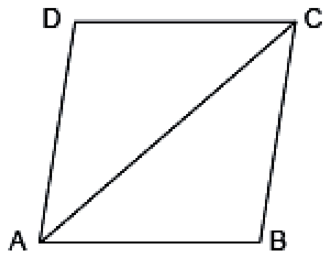
9. Assertion (A): If the diagonal of a parallelogram are equal, then it is a rectangle.
Reason (R): The diogonals of parallelogrom bisect each other at right angles.
Ans. (c) Assertion (A) is true but reason (R) is false.
A rectangle is a parallelogrom whose diogonals are equal and bisect each other. Here, only Assertian is true.

10. Assertion (A): The quadrilateral formed by joining the midpoints of consecutive sides of a quadrilateral whose diagonals are perpendicular is a rectangle.
Reason (R): The line segment in a triangle joining the midpoint of any two sides of the triangle is said to be parallel to its third side and is also half of the length of the third side and the quadrilateral formed by joining the midpoints of consecutive sides of a quadrilateral is a parallelogram.
Ans: (a) Both A and R are true and R is the correct explanation of A.

SECTION – B

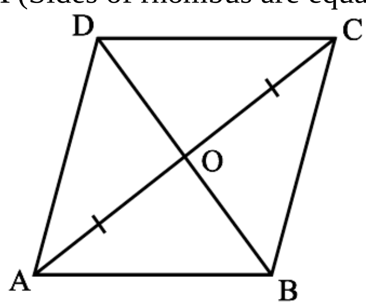
Questions 11 to 14 carry 2 marks each.

11. Prove that a diagonal of a parallelogram divides it into two congruent triangles.
Ans: Given: ABCD is a parallelogram.
To prove: $\Delta ABC \cong \Delta ADC$



Proof: In ΔABC and ΔADC,
AB = DC (Opposite sides of parallelogram)
BC = AD (Opposite sides of parallelogram)
AC = AC (Common)
$\therefore \Delta ABC \cong \Delta ADC$ (SSS congruence rule)
$\therefore$ Diagonal AC divides parallelogram ABCD into two congruent triangles ABC and CDA.

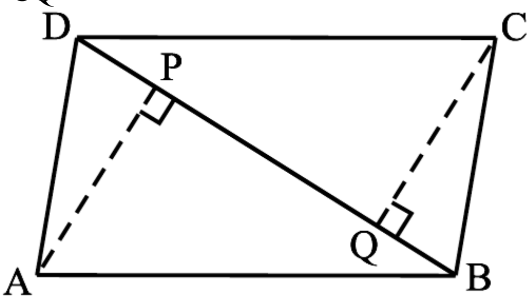
12. Show that the diagonals of a rhombus are perpendicular to each other.
Ans. Consider the rhombus ABCD (see the below figure).
We know that AB = BC = CD = DA (Sides of rhombus are equal)



Now, in Δ AOD and Δ COD,
OA = OC (Diagonals of a parallelogram bisect each other)
OD = OD (Common)
AD = CD
Therefore, $\Delta AOD \cong \Delta COD$ (by SSS congruence rule)
This gives, $\angle AOD = \angle COD$ (CPCT)
But, $\angle AOD + \angle COD = 180°$ (Linear pair)
$\Rightarrow 2\angle AOD = 180° \Rightarrow \angle AOD = 90°$
So, the diagonals of a rhombus are perpendicular to each other.

13. ABCD is a parallelogram and AP and CQ are perpendiculars from vertices A and C on diagonal BD (see the below). Show that

(i) Δ APB ≅ Δ CQD (ii) AP = CQ



Ans. Given : ABCD is a parallelogram and AP and CQ are perpendiculars from vertices A and C on BD.

(a) In ΔAPB and ΔCQD, we have

∠ABP = ∠CDQ [Alternate angles]

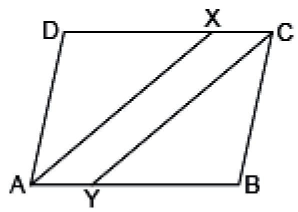
AB = CD [Opposite sides of a parallelogram]

∠APB = ∠CQD [Each = 90°]

∴ ΔAPB ≅ ΔCQD [ASA congruence]

(b) So, AP = CQ [CPCT]

14. In the given figure, ABCD is a parallelogram and line segments AX and CY bisect the angles A and C respectively. Show that AX || CY.



Ans: AX bisects ∠A

∴ $\angle XAB = \frac{1}{2}\angle DAB$ ...(i)

CY bisects ∠C.

∴ ∠XCY = ∠DCB ...(ii)

Also, ∠DAB = ∠DCB (Opposite angles of parallelogram)

⇒ $\frac{1}{2}\angle DAB = \frac{1}{2}\angle DCB$

⇒ ∠XAB = ∠XCY

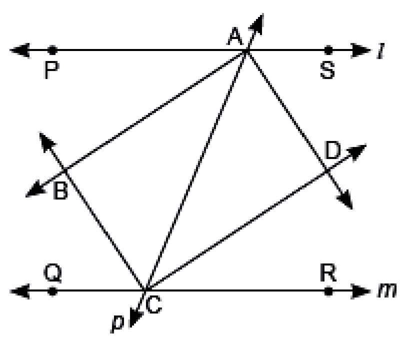
⇒ XC || AY (Parts of parallel lines are parallel)

SECTION – C

Questions 15 to 17 carry 3 marks each.

15. 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.

Ans:



We have $\angle PAC = \angle ACR$ (Alternate interior angles as $l \parallel m$ and p is transversal)

$\frac{1}{2}\angle PAC = \frac{1}{2}\angle ACR$

$\Rightarrow \angle BAC = \angle ACD$ (As BA and DC are bisectors of $\angle PAC$ and $\angle ACR$ respectively)

But these are alternate angles. This shows that AB || CD

Similarly, BC || AD

$\Rightarrow$ Quadrilateral ABCD is a parallelogram. ...(i)

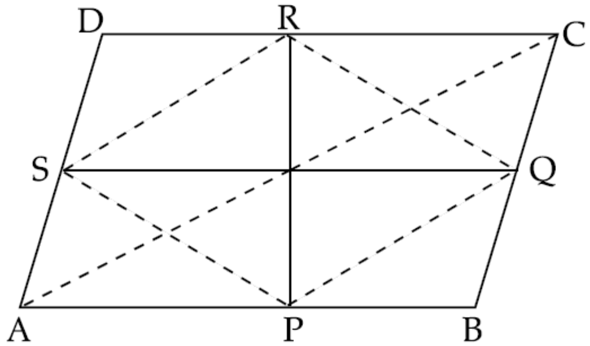
Now, $\angle PAC + \angle CAS = 180°$ (Linear pair axiom)

$\Rightarrow \frac{1}{2}\angle PAC + \frac{1}{2}\angle CAS = 90° \Rightarrow \angle BAC + \angle CAD = 90° \Rightarrow \angle BAD = 90°$ ...(ii)

From (i) and (ii), we can say that ABCD is a rectangle.

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

Ans. Join SP, PQ, QR, RS and AC



In ΔDAC, RS || AC

and RS = $\frac{1}{2}$ AC (Mid-point theorem) ...(i)

In ΔABC, PQ || AC

and PQ = $\frac{1}{2}$ AC (Mid-point theorem) ...(ii)

From (i) and (ii), we get

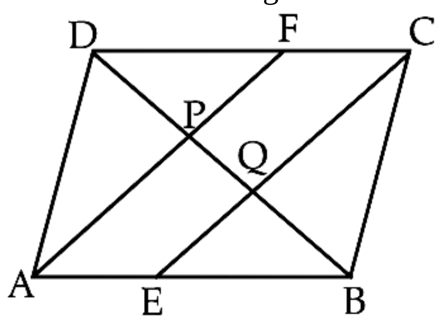
RS || PQ and RS = PQ

or, PQRS is a parallelogram.

Since, diagonals of a parallelogram bisect each other.

$\therefore$ PR and QS bisect each other.

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



Ans. According to the question, E and F are the midpoints of sides AB and CD.

$\therefore$ AE = AB and CF = CD

In the parallelogram opposite sides are equal, so AB = CD

$\Rightarrow \frac{1}{2}AB = \frac{1}{2}CD$

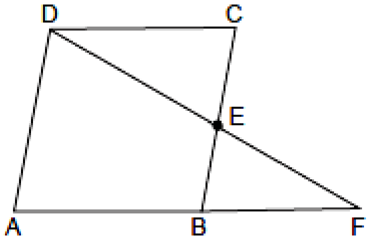
$\therefore$ AE = CF

Again, AB || CD $\Rightarrow$ AE || FC

Hence, AECF is a parallelogram.
In ΔABP, E is the mid-point of AB and EQ || AP.
∴ Q is the mid-point of BP. (By converse of mid-point theorem)
Similarly, P is the mid-point of DQ.
∴ DP = PQ = QB
∴ Line segments AF and EC trisect the diagonal BD.

OR

ABCD is a parallelogram and E is the mid-point of side BC. DE and AB on producing meet at F. Prove that AF = 2AB.

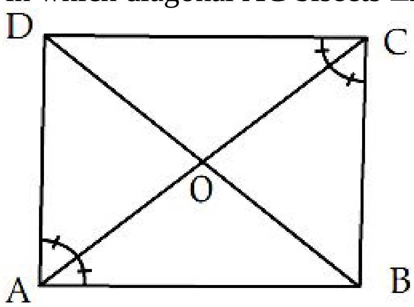


Ans: In ΔDCE and ΔBFE,
CE = EB (E is mid-point of BC)
∠DCE = ∠FBE (Alternate interior angles as CD | | AF)
∠DEC = ∠BEF (Vertically opposite angles)
∴ ΔDCE ≅ ΔBFE (ASA congruence rule)
∴ DE = EF (CPCT)
⇒ E is mid-point of DF.
In ΔADF,
E is mid-point of DF. (Proved above)
and AD | | BE (As AD | | BC)
⇒ B is mid-point of AF. (By converse of mid-point theorem)
∴ AB = BF ⇒ AF = 2AB

SECTION – D

Questions 18 carry 5 marks.

18. ABCD is a rectangle in which diagonal AC bisects ∠ A as well as ∠ C. Show that: (i) ABCD is a square (ii) diagonal BD bisects ∠ B as well as ∠ D.
Ans, Given : ABCD is a rectangle in which diagonal AC bisects ∠A as well as ∠C.

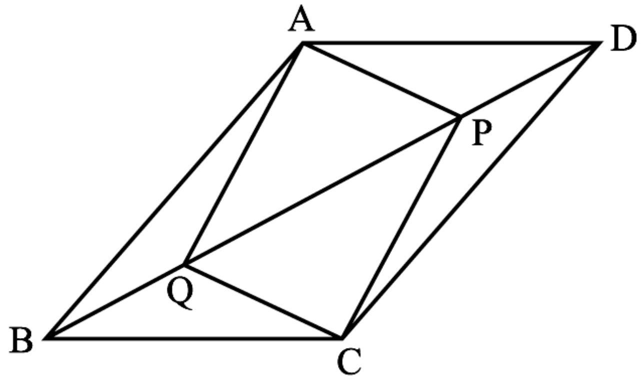


(a) In ΔABC and ΔADC, we have
∠BAC = ∠DAC [Given]
∠BCA = ∠DCA [Given]
AC = AC [common]
∴ ΔABC ≅ ΔADC [by ASA congruence rule]
∴ AB = AD and CB = CD [CPCT]
We know that in a rectangle opposite sides are equal,
i.e., AB = DC and BC = AD
∴ AB = BC = CD = DA
Hence, ABCD is a square.
(b) In ΔABD and ΔCBD, we have
AD = CD [Side of a square]

AB = BC [Side of a square]
BD = BD [Common]
∴ ΔABD ≅ ΔCBD [by SSS congruence rule]
So, ∠ABD = ∠CBD and ∠ADB = ∠CDB [CPCT]
Since, the angles are equal with the diagonal.
Therefore, diagonal BD bisects ∠B as well as ∠D.

OR

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



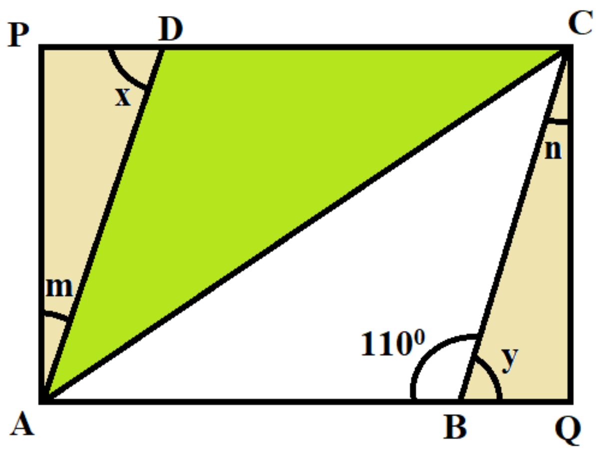
(a) ΔAPD ≅ ΔCQB (b) AP = CQ (c) ΔAQB ≅ ΔCPD
(d) AQ = CP (e) APCQ is a parallelogram

Ans. (a) In ΔAPD and ΔCQB, we have
AD = BC [Opposite sides of a ||gm]
DP = BQ [Given]
∠ADP = ∠CBQ [Alternate angles]
∴ ΔAPD ≅ ΔCQB [by SAS congruence rule]
(b) ∴ AP = CQ [CPCT]
(c) In ΔAQB and ΔCPD, we have
AB = CD [Opposite sides of a ||gm]
DP = BQ [Given]
∠ABQ = ∠CDP [Alternate angles]
∴ ΔAQB ≅ ΔCPD [by SAS congruence rule]
(d) ∴ AQ = CP [CPCT]
(e) We know that if both pair of opposite sides are equal in quadrilateral, therefore, APCQ is a parallelogram.

SECTION – E (Case Study Based Questions)

Questions 19 to 20 carry 4 marks each.

19. In the middle of the city, there was a park ABCD in the form of a parallelogram form so that AB = CD, AB||CD and AD =BC, AD || BC. Municipality converted this park into a rectangular form by adding land in the form of ΔAPD and ΔBCQ. Both the triangular shape of land were covered by planting flower plants.



(a) Show that ΔAPD and ΔBQC are congruent. (2)

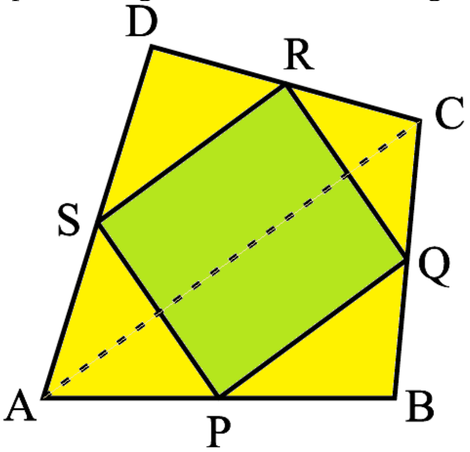
OR

What is the value of ∠m? (2)
(b) Which side is equal to PD? (1)
(c) Show that ΔABC and ΔCDA are congruent. (1)
Ans: (a) In ΔAPD and ΔBQC
AD = BC (given)
AP = CQ (opposite sides of rectangle)
∠APD = ∠BQC =90°
By RHS criteria ΔAPD ≅ ΔCQB

OR

In ΔAPD
∠APD + ∠PAD + ∠ADP = 180°
⇒ 90° + (180° - 110°) + ∠ADP = 180° (angle sum property of /)
⇒ ∠ADP = m = 180°- 90° - 70° = 20 °
⇒ ∠ADP = m = 20°
(b) ΔAPD ≅ ΔCQB
Corresponding part of congruent triangle
side PD = side BQ
(c)ln ΔABC and ΔCDA
AB = CD (given)
BC = AD (given)
AC = AC (common)
By SSS criteria ΔABC ≅ ΔCDA

20. **Activity-based learning-** ensures active engagement of learner with concepts and instructional materials. Learning is hands-on and experiential, providing learners the opportunity of learning through manipulation of materials and objects.
Teachers model the process, and students work independently to copy it. Kumar sir Maths teacher of class 9th wants to explain the properties of parallelograms in a creative way, so he gave students yellow colored paper in the shape of a quadrilateral and then ask the students to make a parallelogram from it by using paper folding and coloured it with green colour.



(a) How can a parallelogram be formed by using paper folding? (2)
(b) (i) If ∠RSP = 30°, then find ∠RQP. (1)
(ii) If SP = 3 cm, Find the RQ. (1)

OR

(b) Find the value of ∠R and ∠S if ∠P : ∠Q = 1 : 4. (2)
Ans:
(a) By joining mid points of sides of a quadrilateral one can make parallelogram.
Now, S and R are mid points of sides AD and CD of ΔADC, P and Q are mid points of sides AB and BC of ΔABC, then by mid-point theorem SR || AC and SR = ½AC
Similarly PQ || AC and PQ = ½AC.

Therefore SR || PQ and SR = PQ
A quadrilateral is a parallelogram if a pair of opposite sides is equal and parallel.
Hence PQRS is parallelogram.
(b) (i) $\angle RQP = 30°$ (Opposite angles of a parallelogram are equal.)
(ii) RQ = 3cm (Opposite side of a parallelogram are equal.)

OR

(b) Since PQRS is a parallelogram, opposite angles are equal.
$\Rightarrow \angle P = \angle R$ and $\angle Q = \angle S$
Also, $\angle P : \angle Q = 1 : 4$
$\Rightarrow \angle P = \angle R = k$ and $\angle Q = \angle S = 4k$
Now, $\angle P + \angle Q + \angle R + \angle S = 360°$ (Angle sum property of quadrilateral)
$\Rightarrow k + 4k + k + 4k = 360°$
$\Rightarrow 10k = 360°$
$\Rightarrow k = 36°$
Hence, $\angle R = k = 36°$ and $\angle S = 4k = 144°$.