# MATHEMATICS

## Class-VIII

## Topic-5

## QUADRILATERALS

## INDEX

# CH-05 QUADRILATERALS

## TERMINOLOGIES

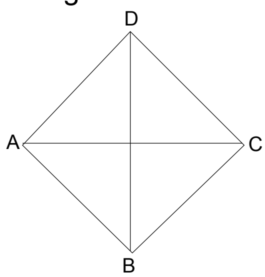
**Polygon, Parallel Lines, Transversal, Collinear, Vertices, Line Segments, Sides, Angles, Convex and concave quadrilateral, diagonals, parallelogram, Rhombus, Rectangle, Square, Trapezium, Kite, Isosceles trapezium, congruent.**

## INTRODUCTION

'Poly' means many and 'gon' means sides. So a polygon is a closed figure of many sides. A polygon of 'n' sides is also called n-gon. Polygon can be classified according to the number of sides like triangle (3 sides), Quadrilateral (4 sides). Pentagon (5 sides).

## 5.1 QUADRILATERAL

A quadrilateral is four sided closed figure.




Let A, B, C and D be four points in a plane such that :

**(i)** No three of them are collinear.

**(ii)** The line segments AB, BC, CD and DA do not intersect except at their end points, then **figure** obtained by joining A, B, C & D is called a **quadrilateral**.

### (a) Definitions

**(i) Vertices :** The point A, B, C and D are called vertices.

**(ii) Opposite vertices :** The vertices A and C; B and D are called the opposite vertices.

**(iii) Sides :** The line segment AB, BC, CD and AD are called sides.

**(iv) Opposite sides :** AB and DC; AD and BC are called opposite sides.

**(v) Adjacent sides :** AD and AB; AB and BC, BC and CD, CD and AD are called the adjacent sides.

**(vi) Angles :** $\angle A$ , $\angle B$, $\angle C$ and $\angle D$ are the angles of the quadrilateral ABCD.

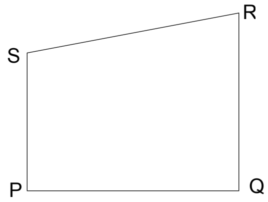
**(vii) Opposite angles :** $\angle A$ and $\angle C$; $\angle B$ and $\angle D$ are opposite angles.

**(viii) Adjacent angles :** $\angle A$ and $\angle B$; $\angle B$ and $\angle C$; $\angle C$ and $\angle D$; $\angle D$ and $\angle A$ are the adjacent angles.

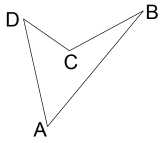
**(ix) Diagonals :** Line segment joining the opposite vertices of a quadrilateral ABCD are called its diagonal. In the above figure AC and BD are two diagonals of the quadrilateral ABCD.

## (b) Convex and Concave Quadrilaterals

**(i)** A quadrilateral in which the measure of each interior angle is less than 180° is called a convex quadrilateral. In **figure**, PQRS is convex quadrilateral.

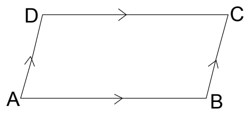



**(ii)** A quadrilateral in which the measure of one of the interior angle is more than 180° is called a concave quadrilateral. In **figure**, ABCD is concave quadrilateral.

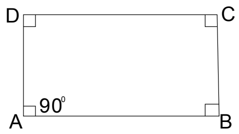



## (c) Special Quadrilaterals

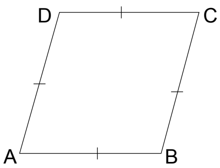
**(i) Parallelogram :** A parallelogram is a quadrilateral in which both pairs of opposite sides are parallel. In **figure**, AB || DC, AD || BC therefore, ABCD is a parallelogram.



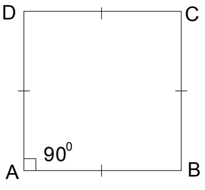

**(ii) Rectangle :** A rectangle is parallelogram, but each of its angle is right angle. If ABCD is a rectangle then ∠A = ∠B = ∠C = ∠D = 90°.




**(iii) Rhombus :** A rhombus is a parallelogram but all its sides are equal in length. If ABCD is a rhombus then AB = BC = CD = DA.

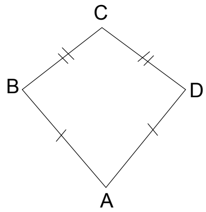



**(iv) Square :** A square is a parallelogram having all sides equal and each angle equal to right angle. If ABCD is a square then AB = BC = CD = DA and ∠A = ∠B = ∠C = ∠D = 90°.

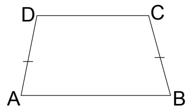


**(v) Trapezium :** A trapezium is a quadrilateral with only one pair of opposite sides parallel. In **figure**, ABCD is a trapezium with AB || DC.


**(vi) Kite :** A kite is a quadrilateral in which two pairs of adjacent sides are equal. If ABCD is a kite then AB = AD and BC = CD.




**(vii) Isosceles trapezium :** A trapezium is said to be an isosceles trapezium, if its non-parallel sides are equal. Thus a quadrilateral ABCD is an isosceles trapezium, if AB || DC and AD = BC and $\angle A = \angle B$ and $\angle D = \angle C$.




## Ask yourself

**1.** It is possible to have a quadrilateral whose angles are of measures 105°, 165°, 55° and 45° ? Give reason.

**2.** The angles of a quadrilateral are respectively 20°, 100°, 80°. Find the fourth angle.

**3.** What will be the sum of all angles of a convex polygon which has
**(i)** 6 sides **(ii)** 8 sides

**4.** How many sides has a regular polygon, each angle of which is of measure 108° ?

**5.** What is the sum of all the angles of
**(a)** A hexagon **(b)** An octagon **(c)** A regular decagon

**6.** It is possible to have a regular polygon whose interior angle measures 124º? Justify

**Answers**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **1.** | No | **2.** | 160° | **3.** | **(i)** | 720° | | **(ii)** | 1080° |
| **4.** | 5 | **5.** | **(i)** | 720° | **(ii)** | 1080° | | **(iii)** | 1440° |
| **6.** | No | | | | | | | | |

## 5.2 PROPERTIES OF VARIOUS SPECIAL TYPES OF QUADRILATERALS

### (a) Parallelogram

Properties in the form of theorems have been given.

**Theorem-1 :** The sum of the four angles of a quadrilateral is 360°.

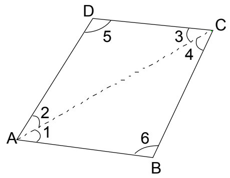
**Given :** Quadrilateral ABCD.

**To Prove :** ∠A + ∠B + ∠C + ∠D = 360°.

**Construction :** Join AC.

**Proof :** In ΔABC , we have

∠1 + ∠4 + ∠6 = 180° ...(i)




In ΔACD, we have

∠2 + ∠3 + ∠5 = 180° ...(ii)

Adding (i) and (ii) we get

(∠1 +∠2) + (∠3 + ∠4) +∠5 + ∠6 = 180° + 180°

∠A + ∠C + ∠D + ∠B = 360°.

∠A +∠B +∠C +∠D = 360°.

**Theorem-2 :** A diagonal of a parallelogram divides it into two congruent triangles.

**Given :** A parallelogram ABCD.

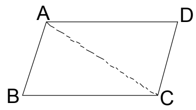
**To Prove :** A diagonal, say, AC of parallelogram ABCD divides it into congruent triangles ABC and CDA i.e. ΔABC ≅ ΔCDA.

**Construction :** Join AC.

**Proof :** Since ABCD is a parallelogram. Therefore, AB || DC and AD || BC

Now, AD || BC and transversal AC intersects them at A and C respectively.

∠DAC = ∠BCA ...(i) [Alternate interior angles]




Again, AB || DC and transversal AC intersects them at A and C respectively.

Therefore,

∠BAC = ∠DCA ...(ii) [Alternate interior angles]

Now, in ΔABC and ΔCDA, we have

∠BCA = ∠DAC [From (i)]

AC = AC [Common side]

∠BAC = ∠DCA [From (ii)]

So, by ASA congruence criterion, we have

ΔABC ≅ ΔCDA

**Theorem-3 :** In a parallelogram, opposite sides are equal.

**Given :** A parallelogram ABCD.

**To Prove :** AB = CD and DA = BC.

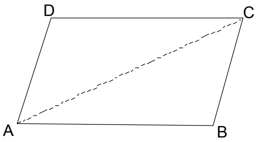
**Construction :** Join AC.

**Proof :** Since ABCD is a parallelogram. Therefore

AB || DC and AD || BC

Now, AD || BC and transversal AC intersects them at A and C respectively.

$\angle DAC = \angle BCA$ ...(i) [Alternate interior angles]




Again, AB || DC and transversal AC intersects them at A and C respectively.

$\angle BAC = \angle DCA$ ...(ii) [Alternate interior angles]

Now, in $\Delta ADC$ and $\Delta CBA$, we have

$\angle DCA = \angle BAC$ [From (ii)]

AC = AC [Common side]

And $\angle DAC = \angle BCA$ [From (i)]

So, by ASA criterion congruence

$\Delta ADC \cong \Delta CBA$

AD = CB and DC = BA [Corresponding parts of congruent triangles are equal]

**Theorem - 4 :** The opposite angles of a parallelogram are equal.

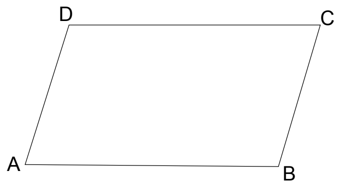
**Given :** A parallelogram ABCD

**To Prove :** $\angle A = \angle C$ and $\angle B = \angle D$

**Proof :** Since ABCD is a parallelogram. Therefore,

AB || DC and AD || BC

Now, AB || DC and transversal AD intersects them at A and D respectively.




$\angle A + \angle D = 180°$ ...(i) [$\because$ Sum of consecutive interior angles is 180°]

Again, AD || BC and DC intersects them at D and C respectively.

$\angle D + \angle C = 180°$ ...(ii) [$\because$ Sum of consecutive interior angles is 180°]

From (i) and (ii) we get

$\angle A + \angle D = \angle D + C \Rightarrow \angle A = \angle C.$

Similarly, $\angle B = \angle D$

Hence, $\angle A = \angle C$ and $\angle B = \angle D$.

**Theorem - 5 :** The diagonals of a parallelogram bisect each other.

**Given :** A parallelogram ABCD such that its diagonals AC and BD intersect at O.

**To Prove :** OA = OC and OB = OD.

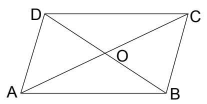
**Proof :** Since ABCD is a parallelogram. Therefore,

AB || DC and AD || BC

Now, AB || DC and transversal AC intersects them at A and C respectively.

$\angle BAC = \angle DCA$ [Alternate interior angles are equal]

$\angle BAO = \angle DCO$ ...(i)



Again, AB || DC and BD intersects them at B and D respectively.

$\angle ABD = \angle CDB$ [Alternate interior angles are equal]

$\angle ABO = \angle CDO$ ...(ii)

Now , in $\Delta AOB$ and $\Delta COD$, we have

$\angle BAO = \angle DCO$ [From (i)]

AB = CD [Opposite sides of a paralleloogram are equal]

And, $\angle ABO = \angle CDO$ [From (ii)]

So, by ASA congruence criterion

$\Delta AOB \cong \Delta COD$

OA = OC and OB = OD [By CPCT]

Hence, OA = OC and OB = OD

**Illustration 5.1**

In a quadrilateral ABCD, the angles A, B, C and D are in the ratio 1 : 2 : 3 : 4. Find the measure of each angles of the quadrilateral.

**Sol.** We have $\angle A : \angle B : \angle C : \angle D = 1 : 2 : 3 : 4$.

So, let $\angle A = x^0$, $\angle B = 2x^0$, $\angle C = 3x^0$, $\angle D = 4x^0$

$\angle A + \angle B + \angle C + \angle D = 360°$

$x + 2x + 3x + 4x = 360$

$10x = 360$

$x = 36$

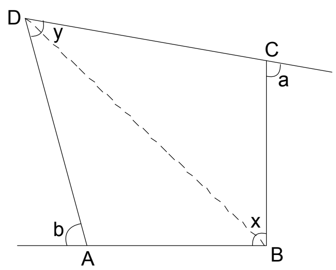
Thus, the angles are :

$\angle A = 36°$, $\angle B = (2 \times 36)° = 72°$, $\angle C = (3 \times 36)° = 108°$

And, $\angle D = (4x)° = (4 \times 36)° = 144$.

**Illustration 5.2**

The sides BA and DC of a quadrilateral ABCD are produced as shown in **figure**, prove that $a + b = x + y$.




**Sol.** Join BD. In $\Delta ABD$, we have

$\angle ABD + \angle ADB = b°$ ...(i) [Exterior angle theorem]

In $\Delta CBD$, we have

$\angle CBD + \angle CDB = a°$ ...(ii) [Exterior angle theorem]

Adding (i) and (ii) we, get

$(\angle ABD + \angle CBD) + (\angle ADB + \angle CDB) = a° + b°$

$\Rightarrow$ $x° + y° = a° + b°$

Hence, $x + y = a + b$.

**Illustration 5.3**

In a parallelogram ABCD diagonals AC and BD intersect at O and AC = 6.8 cm and BD = 5.6 cm. Find the measures of OC and OD.

**Sol.** Since, the diagonals of a parallelogram bisect each other. Therefore, O is the mid-point of AC and BD.

$\therefore$ OC = $\frac{1}{2}$AC = $\frac{1}{2}$ x 6.8 cm = 3.4 cm

And, OD = $\frac{1}{2}$ BD = $\frac{1}{2}$ x 5.6 cm = 2.8 cm

**Illustration 5.4**

Given $\Delta$ABC, lines are drawn through A, B and C parallel respectively to the sides BC, CA and AB, forming $\Delta$PQR show that BC = $\frac{1}{2}$QR.

**Sol.** We have, AQ || CB and AC || QB

$\Rightarrow$ AQBC is parallelogram

BC = AQ ...(i) [$\because$ Opposite sides of a $||^{gm}$ are equal]

Again AR || BC and AB || RC

$\Rightarrow$ ARCB is a parallelogram.

$\Rightarrow$ BC = AR ....(ii) [Opposite sides of || gm are equal] From (i) and (ii), we get

AQ = AR

$\Rightarrow$ AQ = AR = $\frac{1}{2}$QR

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

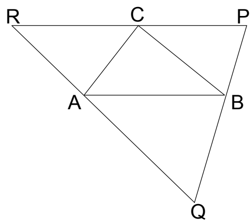



**Illustration 5.5**

If ABCD is a quadrilateral in which AB || CD and AD = BC, prove that $\angle$A = $\angle$B.

**Sol.** Extend AB and draw a line CE parallel to AD as shown in **figure**, since AD || CE and transversal AE cuts them at A and E respectively.

$\therefore$ $\angle$A + $\angle$E = 180° ...... (i)

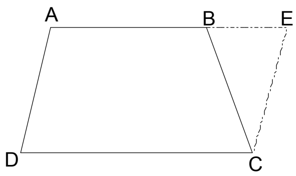
Since AE || CD and AD || CE. Therefore,

AECD is parallelogram.

$\Rightarrow$ AD = CE

$\Rightarrow$ BC = CE [$\because$ AD = BC (given)]

Thus, in $\Delta$BCE , we have




BC = CE

$\Rightarrow$ $\angle$CBE = $\angle$CEB ( $\Delta$BCE is isosceles triangle)

$\Rightarrow$ 180 – $\angle$B = $\angle$E .......(ii)

$\Rightarrow$ 180 – $\angle$E = $\angle$B

From (i) and (ii), we get

$\angle$A = $\angle$B

**Illustration 5.6**

In a parallelogram ABCD, ∠D = 115°, determine the measure of ∠A and ∠B.

**Sol.** Since the sum of any two consecutive angles of a parallelogram is 180°.
Therefore,

∠A + ∠D = 180° and ∠A + ∠B = 180°

Now, ∠A + ∠D = 180°

∠A + 115° = 180° [∠D = 115° (Given)]

∠A = 65°

And , ∠A + ∠B = 180°

65° + ∠B = 180° ∠B. = 115°

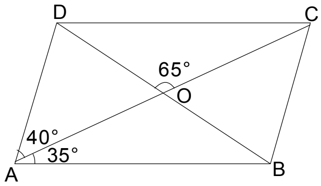
Thus, ∠A = 65° and ∠B = 115°

**Illustration 5.7**

In **fig.**, ABCD is a parallelogram in which ∠DAO = 40°, ∠BAO = 35° and ∠COD = 65°. Find:

**(i)** ∠ABO **(ii)** ∠ODC **(iii)** ∠ACB **(iv)** ∠CBD

**Sol.** Since ∠AOB and ∠COD are vertically opposite angles.




∴ ∠AOB = ∠COD

∠AOB = 65°

**(i)** In ΔAOB, we have

∠OAB + ∠AOB + ∠ABO = 180°

35° + 65° + ∠ABO = 180°

100° + ∠ABO = 180°

∠ABO = 180° – 100° = 80°

**(ii)** Since ∠ABO and ∠ODC are alternate interior angles and alternate interior angles are always equal.

∴ ∠ODC = ∠ABO

∠ODC = 80°

**(iii)** Since ∠ACB and ∠DAC are alternate interior angles.

∴ ∠ACB = ∠DAC

∠ACB = 40°

**(iv)** Since ∠A and ∠B are adjacent interior angles of parallelogram ABCD and adjacent interior angles are supplementary.

∴ ∠A + ∠B = 180°

∠B = 180° – ∠A

⇒ ∠B = 180° – (40° + 35°) = 105°

⇒ ∠ABD + ∠CBD = 105°

⇒ ∠ABO + ∠CBD = 105°

⇒ 80° + ∠CBD = 105°

⇒ ∠CBD = 105° – 80° = 25°

**Illustration 5.8**

The ratio of two sides of a parallelogram is as 3 : 5, and its perimeter is 48 m. Find sides of a parallelogram.

**Sol.** Let the two sides of the parallelogram be $3x$ metres and $5x$ metres in length.
Then,
Perimeter = 2 (length + breadth)
Perimeter = 2 ($3x + 5x$) metres
= 2 × $8x$ metres
= $16x$ metres.
But, the perimeter is given as 48 metres.

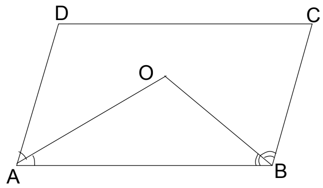
$\therefore \quad 16x = 48 \quad \Rightarrow \quad \frac{16x}{16} = \frac{48}{16} \quad \Rightarrow \quad x = 3$

Hence, the sides of the parallelogram are 3 x 3 m = 9 m and 5 × 3 m = 15 m.

**Illustration 5.9**

In a parallelogram ABCD, the bisectors of ∠A and ∠B meet at O. Find ∠AOB.

**Sol.** Since OA and OB are the bisectors of ∠A and ∠B respectively.




$\therefore \angle OAB + \angle AOB + \angle OBA = 180°$

$\Rightarrow \quad \frac{1}{2}\angle A + \angle AOB + \frac{1}{2}\angle B = 180°$

$\Rightarrow \quad \angle AOB = 180° - \frac{1}{2}(\angle A + \angle B)$

$\Rightarrow \quad \angle AOB = 180° - \frac{1}{2}(180°)$ [∵ ∠A and ∠B are adjacent angles of parallelogram ABCD ∴ ∠A + ∠B = 180°]

$\Rightarrow \quad \angle AOB = 180° - 90° = 90°.$

$\Rightarrow \quad \angle ABO + \angle CBD = 105°$

$\Rightarrow \quad 80° + \angle CBD = 105°$

$\Rightarrow \quad \angle CBD = 105° - 80° = 25°$

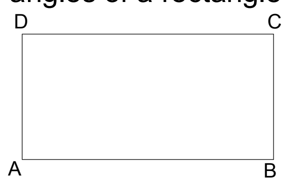
$\Rightarrow \quad \angle AOB = 180° - \frac{1}{2}(180°)$ [∵ ∠A and ∠B are adjacent angles of parallelogram ABCD ∴ ∠A + ∠B = 180°]

$\Rightarrow \quad \angle AOB = 180° - 90° = 90°.$

## (b) Rectangle

Some properties of rectangles, rhombus and squares have been given in the form of theorems:

**Theorem - 6 :** Each of the four angles of a rectangle is a right angle.



**Given :** A rectangle ABCD such that ∠A = 90°.

**To Prove :** ∠A = ∠B = ∠C = ∠D = 90°.

**Proof :** ABCD is a rectangle

ABCD is a parallelogram

AD || BC

Now, AD || BC and line AB intersects them at A and B.

∴ ∠A + ∠B = 180° [∵ Sum of the interior angles on the same side of a transversal is 180°]

⇒ 90° + ∠B = 180° [∵ ∠A = 90° (Given)]

⇒ ∠B = 90°

Similarly, we can show that ∠C = 90° and ∠D = 90°

Hence, ∠A = ∠B = ∠C = ∠D = 90°

**Theorem - 7 :** The diagonals of a rectangle are of equal length.

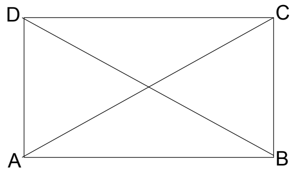
**Given :** A rectangle ABCD with AC and BD as its diagonals.

**To Prove :** AC = BD.

**Proof :** ABCD is a rectangle.

⇒ ABCD is a parallelogram such that one of its angles, say, ∠A is a right angle.

⇒ AD = BC and ∠A = 90° ...(i)




Now, AD || BC and AB intersects them at A and B respectively.

∴ ∠A + ∠B = 180°

⇒ 90° + ∠B = 180°

⇒ ∠B = 90° [∵ ∠A = 90°]

Now, in Δs ABD and BAC, we have

AB = BA [Common side]

∠A = ∠B [Each equal to 90°]

AD = BC [From (i)]

So, by SAS criterion of congruence

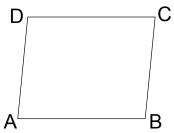
ΔABD ≅ ΔBAC

BD = AC [∵ Corresponding parts of congruent triangles are equal]

Hence, AC = BD.

## (c) Rhombus

**Theorem - 8 :** Each of the four sides of a rhombus is of the same length.




**Given :** A rhombus ABCD such that AB = BC

**To Prove :** AB = BC = CD = DA

**Proof :** ABCD is a rhombus

$\Rightarrow$ ABCD is a parallelogram

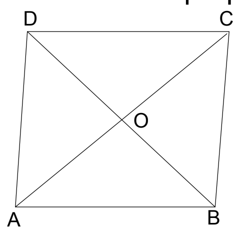
$\Rightarrow$ AB = CD and BC = AD

But AB = BC (Given)

$\therefore$ AB = BC = CD = AD

Hence, all the four sides of a rhombus are equal.

**Theorem -9 :** The diagonals of a rhombus are perpendicular to each other.




**Given :** A rhombus ABCD whose diagonals AC and BD intersect at O.

**To Prove :** $\angle BOC = \angle DOC = \angle AOD = \angle AOB = 90°$

**Proof :** We know that a parallelogram is rhombus, if all of its sides are equal. So, ABCD is a rhombus

$\Rightarrow$ ABCD is a $||^{gm}$ such that AB = BC = CD = DA ...(i)

Since the diagonals of a parallelogram bisect each other.

$\therefore$ OB = OD and OA = OC ...(ii)

Now, in $\Delta$s BOC and DOC, we have

BO = OD [From (ii)]

BC = DC [From (i)]

OC = OC [Common]

So, by SSS criterion of congruence

$\Delta BOC \cong \Delta DOC$ [$\because$ Corresponding parts of congruent triangles are equal]

$\Rightarrow$ $\angle BOC = \angle DOC$

But, $\angle BOC + \angle DOC = 180°$ [Linear pair axiom ]

$\therefore$ $\angle BOC = \angle DOC = 90°$ [$\therefore \angle BOC = \angle DOC$]

Similarly, $\angle AOB = \angle AOD = 90°$

Hence, $\angle AOB = \angle BOC = \angle COD = \angle DOA = 90°$.

## (d) Square

**Theorem - 10 :** Each of the angles of a square is a right angle and each of the four sides is of the same length.

**Given :** A square ABCD such that AB = BC

**To Prove :** AB = BC = CD = DA and $\angle A = \angle B = \angle C = \angle D = 90°$

**Proof :** ABCD is a square

$\Rightarrow$ ABCD is a rectangle

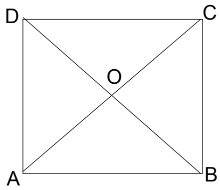
$\Rightarrow$ $\angle A = \angle B = \angle C = \angle D = 90°$

Again, ABCD is a square

$\Rightarrow$ ABCD is a parallelogram such that AB = BC

$\Rightarrow$ AB = BC = CD = AD.

**Theorem - 11 :** The diagonals of a square are equal and perpendicular to each other.




**Given :** A square ABCD

**To Prove :** AC = BD and AC⊥BD.

**Proof :** In ΔADB and ΔBCA, we have

AD = BC [∵ Sides of a square are equal]

∠BAD = ∠ABC [Each equal to 90°]

And, AB = BA [Common]

So, by SAS criterion of congruence

ΔADB ≅ ΔBCA [∵ Corresponding parts of congruent triangles are equal]

⇒ AC = BD

Now, in ΔAOB and ΔAOD, we have

OB = OD [∵ Diagonals of ||gm bisect each other]

AB = AD [∵ Sides of a square are equal]

And, AO = AO [Common]

So, by SSS criterion of congruence

ΔAOB ≅ ΔAOD [∵ Corresponding parts of congruent triangles are equal]

⇒ ∠AOB = ∠AOD

But, ∠AOB + ∠AOD = 180°

∴ ∠AOB = ∠AOD = 90°

AO ⊥ BD ⇒ AC ⊥ BD

Hence, AC = BD and AC ⊥BD.

**Illustration 5.10**

AB,CD are two parallel lines and a transversal $\ell$ intersects AB at X and CD at Y. Prove that the bisectors of the interior angles form a parallelogram, with all its angles right angles.

**Sol.** **Given :** AB, CD are two parallel lines which are cut by a transversal *l* in points X and Y respectively. The bisectors of interior angles intersect in P and Q.

**To Prove :** XPYQ is a rectangle.

**Proof :** Since AB || CD and transversal *l* intersects them.

∴ ∠AXY = ∠DYX [Alternate angles are equal]

$\frac{1}{2}\angle AXY = \frac{1}{2}\angle DYX$ ⇒ ∠1 = ∠2 [XP and YQ are the bisectors of ∠AXY and ∠DYX respectively]

Thus, XY intersects PX and QY at X and Y respectively such that ∠1 = ∠2 i.e. alternate interior angles are equal.

PX || QY

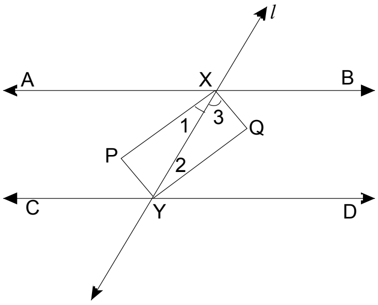
Similarly, YP || QX

Hence, PYQX is a parallelogram.
Now, we shall show that each angle of the $||^{gm}$ PYQX is right angle.
Since, the sum of the interior angle on the same side of a transversal is 180°.
Therefore,

$\therefore$ $\angle BXY + \angle DYX = 180°$

$\Rightarrow$ $2\angle 3 + 2\angle 2 = 180°$

$\Rightarrow$ $\angle 3 + \angle 2 = 90°$.




Now, in $\Delta XQY$, we have

$\angle 2 + \angle 3 + \angle XQY = 180°$

$\Rightarrow$ $90° + \angle XQY = 180°$

$\Rightarrow$ $\angle XQY = 90°$ [Using (i)]

Since XPYQ is a parallelogram.

$\therefore$ $\angle XQY = \angle XPY$

$\Rightarrow$ $\angle XPY = 90°$ [$\because$ $\angle XQY = 90°$]

Now, $\angle PXQ + \angle XQY = 180°$ [$\because$ *Adjacent angles in a* $||^{gm}$ *are supplementary*]

$\Rightarrow$ $\angle PXQ + 90° = 180°$

$\Rightarrow$ $\angle PXQ = 90°$

$\Rightarrow$ $\angle PYQ = 90°$ [$\because$ $\angle PXQ = \angle PYQ$]

Hence, all the interior angles are right angles.

**Illustration 5.11**

The diagonals of a rectangle ABCD meet at O. If $\angle BOC = 44°$, find $\angle OAD$.

**Sol.** We have,

$\angle BOC + \angle BOA = 180°$ [Linear pairs]

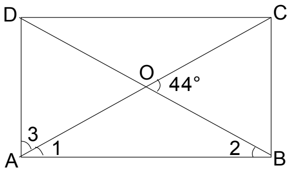
$\Rightarrow$ $44° + \angle BOA = 180°$

$\Rightarrow$ $\angle BOA = 136°$

Since diagonals of a rectangles are equal and they bisect each other. Therefore, in , we have

OA = OB [$\because$ Angles opp. to equal sides are equal]

$\Rightarrow$ $\angle 1 = \angle 2$




Now, in $\Delta OAB$, we have

$\angle 1 + \angle 2 + \angle BOA = 180°$

$\Rightarrow$ $2\angle 1 + 136 = 180°$

⇒ $2\angle 1 = 44°$

⇒ $\angle 1 = 22°$

Since each angle of a rectangle is a right angle. Therefore,

$\angle BAD = 90°$

⇒ $\angle 1 + \angle 3 = 90°$

⇒ $22° + \angle 3 = 90°$

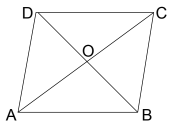
⇒ $\angle 3 = 68°$

⇒ $\angle OAD = 68°$

**Illustration 5.12**

The diagonals of a rhombus are 6 cm and 8 cm. Find the length of a side of the rhombus.

**Sol.** Let ABCD be the rhombus whose diagonals AC and BD are of lengths 8 cm and 6 cm respectively. Let AC and BD intersect at O. Since the diagonals of a rhombus bisect each other at right angles.




∴ $AO = \frac{1}{2}AC = \frac{1}{2} \times 8\text{ cm} = 4\text{cm}$ and $BO = \frac{1}{2}BD = \frac{1}{2} \times 6\text{cm} = 3\text{ cm}.$

Since $\Delta AOB$ is a right triangle, right angled at O. Therefore, by pythagoras theorem

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

⇒ $AB^2 = 4^2 + 3^2$

⇒ $AB^2 = 16 + 9$

⇒ $AB = 5$

Hence, the length of each side of the rhombus is 5 cm.

**Illustration 5.13**

In figure ABCD is a rectangle. BM and DN are perpendiculars from B and D respectively on AC. Prove that

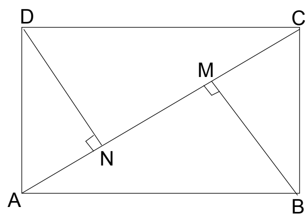
**(i)** $\Delta BMC \cong \Delta DNA$ **(ii)** BM = DN

**Sol.** **(i)** Since BM and DN are perpendiculars from B and D respectively on AC.

∴ BM || DN

Also, AD || BC.

$\angle ADN = \angle CBM$.




Now in $\Delta$s ADN and BCM, we have

$\angle ADN = \angle CBM$

AD = BC

$\angle DAN = \angle BCM$ [Alternate angles as AD || BC]

So, by ASA congruence condition, we have

$\Delta BMC \cong \Delta DNA$ ....(ii)

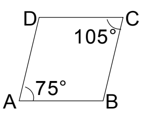
∴ $\Delta BMC \cong \Delta DNA$

⇒ BM = DN [∵ Corresponding parts of congruent triangles are equal]

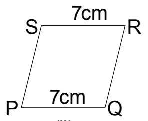
## Ask yourself

**1.** Adjacent angles of a parallelogram are in 7 : 2. Find all the angles.

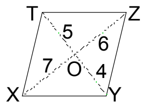
**2.** Can the following figures be parallelogram ? Justify your answer.



(i)

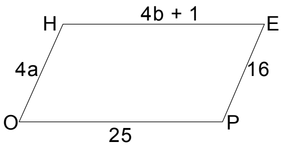


(ii)

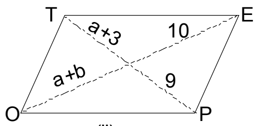


(iii)

**3.** The following figures HOPE and TOPE are parallelogram. Find 'a' and 'b'.

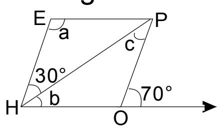


(i)

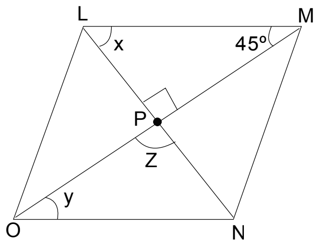


(ii)

**4.** In the figure below, HOPE is a parallelogram. Find the measures of angles a, b and c.




**5.** In the given parallelogram, find missing values?




**6.** The permeter of a square is 40 cm. Find the length of its diagonal?

**7.** ABCD is a rectangle with diagonals AC and BD meeting at point O. Find x if OA = 5x – 7 and OD = 4x – 5.

**Answers**

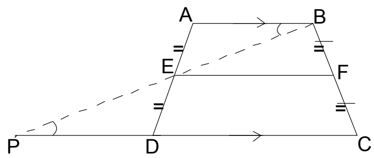
**1.** 140° , 40° , 140° , 40° **2.** **(i)** No **(ii)** Yes **(iii)** No

**3.** **(i)** a = 4 , b = 6 **(ii)** a = 6 , b = 4 **4.** a = 110° , b = 40° , c = 30°

**5.** x = 45° , y = 45° , z = 90° **6.** $10\sqrt{2}$ cm **7.** 2

## Add to Your Knowledge

**1.** In the given figure, E and F are respectively, the mid-points of non-parallel sides of a trapezium ABCD.




Then :

**(i)** EF || AB **(ii)** $EF = \frac{1}{2}(AB + DC)$.

**2.** The figure formed by joining the midpoints of the pairs of consecutive sides of a quadrilateral is a parallelogram.

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

## Concept Map

**Quadrilaterals**

A quadrilateral is four sided closed figure.

**Q.** ABCD is $||^{gm}$ find all angle of $||^{gm}$

**Sol.** $\angle C = \angle A = 50°$

$\therefore \angle C = 50°$

as AB||CD

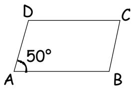
$\therefore \angle A + \angle D = 180°$

$50° + \angle D = 180°$

$\angle D = 130°$

$\angle B = \angle D = 130°$

$\therefore \angle B = 130°$




**Property of parallelogram**

Opposite angle are equal
Opposite sides are equal
Diagonal bisect each other
Diagonal divide parallelogram in to two congruent triangle.

**Angle sum property**

sum of all interior angle of quadrilateral is 360°

**Q.** Angle of Quadrilateral are in the ratio 1 : 2 : 3 : 4 find angle

**Sol.** Let angle are x, 2x, 3x, 4x

x + 2x + 3x + 4x = 360

10x = 360

x = 36

So, angle are 36, 2× 36
3× 36, 4× 36

i.e. 36°, 72°, 108°, 144°

**Q.** If ABCD is $||^{gm}$ find x,y

**Sol.** In $||^{gm}$ diagonal bisect each other

$\therefore$ OA = OC

x – 5 = 7

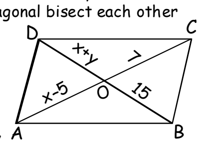
x = 12

and OB = OD

15 = x + y

15 = 12 + y

y = 3




**Polygon**

**Sum of interior angle = (n –2)180**

**Sum of exterior angle = 360°**

**For Regular polygon**

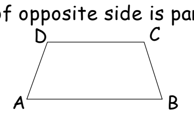
**Each Interior angle** $= \frac{(n-2)180}{n}$

**Each Interior angle** $= \frac{360}{n}$

**Types of Quadrilateral**

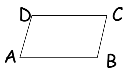
**Trapezium**

Quadrilateral with one pair of opposite side is parallel.




If AD = BC, it is known as isosceles trapezium

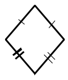
**Parallelogram**



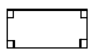

Quadrilateral in which both pair of opposite side is parallel.

**Kite**

Quadrilateral in which adjacent sides equal but unequal opp. side

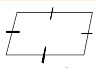


**Rectangle**



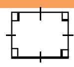
$||^{gm}$ with
all angle 90°
*Length of diagonal are equal

**Rhombus**



$||^{gm}$ with
all side equal
*diagonal bisect each other at 90°

**Square**



$||^{gm}$ with
all side equal and
all angle 90°
*Length of diagonal are equal
*Diagonal bisect at 90°

## Summary

1. A quadrilateral two of whose opposite sides are parallel is called a trapezium.

2. A quadrilateral in which opposite sides are parallel is called a parallelogram.

3. A parallelogram with a pair of adjacent sides equal is called a rhombus. In fact, all the sides of a rhombus are equal.

4. A parallelogram with one angle a right angle is called a rectangle. In fact, all the angles of a rectangle are right angles.

5. A parallelogram with a pair of adjacent sides equal and one angle a right angle is called a square. In fact, all the sides of a square are equal and all its angles are right angles.

6. In a parallelogram,
   **(i)** opposite sides are equal,
   **(ii)** opposite angles are equal, and
   **(iii)** diagonals bisect each other.

7. Diagonals of a rhombus bisect each other at right angles.

8. Diagonals of a rectangle are equal and bisect each other.

9. Diagonals of a square are equal and bisect each other at right angles

# Exercise-1

## SECTION -A (FIXED RESPONSE TYPE)

## OBJECTIVE QUESTIONS

**1.** If all the angles of a quadrilateral are less than 180º, then the quadrilateral is a :
(A) Convex quadrilateral (B) Parallelogram
(C) Concave quadrilateral (D) Trapezium

**2.** If one angle of a quadrilateral is greater than 180º, then the quadrilateral is a :
(A) Concave quadrilateral (B) Trapezium
(C) Rectangle (D) Convex quadrilateral

**3.** If the opposite sides and the opposite angles of a quadrilateral are equal, then the quadrilateral is a :
(A) Trapezium (B) Concave quadrilateral
(C) Convex quadrilateral (D) parallelogram

**4.** A quadrilateral whose opposite sides and all the angles are equal is a :
(A) Square (B) Rectangle (C) Rhombus (D) Parallelogram

**5.** A quadrilateral whose all the sides, diagonals and angles are equal is a :
(A) Square (B) Rhombus (C) Trapezium (D) Rectangle

**6.** If the adjacent angles of a parallelogram are equal, then the parallelogram is a :
(A) Trapezium (B) Rectangle (C) Rhombus (D) All of these

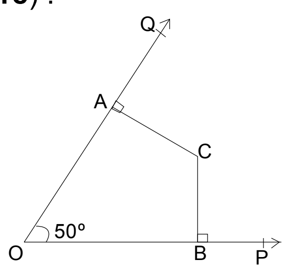
**7.** If the diagonals of a quadrilateral are equal and bisect each other (not at right angles), then the quadrilateral is a :
(A) Square (B) Rhombus (C) Parallelogram (D) Rectangle

**8.** If the diagonals of a quadrilateral bisect each other at right angles, then it is a :
(A) Trapezium (B) Parallelogram (C) Rectangle (D) Rhombus

**9.** A quadrilateral whose all the sides and opposite angles are equal and the diagonals bisect each other at right angles is a :
(A) Square (B) Rhombus (C) Rectangle (D) Parallelogram

**10.** The quadrilateral having only one pair of opposite sides parallel is called a :
(A) Kite (B) Rhombus (C) Trapezium (D) Parallelogram

**11.** The measure of $\angle BCA$ (in **figure**) :




(A) 180º (B) 130º (C) 110º (D) 108º

**12.** The sum of adjacent angles of a parallelogram is :
(A) 180º (B) 120º (C) 360º (D) 90º

**13.** In a quadrilateral ABCD, ∠A = 35º, ∠B = 65º, ∠C = 65º the ∠D is :
(A) 100º (B) 120º (C) 195º (D) 180º

**14.** Adjacent angles of a parallelogram are in the ratio of 2 : 7, their values will be :
(A) 20, 160º (B) 30, 150º (C) 40, 140º (D) 60, 120º

**15.** The angles of a quadrilateral are in the ratio 1 : 2 : 3 : 4, the angles are :
(A) 36º, 72º, 108º, 144º (B) 15º, 130º, 45º, 150º
(C) 45º, 110º, 55º, 150º (D) None of these

**16.** ABCD is a parallelogram and E is the mid point of BC. DE and AB when produced meet at F. Then,
(A) $AF = \frac{3}{2}AB$ (B) AF = 2AB (C) AF = 3AB (D) $AF^2 = 2AB^2$

## FILL IN THE BLANKS

**1.** A quadrilateral in which the measure of each interior angles is less than 180° is called a _____quadrilateral.

**2.** A _________is a quadrilateral with only one pair of opposite sides parallel.

**3.** A _________is a quadrilateral in which two pairs of adjacent sides are equal and pairs of adjacent unequal sides.

**4.** A diagonal of a parallelogram divides it two ________ triangles.

**5.** The diagonal of a rhombus are ___________ to each other.

**6.** A ________ is a parallelogram having all sides equal and each angle equal to right angle.

**7.** A quadrilateral in which the measure at one of integerior angle is greater than 180° is called a ____________quadrilateral.

**8.** A line segment joining the opposite verties of a quadrilateral are called its __________.

**9.** A trapezium is said to be an __________trapezium, if its non-parallel sides are equal.

**10.** A __________is a parallelogram but all its sides are equal in length.

## TRUE / FALSE

**1.** If all the angles of a quadrilateral are equal, it is a rectangle.

**2.** The adjacent angles of a parallelogram are equal.

**3.** The diagonals of a parallelogram bisect each other.

**4.** In a parallelogram, the diagonals are equal.

**5.** The diagonals of a rectangle are of equal length.

**6.** The diagonals of a square are equal and perpendicular to each other.

**7.** The diagonals of a rhombus are perpendicular bisectors.

8. In a convex quadrilateral all the angle is greater than 180°.

9. A kite is a quadrilateral in which two pair of adjacent sides are equal.

10. In a quadrilateral sum of all interior angle is 360.

11. In a concave quadrilateral all the angle is greater than 180°.

12. In any quadrilateral, if a pair of opposite sides is equal, it is a parallelogram.

13. If three sides of a quadrilateral are equal, it is a parallelogram.

## MATCH THE COLUMN

1.

| | Column – I | | Column – II |
|---|---|---|---|
| (A) | A quadrilateral in which both pairs of opposite side are parallel | (p) | kite |
| (B) | A quadrilateral whose all the sides are equal and each angle is 90° | (q) | two right |
| (C) | Sum of all angles of quadrilateral | (r) | parallelogram |
| (D) | Sum of the angles on a straight line | (s) | square |
| (E) | A quadrilateral in which two pairs of adjacent side are equal. | (t) | four right angles |

## SECTION -B (FREE RESPONSE TYPE)

## SUBJECTIVE QUESTIONS

## VERY SHORT ANSWER TYPE

1. If an angle of a parallelogram is two third of its adjacent angle, find the angles of the parallelogram.

2. Three angles of a quadrilateral are equal and the fourth angle is equal to 144°. Find each of the equal angle of the quadrilateral.

3. Two opposite angles of a parallelogram are $(3x - 2)°$ and $(50 - x)°$. Find the measure of each angle.

4. The sides of a rectangle are in the ratio 4 : 5. Find its sides if the perimeter is 90 cm.

5. Find the length of the diagonal of a rectangle whose sides are 12 cm and 5 cm.

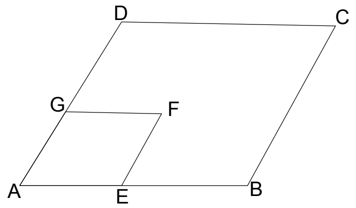
## SHORT ANSWER TYPE

6. In quadrilateral PQRS if $\angle P = 60°$ and $\angle Q : \angle R : \angle S = 2 : 3 : 7$, then find the measure of $\angle S$.

7. PQRS is a trapezium in which PQ || RS. If $\angle P = \angle Q = 50°$, what are the measures of the other two angles?

**8.** The perimeter of a parallelogram is 150 cm. One of its sides is greater than the other by 25 cm. Find the length of the sides of the parallelogram.

**9.** In **figure**, ABCD and AEFG are each a parallelogram. If ∠C = 55°, what is the measure of ∠F ?

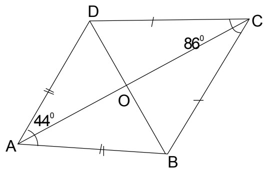



**10.** EFGH is a square. ∠E = x + 60 and EF = x + 1 cm. Find the perimeter of EFGH.

**11.** Diagonal AC of a rhombus ABCD is equal to one of its side BC. Find all the angles of the rhombus.

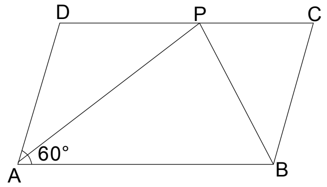
## LONG ANSWER TYPE

**12.** In figure, ABCD is a kite whose diagonals intersect at O. If ∠DAB = 44° and ∠BCD = 86°
**Find :** (i) ∠ODA (ii) ∠OBC




**13.** The diagonals of a quadrilateral are of lengths 6 cm and 8 cm. If the diagonals bisect each other at right angles, what is the length of each side of the quadrilateral ?

**14.** In **figure**, ABCD is a parallelogram in which ∠A = 60°. If the bisectors of ∠A and ∠B meet at P, prove that AD = DP, PC = BC and DC = 2AD.




**15.** The diagonals of a ||gm PQRS intersect at O. A line through O intersects PQ at M and RS at N. Prove that OM = ON.

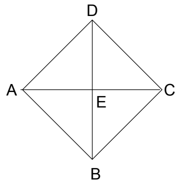
# Exercise-2

## SECTION -A (COMPETITIVE EXAMINATION QUESTION)

## OBJECTIVE QUESTIONS

**1.** The ratio of two sides of a parallelogram is as 3 : 5, and its perimeter is 48 m, then the sides of the parallelogram is :
(A) 9 m, 15 m (B) 3 m, 5 m (C) 33 m, 25 m (D) None of these

**2.** In the figure, parallelogram ABCD is composed of four congruent triangles. If BE = 3 cm and CE = 4 cm then the perimeter of the entire figure is :

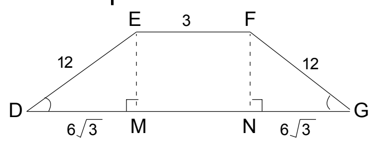



(A) 20 cm (B) 25 cm (C) 22 cm (D) None of these

**3.** The diagonals of a square with area 9 $m^2$ divide the square into four non-overlapping triangles. What is the sum of the perimeter of the four triangles ?

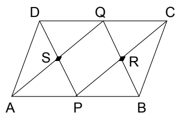
(A) 12 m (B) $12\sqrt{2}$ m (C) $12 + 12\sqrt{2}$ m (D) none of these

**4.** In given figure, area of isosceles trapezium DEFG is :



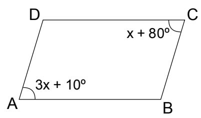

(A) $18(1 + \sqrt{3})$ (B) $18\sqrt{3}$ (C) $\sqrt{3} + 1$ (D) $18(1 + 2\sqrt{3})$

**5.** In fig. ABCD is a parallelogram. P and Q are mid points of the sides AB and CD, respectively. Then PRQS is :




(A) Parallelogram (B) Trapezium (C) Rectangle (D) None of these

**6.** In the given figure ABCD is parallelogram. Then, find the value of x if $\angle A = 3x + 10$ and $\angle C = x + 80^\circ$.

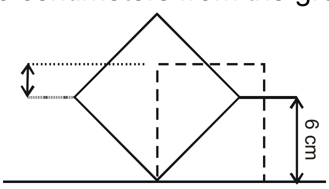



(A) 40° (B) 35° (C) 60° (D) 115°

**7.** The diagonals of a parallelogram ABCD intersect each other at the point O. If $\angle DAC = 32^\circ$ and $\angle AOB = 70^\circ$, then $\angle DBC$ is :

(A) 24° (B) 32° (C) 38° (D) 86°

**8.** A square board side 10 centimeters, standing vertically, is tilted to the left so that the bottom-right corner is raised 6 centimeters from the ground.



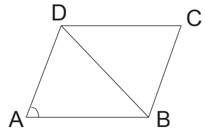

By what distance is the top-left corner lowered from its original position ?

(A) 1 cm (B) 2 cm (C) 3 cm (D) 0.5 cm

**9.** A quadrilateral ABCD has four angles $x^\circ$, $2x^\circ$, $\frac{5x^\circ}{2}$ and $\frac{7x^\circ}{2}$ respectively. What is the difference between the value of biggest and the smallest angles.

(A) 40° (B) 100° (C) 80° (D) 20°

**10.** Diagonal DB of a rhombus ABCD is equal to one of its sides.




The values of ∠A is :

(A) 30º (B) 60º (C) 120º (D) 90º

## SECTION -B (TECHIE STUFF)

**11.** LMNO is a trapezium with LM || NO. If P and Q are the mid-points of LO and MN respectively and LM = 5 cm and ON = 10 cm, then PQ =

(A) 2.5 cm (B) 5 cm (C) 7.5 cm (D) 15 cm

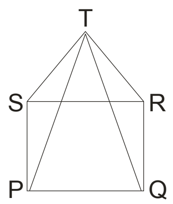
**12.** The figure formed by joining the midpoints of the pairs of consecutive sides of a rectangle is a

(A) kite (B) rectangle (C) rhombus (D) trapezium

# Exercise-3

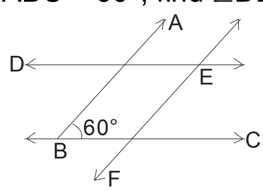
## (PREVIOUS YEAR EXAMINATION QUESTIONS)

**1.** In the figure PQRS is a square and SRT is an equilateral traingle. Then find ∠TQR **[Aryabhatta 2002]**



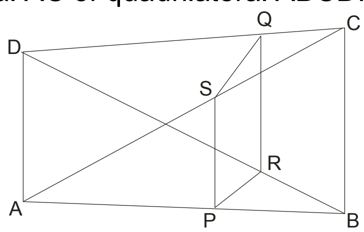

(A) 60° (B) 90° (C) 30° (D) 15°

**2.** In figure AB || EF, DE || BC & ∠ABC = 60°, find ∠DEF **[Aryabhatta 2002]**




(A) 60° (B) 120° (C) 30° (D) 80°

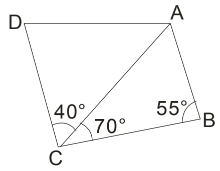
**3.** In the given figure, points P, Q, R and S are respectively the mid points of side AB, side CD, diagonal BD and diagonal AC of quadrilateral ABCD. The quadrilateral PRQS is a




**[Aryabhatta-2004]**

(A) rectangle (B) rhombus (C) square (D) parallogram

**4.** In the diagram DA = CB what is the measure of $\angle DAC$ ? **[NSTSE - 2009]**

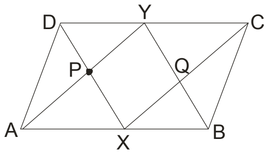



(A) 70° (B) 100° (C) 95° (D) 125°

**5.** Each angle of a rectangle is bisected. Let P,Q,R and S be the points of intersection of the pairs of bisectors adjacent to the same side of the rectangle. Then PQRS is a **[NSTSE - 2009]**

(A) rectangle
(B) rhombus
(C) parallelogram with unequal adjacent sides
(D) quadrilateral with no special property

**6.** X, Y are the mid points of opposite sides AB and DC of a parallelogram ABCD. AY and DX are joined intersecting in P, CX and BY are joined intersecting in Q. The PXQY is **[NSTSE - 2010]**




(A) rectangle (B) rhombus (C) parallelogram (D) square

**7.** Of all quadrilaterals of a given perimeter, which has the largest area ? **[Aryabhatta 2010]**
(A) square (B) rectangle (C) parallelogram (D) rhombus

**8.** ABCD is a parallelogram. The angle bisectors of $\angle A$ and $\angle D$ meet at O. The measure of $\angle AOD$ is ____. **(IMO 2010)**
(A) 45º (B) 90º
(C) Depends on the angles A and D (D) Not able to determine from given data

**9.** The diagonal of a rectangle is thrice its smaller side. The ratio of its sides is
(A) $\sqrt{2}:1$ (B) $2\sqrt{2}:1$ (C) 3 : 2 (D) $\sqrt{3}:1$

**10.** In a quadrilateral ABCD, AB || CD and AD = BC = 7 cm. If $\angle A = 70°$ then the measure of $\angle C$ is **[Aryabhatta-2011]**
(A) 70° (B) 100° (C) 80° (D) 110°

**11.** Smallest angle of a triangle ¡s equal to two-third the smallest angle of a quadrilateral. The ratio of the angles of the quadrilateral is 3 : 4 : 5 : 6. Largest angle of the triangle is twice its smallest angle. What is the sum of second largest angle of the triangle and largest angle of the quadrilateral ? **(IMO 2011)**
(A) 160º (B) 180º (C) 190º (D) 170º

**12.** Which of the following statements is INCORRECT? **(IMO 2011)**
(A) All rhombuses are parallelograms. (B) All squares are parallelograms.
(C) All rectangles are not squares. (D) All squares are trapeziums.

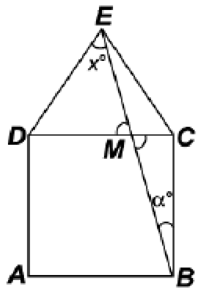
**13.** A quadrilateral that is not a parallelelogram but has exactly two equal opposite angles is **[NSTSE - 2012]**

(A) a rhombus (B) a trapezium (C) a square (D) a kite

**14.** Find the measure of largest angle of a quadrilateral if the measures of its interior angles are in the ratio of 3 : 4: 5 : 6. **(IMO 2012)**

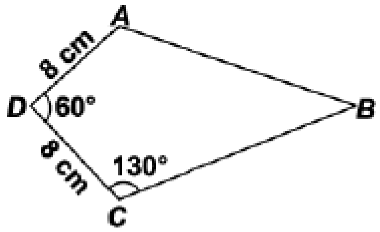
(A) 60º (B) 120º (C) 90º (D) Can't be determined

**15.** In the given diagram, equilateral triangle EDC surmounts square ABCD. Find ∠BED represented by x, where EBC = $\alpha$º. **(IMO 2012)**




(A) 45° (B) 60° (C) 30° (D) None of these

**16.** In the kite ABCD, AD = CD = 8 cm, ∠ADC = 60°, ∠DCB = 130° and AB = CB. Find ∠ABC.




**(IMO 2012)**

(A) 50º (B) 40º (C) 60º (D) 25°

**17.** In a parallelogram, **(IMO 2012)**

Statement 1 : Diagonals bisect each other.

Statement 2 : Diagonals divide the parallelogram into two triangles.

(A) Only statement 1 ¡s true. (B) Only statement 2 is true.

(C) Both statement 1 and 2 are true. (D) Both statement 1 and 2 are false.

# Answer Key

## Exercise-1

### SECTION -A (FIXED RESPONSE TYPE)

### OBJECTIVE QUESTIONS

| Ques. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ans. | A | A | D | B | A | B | D | D | B | C | B | A | C | C | A | B |

### FILL IN THE BLANKS

**1.** convex **2.** trapezium **3.** kite **4.** Congruent

**5.** perpendicular **6.** square **7.** Concave **8.** Diagonal

**9.** isosceles **10.** rhombus

### TRUE / FALSE

**1.** True **2.** False **3.** True **4.** False

**5.** True **6.** True **7.** True **8.** False

**9.** True **10.** True **11.** False **12.** False

**13.** False

### MATCH THE COLUMN

**1.** (A) – r, (B) – s, (C) – t, (D) – q, (E) – p

### SECTION -B (FREE RESPONSE TYPE)

### SUBJECTIVE QUESTIONS

### VERY SHORT ANSWER TYPE

**1.** 108°, 72°, 108°, 72° **2.** 72° **3.** 37°, 143°, 37°, 143°

**4.** 20 cm, 25 cm **5.** 13 cm

### SHORT ANSWER TYPE

**6.** $\angle S = 175°$. **7.** 130°, 130° **8.** 50 cm , 25 cm

**9.** $55^0$ **10.** 124 cm **11.** 120°, 60°, 120°, 60°

### LONG ANSWER TYPE

**12.** **(i)** 68° **(ii)** 47° **13.** 5 cm.

# Exercise-2

## SECTION -A (COMPETITIVE EXAMINATION QUESTION)

## OBJECTIVE QUESTIONS

| Ques. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ans. | A | A | D | D | A | B | C | B | B | B | C | C |

# Exercise-3

## PREVIOUS YEAR EXAMINATION QUESTIONS

| Ques. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ans. | D | A | D | A | A | C | A | B | B | D | B | D | D | B | A | B | A |