8th CLASS

MATHEMATICS

IIT FOUNDATION

STUDY MATERIAL

3. QUADRILATERALS

TECHING TASK

JEE MAINS LEVEL QUESTIONS

① Side length of Square ABCD = $5\sqrt{2}$ cm

So, the side length of the smaller square

$= \frac{1}{2}$ (Side of ABCD.)

$= \frac{1}{2} \times 5\sqrt{2} = \frac{1}{2} \times (5 \times 1.414) = \frac{7.07}{2} = 3.535$

Rounding to the nearest whole number, we get approximately 4.

ABCD = C

② Let x denote the measure of each of the three equal angles

$3x + 120 = 360^\circ$

$3x = 360^\circ - 120^\circ$

$3x = 240^\circ$ ANS: A

$x = \frac{240^\circ}{3}$

$x = 80^\circ$

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③ In a parallelogram, opposite angles are equal.

let the given angle be 100°

Now, let's denote the other two angles as x and y.

→ x and y are adjacent angles to 100°

$\Rightarrow x + 100^\circ = 180^\circ$

$\Rightarrow x = 180 - 100 \Rightarrow 80^\circ$

Similarly, the angle y, which is adjacent to 100°, will also be 80°

∴ The angles in the parallelogram are 100°, 80°, 100° and 80° Ans: A

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④ First, calculate the sum of ∠A and ∠B

$\therefore \angle A + \angle B = 60^\circ + 120^\circ = 180^\circ$ Ans: B

$\therefore \angle C + \angle D = 60^\circ + 120^\circ = 180^\circ$

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⑤ In a trapezium ABCD where AB is parallel to CD,

→ ∠A and ∠D are consecutive angles ~~are~~ on the same side of the transversal AD formed by the non-parallel sides of the trapezium, meaning they add up to 180°

→ ∠B and ∠C are consecutive angles on the opposite side of the transversal BC. These angles are also supplementary. $\angle A + \angle D = 180^\circ$

$\angle B + \angle C = 18^\circ$ Ans: C

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(6) AD || EF || BC,

EB = 2AE, DF = 1.5 cm, Length of FC is

All are parallel lines so,

$AE = DF$, $BE = FC$

$FC = 2DF \Rightarrow FC = 2 \times 1.5\,cm$

$FC = 3\,cm$. Ans: B

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(7) In a parallelogram ABCD, opposite angles are equal.

Let's denote the given angles are $\angle A$ and $\angle C$

$\angle A = 2x + 30^\circ$, $\angle C = x + 120^\circ$

$\angle A = \angle B$

$\Rightarrow 2x + 30^\circ = x + 120^\circ$

$\Rightarrow 2x - x = 120^\circ - 30^\circ$ Ans: B

$\Rightarrow x = 90^\circ$

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(8) In a parallelogram ABCD, the diagonals bisect each others.

→ Let $\angle A$ be the angle at vertex A.

→ Let $\angle B$ be the angle at vertex B.

$\angle A = \angle C$ and $\angle B = \angle D$

$\angle AOB = \frac{180^\circ}{2} = 90^\circ$ Ans = B

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(9) In a Rectangle ABCD, the diagonal bisect each other at right angles:

So, $\angle BOC = \frac{1}{2} \times 90^\circ = 45^\circ$ Ans: No correct option.

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(10) In trapezium ABCD where AB is parallel to DC, given that $\angle ABC = 120^\circ$

Since $\angle ABC = 120^\circ$,

$\angle BCD + \angle ABC = 180^\circ$

$\angle BCD + 120^\circ = 180^\circ$ Ans: D

$\angle BCD = 180^\circ - 120^\circ$

$\angle BCD = 60^\circ$

JEE ADVANCED LEVEL QUESTIONS

Multi Correct answer type questions:

(11) In a parallelogram ABCD, opposite angles are equal. Given that $\angle A = 115^\circ$,

$\angle C = \angle A$, opposite angles in a parallelogram are equal.

$\angle C = 115^\circ$.

$\angle B$ and $\angle D$ are adjacent angles to angle A and $\angle C$.

$\angle B + \angle A = 180^\circ$

$\angle B = 180^\circ - 115^\circ$

$\therefore \angle D + \angle C = 180^\circ$

$\angle D = 180^\circ - 115^\circ$

$\angle A = 115^\circ$

$\angle C = 115^\circ$

$\angle B = \angle D = 65^\circ$

Ans: A, C, D

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(12) In a isosceles trapezium, the non-parallel sides are equal in length, and the angles on the same side of the ledg are equal. $\cdot \angle A = \angle B$
$\cdot \angle C = \angle D$

→ The diagonals of an isosceles trapezium are equal in lengths $AC = BD$

Ans: A and B

STATEMENT TYPE :

(13) Statement-I: PQRS is states to be a square.

→ PR and SQ are diagonals of the square, and they intersect at point O.

→ It is given that angle $POQ = 45°$

Statement-II: In a square, it is a well-known geometric property that the diagonals bisect each other and are angle bisectors.

→ This means each diagonal divides the angles at the vertices of the square into two equal parts.

Ans: A.

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(14) Statement-I: This statement is true. By definition a rhombus is a parallelogram with all sides equal. If two adjacent sides are equal in a parallelogram, it meets the criteria to be classified as a rhombus.

Statement-II: It a true. A quardrilateral is indeed a closed geometric figure formed by four line segments.

Ans: A

Comprehension type:

(15) Given that, If $\triangle ABC$ is an equilateral triangle, each angle measures 60°.

$\therefore \angle ACB = 60^\circ$ Ans: 60°

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(16) At LB is a Right angle so

$$\angle OBC = \frac{\angle B}{2} = \frac{90}{2} = 45^\circ \quad \text{Ans} = D$$

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Integer type:

(17) In a parallelogram, the diagonals bisects each other. This means that O is the midpoint of both diagonals.

$OE = 4\,cm$,

Let $PE = x$, According to the problem, HL is 5cm more than PE:

$HL = PE + 5$

Since O is the midpoint of the diagonals:

$OE = OH = \frac{1}{2} \times EH$

$\therefore OH = 4\,cm$.

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(18) In a parallelogram:

→ LR = LN, opposite angles are equal.

$\therefore LN = LR = 70^\circ$

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Matching Type :

(19) (a) $\angle BAC = 32^\circ$, Since ABCD is a rectangle, opposite angles are equal, $\angle BAC = \angle ADL = 32^\circ$

$\angle DBC = 90^\circ - \angle BAC$

$\angle DBC = 90^\circ - 32^\circ = 58^\circ$ Ans: q

(b) In a rectangle, the diagonals bisect each other at right angles. $\angle BOC = \angle AOD = 44^\circ$

$\therefore \angle OAD$, which is a part of $\angle AOD$ is

$\angle OAD = 90^\circ - \angle AOD \Rightarrow 90^\circ - 44^\circ$

$\angle OAD = 46^\circ$ Ans: No correct option

(c) ABCD is a rhombus, all sides are equal

→ Adjacent angles are supplementary 180°.

$\angle ABC = 56^\circ$

$\angle ABC + \angle ACD = 180^\circ$

$56^\circ + \angle ACD = 180^\circ \Rightarrow \angle ACD = 180^\circ - 56^\circ = 124^\circ$

Ans: No correct option

(d) ABCD is a parallelogram, opposite angles are equal

$\angle A = 82^\circ$, $\angle A = \angle D = 82^\circ$.

Ans: No correct option

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(20)

(a) The Isosceles trapezium non-parallel sides are of equal length. Ans: P

(b) A quadrilateral having two pairs of equal adjacent sides but unequal opposite sides is called a kite. Ans: Q

(c) One pair of opposite side are parallel, this difines a trapezium also known as a trapezoid in some regions. Ans: S

(d) This describes a parallelogram, where each diagonal divides the quadrilateral into two congruent triangles. Ans: R

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LEARNERS TASK

Conceptual understanding questions:

(1) Each diagonal of a parallelogram divides it into two pairs of congruent triangles, for a total of 4 triangles.

Ans: C

(2) In a parallelogram, opposite angles are supplementary so $\angle A + \angle G = 180^\circ$

Ans: C

(3) Each diagonal of a rhombus divides it into two congruent isosceles triangles, since the diagonals bisect each other and the sides of a rhombus are all equal.

Ans: B

(4) In a rhombus, opposite angles are equal. This is a property of parallelograms, and a rhombus is a type of parallelogram.

Ans: A

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(5) In a Square, Rectangle and rhombus, the diagonals bisect each other. This means that the point of intersection of the diagonals divides each diagonal into two equal parts.

These three quadrilaterals are all types of parallelograms, and this property is a characteristic of parallelograms.

Ans: D

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(6) The sum of the interior angles of a quadrilateral (a four-sided shape) is always 360°. This is a fundamental property of quadrilaterals and is used extensively in geometry and trigonometry.

Ans: D

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(7) Since the rhombus is a parallelogram, opposite angles are equal. So $\angle A = \angle C = 70°$

Additionally, the diagonals of a rhombus bisect each other at a 90° angle, forming four right triangles. Using the properties of triangles, we can find the measure of $\angle CDB$.

$$\angle CDB = \frac{180° - 70°}{2} = 55° \Rightarrow \angle CDB = 55°$$

Ans: C

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(8) A trapezium is a quadrilateral with one pair of opposite sides that are parallel. The other pair of sides may or may not be parallel. This is the defining characteristic of a trapezium.

Ans: D

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(9) A Rectangle is a quadrilateral with:

* Opposite sides that are equal (A)
* Diagonals that are equal (B)
* All angles being right angle 90° (C)

Ans: D

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(10) A parallelogram with one right angle 90° is a Rectangle. This is a defining property of Rectangles, which are a type of parallelogram.

Ans: B

JEE MAINS LEVEL QUESTIONS

(1) The sum of the interior angles of a quadrilateral is always 360°. If the sum of three angles is 320°, then the fourth angle can be found by substituting 320° from 360°

∴ 360° - 320° = 40° Ans: C

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(2) A Square is a quadrilateral with all sides equal and all internal angles right angles ($90°$). Since all four angles are equal, each interior angle of a square is $90°$

Ans: B

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(3) In a rhombus, the diagonals bisect each other at $90°$ angle.

Let x be the length of the other diagonal.

$$(10cm)^2 = (8cm)^2 + \left(\frac{x}{2}\right)^2$$

$$x^2 = 100 - 64 \ cm^2$$

$$x^2 = 36cm^2 \Rightarrow x = \sqrt{36}$$

$$x = 6cm.$$

Ans: B

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(4) Since AB||CD, the trapezium ABCD is isosceles, and AD=BC, which means the triangles ABD and BCD are congruent.

∴ corresponding angles are equal, $\angle A = \angle B$

Ans: A

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(5) Let the fourth angle be x.

* We know that the sum of the interior angles of a quadrilateral is always 360°

$$75^\circ + 90^\circ + 75^\circ + x = 360^\circ$$

$$240^\circ + x = 360^\circ \Rightarrow x = 360^\circ - 240^\circ$$

$$x = 120^\circ$$

Ans: D

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(6) In a rhombus, the diagonals bisect each other at a 90° angle, forming four right triangles.

$\angle ACB = 40^\circ$, the othe angle in the triangle ADB is $90^\circ - 40^\circ = 50^\circ$

Ans: C

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JEE ADVANCED LEVEL QUESTIONS

Multi correct answer type

(7) Through options:

A): In a trapezium, the diagonals do not necessarily bisects each other.

B): In an isosceles trapezium, the diagonals are equal in length. This is a property of isosceles trapeziums.

C): In a kite, the diagonals are indeed perpendicular to each other. A kite is a quadrilateral with two pairs of adjacent sides equal, and the diagonal intersect at a right angle

∴ Ans: B and C

Statement type:

(8) Statement-I : It is true, in a rhombus, the diagonals bisect each other at a 90° angle, forming four right triangles. $\angle AOB = 90°$

Statement-II : In a rhombus, the diagonals are not necessarily equal in magnitude. only the sides are equal. It is a false.

Ans: C

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Comprehension type

(9) The diagonals of a rhombus bisect each other,

$AO = OC = \frac{1}{2}(AC)$

$\Rightarrow AO = \frac{24}{2} = 12\text{cm}.$

Similarly $BO = OD = \frac{BD}{2} = \frac{18}{2} = 9\text{cm}.$

Ans: B

Integer answer type questions:

(10) The sum of the interior angles of a quadrilateral is always 360°, if all the angles are equal, each angle is $\frac{360^\circ}{4} = 90^\circ$

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(11) Matching type questions:

(a) In ABCD, $\angle A + \angle C = 180^\circ$,

Similarly opposite angles are equal

$\angle B + \angle D = 180^\circ$ Ans: q

(b) Sum of interior angles in a quadrilateral is 360° Ans: r

(c) Each interior angle $< 180^\circ$ is convex quadrilateral. Ans: s

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(d) Atleast one interior angle $> 180^\circ$ is concave quadrilateral. Ans: p

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