

MATHEMATICS

Chapter 3: Understanding Quadrilaterals



Important Questions

Multiple Choice Questions-

Question 1. The opposite sides of a parallelogram are of _____ length.

- (a) not equal
- (b) different
- (c) equal
- (d) none of these

Question 2. In the quadrilateral ABCD, the diagonals AC and BD are equal and perpendicular to each other. What type of a quadrilateral is ABCD?

- (a) A square
- (b) A parallelogram
- (c) A rhombus
- (d) A trapezium

Question 3. If ABCD is an isosceles trapezium, what is the measure of $\angle C$?

- (a) $\angle B$
- (b) $\angle A$
- (c) $\angle D$
- (d) 90°

Question 4. Which of the following is true for the adjacent angles of a parallelogram?

- (a) they are equal to each other
- (b) they are complementary angles
- (c) they are supplementary angles
- (d) none of these.

Question 5. State the name of a regular polygon of 6 sides.

- (a) pentagon
- (b) hexagon
- (c) heptagon
- (d) none of these

Question 6. The diagonal of a rectangle is 10 cm and its breadth is 6 cm. What is its length?

- (a) 6 cm
- (b) 5cm
- (c) 8cm

(d) 4cm

Question 7. The perimeter of a parallelogram is 180 cm. If one side exceeds the other by 10 cm, what are the sides of the parallelogram?

(a) 40 cm, 50 cm

(b) 45 cm each

(c) 50 cm each

(d) 45 cm, 50 cm

Question 8. A _____ is both 'equiangular' and 'equilateral'.

(a) regular polygon

(b) triangle

(c) quadrilateral

(d) none of these

Question 9. Which of the following quadrilaterals has two pairs of adjacent sides equal and diagonals intersecting at right angles?

(a) square

(b) rhombus

(c) kite

(d) rectangle

Question 10. Which one of the following is a regular quadrilateral?

(a) Square

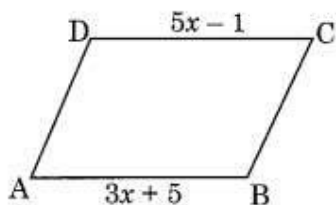
(b) Trapezium

(c) Kite

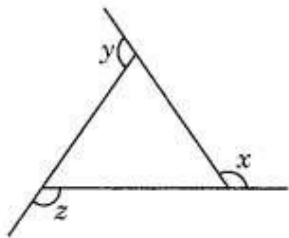
(d) Rectangle

Very Short Questions:

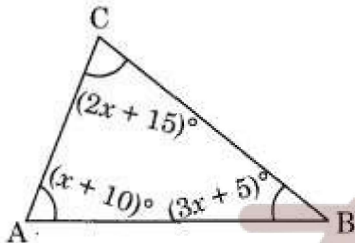
1. In the given figure, ABCD is a parallelogram. Find x.



2. In the given figure find $x + y + z$.



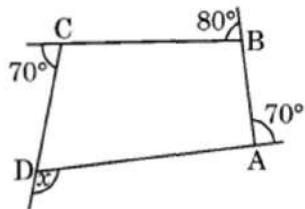
3. In the given figure, find x .



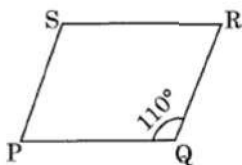
4. The angles of a quadrilateral are in the ratio of $2 : 3 : 5 : 8$. Find the measure of each angle.
5. Find the measure of an interior angle of a regular polygon of 9 sides.
6. Length and breadth of a rectangular wire are 9 cm and 7 cm respectively. If the wire is bent into a square, find the length of its side.

Short Questions :

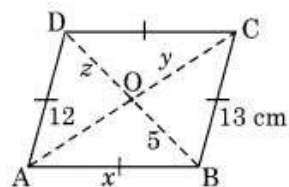
1. In the given figure ABCD, find the value of x .



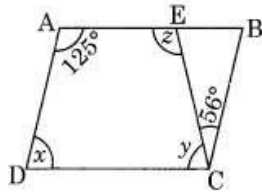
2. In the parallelogram given alongside if $m\angle Q = 110^\circ$, find all the other angles.



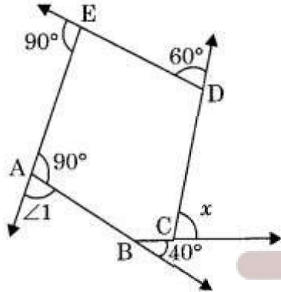
3. In the given figure, ABCD is a rhombus. Find the values of x , y and z .



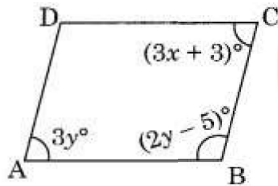
4. In the given figure, ABCD is a parallelogram. Find x , y and z .



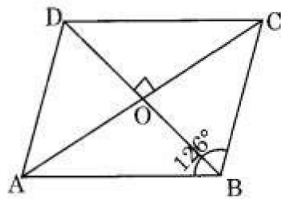
5. Find x in the following figure.



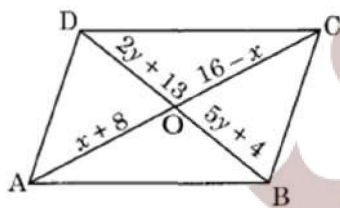
6. In the given parallelogram ABCD, find the value of x and y .



7. ABCD is a rhombus with $\angle ABC = 126^\circ$, find the measure of $\angle ACD$.

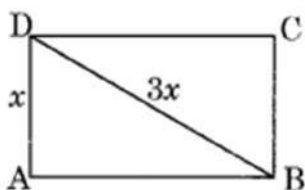


8. Find the values of x and y in the following parallelogram.



Long Questions :

- The sides AB and CD of a quadrilateral ABCD are extended to points P and Q respectively. Is $\angle ADQ + \angle CBP = \angle A + \angle C$? Give reason.
- The diagonal of a rectangle is thrice its smaller side. Find the ratio of its sides.



3. If AM and CN are perpendiculars on the diagonal BD of a parallelogram ABCD, Is $\triangle AMD = \triangle CNB$? Give reason.

Answer Key-

Multiple Choice questions-

1. (c) equal
2. (a) A square
3. (c) $\angle D$
4. (c) they are supplementary angles
5. (b) hexagon
6. (c) 8cm
7. (a) 40 cm, 50 cm
8. (a) regular polygon
9. (b) rhombus
10. (a) Square

Very Short Answer:

1. $AB = DC$ [Opposite sides of a parallelogram]
 $3x + 5 = 5x - 1$
 $\Rightarrow 3x - 5x = -1 - 5$
 $\Rightarrow -2x = -6$
 $\Rightarrow x = 3$
2. We know that the sum of all the exterior angles of a polygon = 360°
 $x + y + z = 360^\circ$
3. $\angle A + \angle B + \angle C = 180^\circ$ [Angle sum property]
 $(x + 10)^\circ + (3x + 5)^\circ + (2x + 15)^\circ = 180^\circ$
 $\Rightarrow x + 10 + 3x + 5 + 2x + 15 = 180$
 $\Rightarrow 6x + 30 = 180$
 $\Rightarrow 6x = 180 - 30$
 $\Rightarrow 6x = 150$
 $\Rightarrow x = 25$
4. Sum of all interior angles of a quadrilateral = 360°
Let the angles of the quadrilateral be $2x^\circ$, $3x^\circ$, $5x^\circ$ and $8x^\circ$.
 $2x + 3x + 5x + 8x = 360^\circ$

$$\Rightarrow 18x = 360^\circ$$

$$\Rightarrow x = 20^\circ$$

Hence the angles are

$$2 \times 20 = 40^\circ,$$

$$3 \times 20 = 60^\circ,$$

$$5 \times 20 = 100^\circ$$

$$\text{and } 8 \times 20 = 160^\circ.$$

5. Measure of an interior angle of a regular polygon

$$\text{of } n \text{ sides} = \frac{(n-2) \times 180^\circ}{n}$$

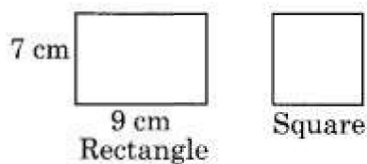
For $n = 9$, we have

$$\begin{aligned} \frac{(9-2) \times 180^\circ}{9} &= \frac{7 \times 180^\circ}{9} \\ &= 7 \times 20^\circ = 140^\circ \end{aligned}$$

Hence, the angle is 140° .

6. Perimeter of the rectangle = 2 [length + breadth]

$$= 2[9 + 7] = 2 \times 16 = 32 \text{ cm.}$$



Now perimeter of the square = Perimeter of rectangle = 32 cm.

$$\text{Side of the square} = \frac{32}{4} = 8 \text{ cm.}$$

Hence, the length of the side of square = 8 cm.

Short Answer:

1. Sum of all the exterior angles of a polygon = 360°

$$x + 70^\circ + 80^\circ + 70^\circ = 360^\circ$$

$$\Rightarrow x + 220^\circ = 360^\circ$$

$$\Rightarrow x = 360^\circ - 220^\circ = 140^\circ$$

2. Given $m\angle Q = 110^\circ$

Then $m\angle S = 110^\circ$ (Opposite angles are equal)

Since $\angle P$ and $\angle Q$ are supplementary.

$$\text{Then } m\angle P + m\angle Q = 180^\circ$$

$$\Rightarrow m\angle P + 110^\circ = 180^\circ$$

$$\Rightarrow m\angle P = 180^\circ - 110^\circ = 70^\circ$$

$$\Rightarrow m\angle P = m\angle R = 70^\circ \text{ (Opposite angles)}$$

$$\text{Hence } m\angle P = 70, m\angle R = 70^\circ$$

$$\text{and } m\angle S = 110^\circ$$

3. $AB = BC$ (Sides of a rhombus)

$$x = 13 \text{ cm.}$$

Since the diagonals of a rhombus bisect each other

$$z = 5 \text{ and } y = 12$$

$$\text{Hence, } x = 13 \text{ cm, } y = 12 \text{ cm and } z = 5 \text{ cm.}$$

4. $\angle A + \angle D = 180^\circ$ (Adjacent angles)

$$\Rightarrow 125^\circ + \angle D = 180^\circ$$

$$\Rightarrow \angle D = 180^\circ - 125^\circ$$

$$x = 55^\circ$$

$$\angle A = \angle C \text{ [Opposite angles of a parallelogram]}$$

$$\Rightarrow 125^\circ = y + 56^\circ$$

$$\Rightarrow y = 125^\circ - 56^\circ$$

$$\Rightarrow y = 69^\circ$$

$$\angle z + \angle y = 180^\circ \text{ (Adjacent angles)}$$

$$\Rightarrow \angle z + 69^\circ = 180^\circ$$

$$\Rightarrow \angle z = 180^\circ - 69^\circ = 111^\circ$$

$$\text{Hence the angles } x = 55^\circ, y = 69^\circ \text{ and } z = 111^\circ$$

5. In the given figure $\angle 1 + 90^\circ = 180^\circ$ (linear pair)

$$\angle 1 = 90^\circ$$

Now, sum of exterior angles of a polygon is 360° , therefore,

$$x + 60^\circ + 90^\circ + 90^\circ + 40^\circ = 360^\circ$$

$$\Rightarrow x + 280^\circ = 360^\circ$$

$$\Rightarrow x = 80^\circ$$

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

$$3y + 2y - 5 = 180^\circ$$

$$\Rightarrow 5y - 5 = 180^\circ$$

$$\Rightarrow 5y = 180 + 5^\circ$$

$$\Rightarrow 5y = 185^\circ$$

$$\Rightarrow y = 37^\circ$$

Now $\angle A = \angle C$ [Opposite angles of a parallelogram]

$$3y = 3x + 3$$

$$\Rightarrow 3 \times 37 = 3x + 3$$

$$\Rightarrow 111 = 3x + 3$$

$$\Rightarrow 111 - 3 = 3x$$

$$\Rightarrow 108 = 3x$$

$$\Rightarrow x = 36^\circ$$

Hence, $x = 36^\circ$ and $y = 37^\circ$.

7. $\angle ABC = \angle ADC$ (Opposite angles of a rhombus)

$$\angle ADC = 126^\circ$$

$\angle ODC = \frac{1}{2} \angle ADC$ (Diagonal of rhombus bisects the respective angles)

$$\Rightarrow \angle ODC = \frac{1}{2} \times 126^\circ = 63^\circ$$

$\Rightarrow \angle DOC = 90^\circ$ (Diagonals of a rhombus bisect each other at 90°)

In $\triangle OCD$,

$$\angle OCD + \angle ODC + \angle DOC = 180^\circ \text{ (Angle sum property)}$$

$$\Rightarrow \angle OCD + 63^\circ + 90^\circ = 180^\circ$$

$$\Rightarrow \angle OCD + 153^\circ = 180^\circ$$

$$\Rightarrow \angle OCD = 180^\circ - 153^\circ = 27^\circ$$

Hence $\angle OCD$ or $\angle ACD = 27^\circ$

8. Since, the diagonals of a parallelogram bisect each other.

$$OA = OC$$

$$x + 8 = 16 - x$$

$$\Rightarrow x + x = 16 - 8$$

$$\Rightarrow 2x = 8$$

$$x = 4$$

Similarly, $OB = OD$

$$5y + 4 = 2y + 13$$

$$\Rightarrow 3y = 9$$

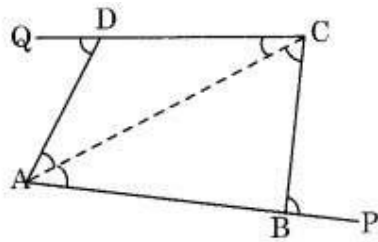
$$\Rightarrow y = 3$$

Hence, $x = 4$ and $y = 3$

Long Answer :

1. Join AC, then

$\angle CBP = \angle BCA + \angle BAC$ and $\angle ADQ = \angle ACD + \angle DAC$ (Exterior angles of triangles)



Therefore,

$$\begin{aligned} \angle CBP + \angle ADQ &= \angle BCA + \angle BAC + \angle ACD + \angle DAC \\ &= (\angle BCA + \angle ACD) + (\angle BAC + \angle DAC) \\ &= \angle C + \angle A \end{aligned}$$

2. Let $AD = x$ cm

diagonal $BD = 3x$ cm

In right-angled triangle DAB ,

$AD^2 + AB^2 = BD^2$ (Using Pythagoras Theorem)

$$x^2 + AB^2 = (3x)^2$$

$$\Rightarrow x^2 + AB^2 = 9x^2$$

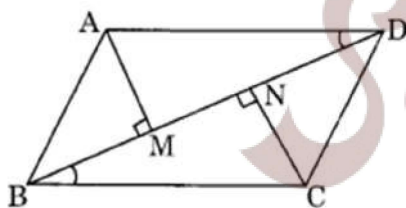
$$\Rightarrow AB^2 = 9x^2 - x^2$$

$$\Rightarrow AB^2 = 8x^2$$

$$\Rightarrow AB = \sqrt{8x} = 2\sqrt{2}x$$

Required ratio of $AB : AD = 2\sqrt{2}x : x = 2\sqrt{2} : 1$

- 3.



In triangles AMD and CNB ,

$AD = BC$ (opposite sides of parallelogram)

$$\angle AMD = \angle CNB = 90^\circ$$

$\angle ADM = \angle NBC$ ($AD \parallel BC$ and BD is transversal.)

So, $\triangle AMD = \triangle CNB$ (AAS)