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MATHS

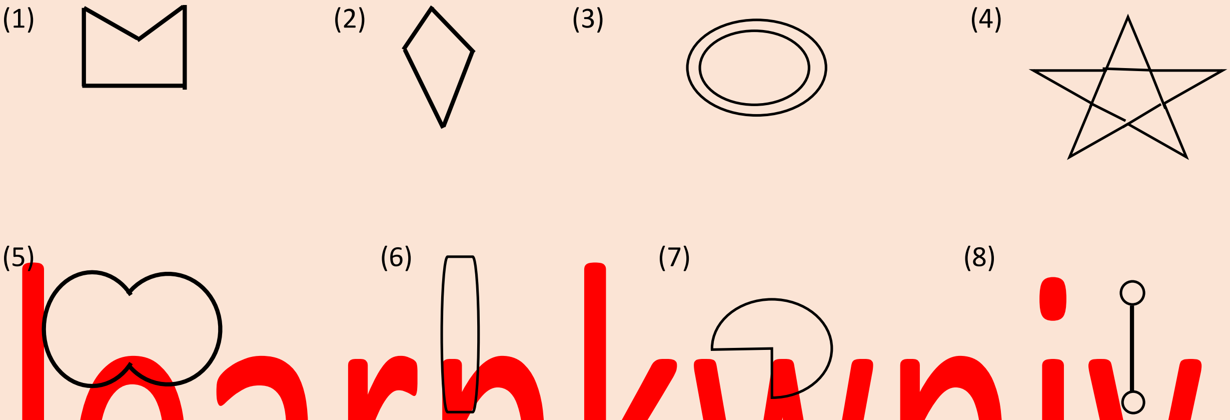
CHAPTER- 3rd

Understanding Quadrilaterals

EXERCISE- 3.1

NCERT SOLUTION

1. Given here are some figures.



Classify each of them on the basis of the following.

(a) Simple curve (b) Simple closed curve (c) Polygon (d) Convex polygon (e) Concave polygon

Ans.

(a) Simple Curve

From the given figures, simple curve figures are 1,2,5,6 and 7

(b) Simple closed curve

From the given figures, simple closed curve figures are 1,2,5,6 and 7

(c) Polygon

From the given figures, polygons are 1 and 2

(d) Convex polygon

From the given figures, convex polygon is figure 2

(e) Concave polygon

From the given figures, concave polygon is figure 1

2. What is a regular polygon? State the name of a regular polygon of (i) 3 sides (ii) 4 sides (iii) 6 sides

Ans.

When a polygon has equal side and equal angles, then we can say that the polygon is a regular polygon.

(i) 3 sides: Triangle is a three sided polygon.

(ii) 4 sides: Quadrilateral is a polygon having four sides.

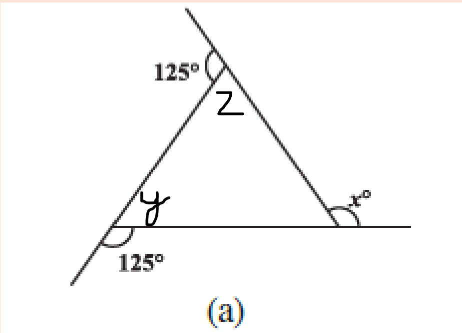
(iii) 6 sides: Hexagon is a polygon having four sides.

EXERCISE- 3.2

NCERT SOLUTION

1. Find x in the following figures.

(a)



Ans.

Here, $125^{\circ} + z = 180^{\circ}$

$z = 180^\circ - 125^\circ = 55^\circ$

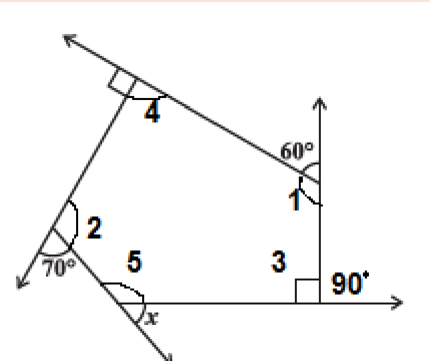
And, $125^\circ + y = 180^\circ$

$y = 180^\circ - 125^\circ = 55^\circ$

Exterior Angle x = Sum of opposite interior angles

$x^\circ = 55^\circ + 55^\circ = 110^\circ$

(b)



(b)

Ans.

Sum of angles of a pentagon $= (n-2) \times 180^\circ$

$= (5-2) \times 180^\circ$

$= 3 \times 180^\circ = 540^\circ$

$\angle 1 + 60^\circ = 180^\circ$

$\angle 1 = 180^\circ - 60^\circ$

$\angle 1 = 120^\circ$

$\angle 2 + 70^\circ = 180^\circ$

$\angle 2 = 180^\circ - 70^\circ$

$\angle 2 = 110^\circ$

$\angle 3 + 90^\circ = 180^\circ$

$\angle 3 = 180^\circ - 90^\circ$

$\angle 3 = 90^\circ$

$\angle 4 + 90^\circ = 180^\circ$

$\angle 4 = 180^\circ - 90^\circ$

$\angle 4 = 90^\circ$

Sum of all the angles of a pentagon is 540°

$\angle 1 + \angle 2 + \angle 3 + \angle 4 + \angle 5 = 540^\circ$

$120^\circ + 110^\circ + 90^\circ + 90^\circ + \angle 5 = 540^\circ$

$410^\circ + \angle 5 = 540^\circ$

$\angle 5 = 540^\circ - 410^\circ$

$\angle 5 = 130^\circ$

$\angle 5 + x = 180^\circ$

$130^\circ + x = 180^\circ$

$x = 180^\circ - 130^\circ$

$x = 50^\circ$

2. Find the measure of each exterior angle of a regular polygon of

(i) 9 sides

Ans.

Sum of angles of regular polygon $= (n - 2) \times 180^\circ$

$= (9 - 2) \times 180^\circ$

$= 7 \times 180^\circ = 1260^\circ$

Each interior angle $= \frac{\text{Sum of interior angles}}{\text{Number of sides}} = \frac{1260^\circ}{9} = 140^\circ$

Each exterior angle $= 180^\circ - 140^\circ = 40^\circ$

(ii) 15 sides

Ans.

Sum of angles of regular polygon $= (n - 2) \times 180^\circ$

$$= (15 - 2) \times 180^\circ$$

$$= 13 \times 180^\circ = 2340^\circ$$

Each interior angle $= \frac{Sum\ of\ interior\ angles}{Number\ of\ sides} = \frac{2340^\circ}{15} = 156^\circ$

Each exterior angle $= 180^\circ - 156^\circ = 24^\circ$

3. How many sides does a regular polygon have if the measure of an exterior angle is 24°?

Ans.

Sum of exterior angle of a regular polygon = 360°

Measure of an exterior angle = 24°

Let number of sides be n

Number of sides $(n) = \frac{Sum\ of\ exterior\ angles}{Exterior\ angles} = \frac{360^\circ}{24^\circ} = 15$ sides

Hence, the regular polygon has 15 sides.

4. How many sides does a regular polygon have if each of its interior angles is 165°?

Ans.

Interior angle $= 165^\circ$

Exterior angle $= 180^\circ - 165^\circ = 15^\circ$

Sum of exterior angles $= 360^\circ$

Number of sides $(n) = \frac{Sum\ of\ exterior\ angles}{Exterior\ angles} = \frac{360^\circ}{15^\circ} = 24$ sides

Hence, the regular polygon has 24 sides.

5. (a) Is it possible to have a regular polygon with measure of each exterior angle as 22°?

Ans.

No, because 22 is not a divisor of 360°

(b) Can it be an interior angle of a regular polygon? Why?

Ans.

No, because interior angle is $180^\circ - 22^\circ = 158^\circ$, which is not a divisor of 360°

6. (a) What is the minimum interior angle possible for a regular polygon? Why?

Ans.

An equilateral triangle is the regular polygon with 3 sides having the least measure of an interior angle of 60°.
Since the sum of all interior angles of a triangle = 180°
Each interior angle $= \frac{180^\circ}{3} = 60^\circ$

(b) What is the maximum exterior angle possible for a regular polygon?

Ans.

An equilateral triangle is the regular polygon with 3 sides having the maximum exterior angle of 120°.
Maximum exterior angle = 180 – 60° = 120°

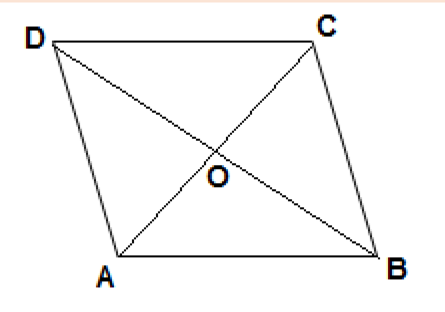
EXERCISE- 3.3

NCERT SOLUTION

1. Given a parallelogram ABCD. Complete each statement along with the definition or property used.

(i) AD =...... (ii) ∠DCB =......

(iii) OC =...... (iv) m ∠DAB + m ∠CDA = ...



Ans.

(i) AD =<u>BC</u>
(Opposite side of a parallelogram are equal.)

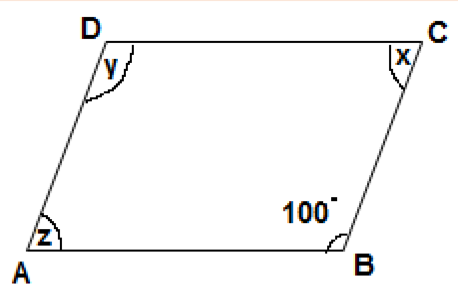
(ii) ∠DCB = <u>∠ACB</u>
(Opposite angle of a parallelogram are equal.)

(iii) OC = <u>OA</u>
(Opposite side of a parallelogram are equal.)

(iv) m ∠DAB + m ∠CDA = <u>180°</u>
(The adjacent angles in a parallelogram are supplementary.)

2. Consider the following parallelograms. Find the values of the unknowns x, y, z.

(i)



Ans.

$\angle B + \angle C = 180^\circ$ (The adjacent angles in a parallelogram are supplementary.)

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

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

$x = 80^\circ$

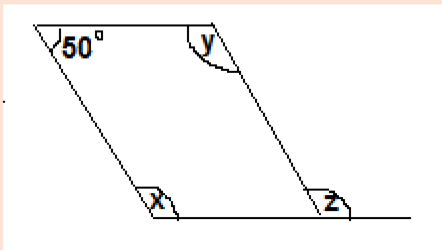
And, $\angle C = \angle D$ (Opposite angle of a parallelogram are equal)

$x = z$

$z = 80^\circ$

Also, $y = 100^\circ$ (Opposite angle of a parallelogram are equal)

(ii)



Ans.

$50^\circ + y = 180^\circ$ (The adjacent angles in a parallelogram are supplementary.)

$y = 180^\circ - 50^\circ$

$y = 130^\circ$

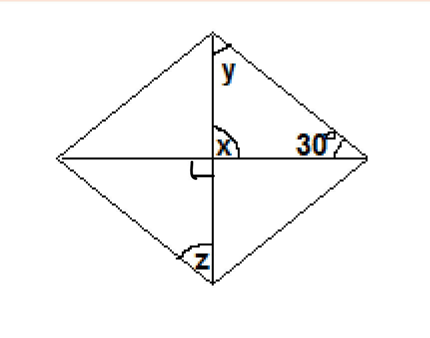
$x = y$ (Opposite angle of a parallelogram are equal)

$x = 130^\circ$

$x = z$ (Corresponding angle)

$z = 130^\circ$

(iii)



Ans.

$x = 90^\circ$ (Vertically opposite angles)

$x + y + 30^\circ = 180^\circ$ (Angle sum property of a triangle)

$90^\circ + y + 30^\circ = 180^\circ$

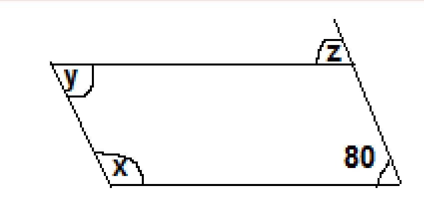
$y + 120^\circ = 180^\circ$

$y = 180^\circ - 120^\circ = 60^\circ$

$z = y$ (Alternate angle)

$z = 60^\circ$

(iv)



Ans.

$z = 80^\circ$ (Corresponding angle)

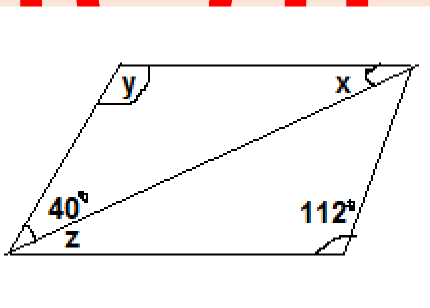
$x + 80^\circ = 180^\circ$ (The adjacent angles in a parallelogram are supplementary.)

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

$x = 100^\circ$

$y = 80^\circ$ (Opposite angle of a parallelogram are equal)

(v)



Ans.

$y = 112^\circ$ (Opposite angle of a parallelogram are equal)

$x + y + 40^\circ = 180^\circ$ (Angle sum property of a triangle)

$x + 112^\circ + 40^\circ = 180^\circ$

$x + 152^\circ = 180^\circ$

$x = 180^\circ - 152^\circ = 28^\circ$

$z = x$ (Alternate angle)

$z = 28^\circ$

3. Can a quadrilateral ABCD be a parallelogram if

(i) ∠D + ∠B = 180°?

Ans.

(i) Yes, a quadrilateral ABCD can be a parallelogram if ∠D + ∠B = 180° but it have to fulfil some conditions, which are:
(a) Sum of the adjacent angles should be 180°.
(b) Opposite angles must be equal.

(ii) AB = DC = 8 cm, AD = 4 cm and BC = 4.4 cm?

Ans.

No, here only one pair of opposite sides are equal and another pair of opposite sides are unequal. So it is not a parallelogram.

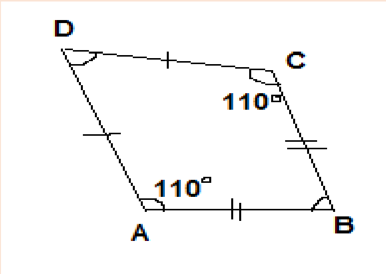
(iii) ∠A = 70° and ∠C = 65°?

Ans.

Since opposite angle of a parallelogram are equal and here opposite angles are not equal. Therefore it is not a parallelogram.

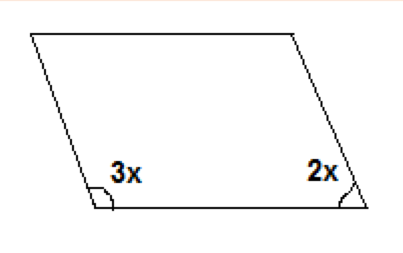
4. Draw a rough figure of a quadrilateral that is not a parallelogram but has exactly two opposite angles of equal measure.

Ans.



5. The measures of two adjacent angles of a parallelogram are in the ratio 3:2. Find the measure of each of the angles of the parallelogram.

Ans.



Let the two adjacent angle be $3x$ and $2\,x$

The adjacent angle of a parallelogram are supplementary

$\therefore 3x + 2x = 180^\circ$

$5x = 180^\circ$

$x = \frac{180^\circ}{5} = 36^\circ$

$\therefore$ One angle $= 3x = 3 \times 36^\circ = 108^\circ$

Another angle $= 2x = 2 \times 36^\circ = 72^\circ$

6. Two adjacent angles of a parallelogram have equal measure. Find the measure of each of the angles of the parallelogram.

Ans.

Let PQRS be a parallelogram.

Sum of adjacent angles of a parallelogram $= 180°$

$\angle P + \angle Q = 180°$

$\Rightarrow 2\angle P = 180°$

$\Rightarrow \angle P = 90°$

Also, $90° + \angle Q = 180°$

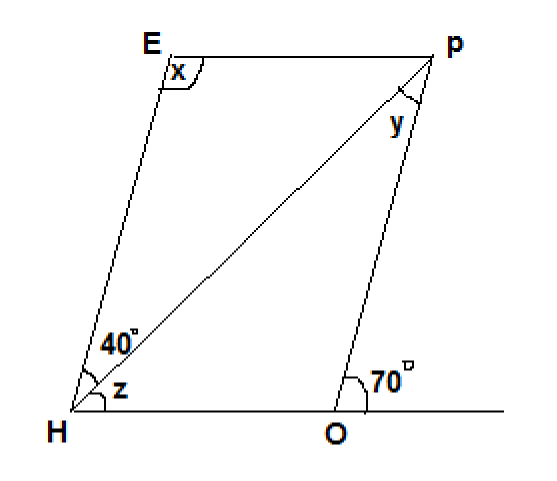
$\Rightarrow \angle Q = 180° - 90° = 90°$

$\angle P = \angle R = 90°$

$\angle Q = \angle S = 90°$

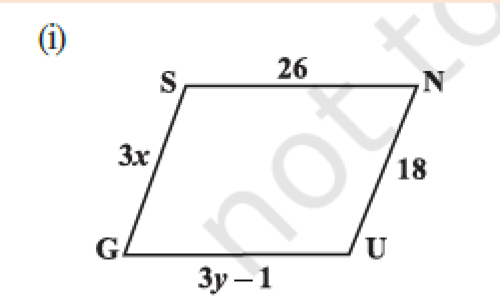
7. The adjacent figure HOPE is a parallelogram. Find the angle measures x, y and z. State the properties you use to find them.

Ans.



$y = 40°$ (alternate interior angle)
$\angle P = 70°$ (alternate interior angle)
$\angle P = \angle H = 70°$ (opposite angles of a parallelogram)
$z = \angle H - 40° = 70° - 40° = 30°$
$\angle H + x = 180°$
$\Rightarrow 70° + x = 180°$
$\Rightarrow x = 180° - 70° = 110°$

8. The following figures GUNS and RUNS are parallelograms. Find x and y. (Lengths are in cm)
(i)



Ans.

In a parallelogram
GS = UN
$3x = 18$
$x = \frac{18}{3} = 6$ cm
GU = SN (Opposite side of a parallelogram are equal)
$3y - 1 = 26$

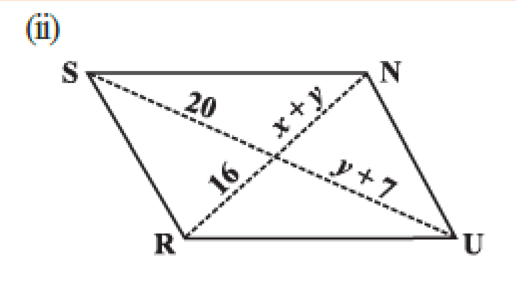
$3y = 26 + 1$

$3y = 27$

$y = \frac{27}{3} = 9$ cm

Hence, $x = 6$cm and $y = 9$cm.

(ii)



Ans.

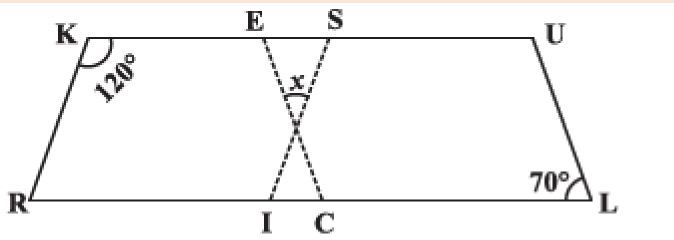
In a parallelogram RUNS,
$y + 7 = 20$ (Diagonal of parallelogram bisect each other)
$y = 20 - 7 = 13$ cm

And, $x + 13 = 16$

$x = 16 - 13 = 3$ cm

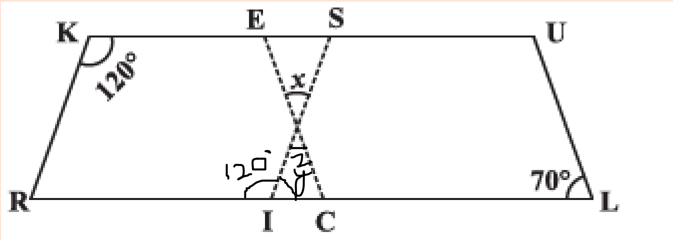
Hence, $x = 3$ cm and $y = 13$ cm.

9.



In the above figure both RISK and CLUE are parallelograms. Find the value of x.

Ans.



In a parallelogram RISK,
$\angle$ RIS $=\angle$ RKS $= 120^\circ$ (Opposite angle of a parallelogram are equal)

$120^\circ + y = 180^\circ$ (Linear pair)
$y = 180^\circ - 120^\circ = 60^\circ$

$\angle$ ECI $=\angle$ ULC $= 70^\circ$ (Corresponding Angle)

$y + z + \angle$ ECI $= 180^\circ$ (Angle sum property of a triangle)
$60^\circ + z + 70^\circ = 180^\circ$
$Z = 180^\circ - 130^\circ = 50^\circ$

$x = y = 50^\circ$ (Vertically opposite angle)

10. Explain how this figure is a trapezium. Which of its two sides are parallel? (Fig 3.26)

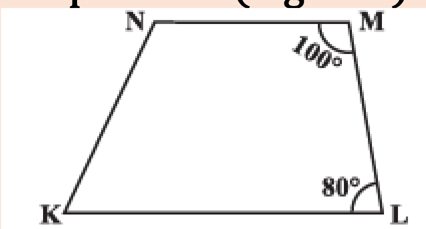


Fig 3.26

Ans.

In a given figure,
$\angle M + \angle L = 180^\circ$
$100^\circ + 80^\circ = 180^\circ$ (Sum of adjacent angles of a parallelogram = 180°)
∴ NM and KL are parallel.
Hence, KLMN is a trapezium.

11. Find m∠C in Fig 3.27 if $\overline{AB} \parallel \overline{DC}$.

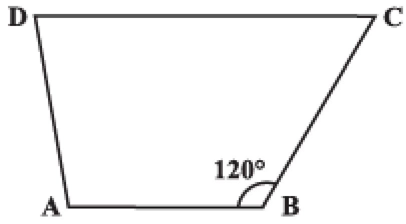


Fig 3.27

Ans.

In a given figure,

$\angle B + \angle C = 180^\circ$ (Sum of adjacent angles of a parallelogram = 180°)

$120^\circ + \angle C = 180^\circ$

$\angle C = 180^\circ - 120^\circ = 60^\circ$

12. Find the measure of ∠P and ∠S if SP ∥ RQ in Fig 3.28. (If you find m∠R, is there more than one method to find m∠P?)

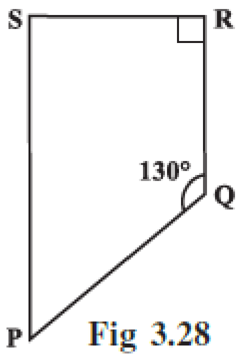


Fig 3.28

Ans.

$\angle P + \angle Q = 180^\circ$ (Interior angles on the same side of transversal)

$\angle P + 130^\circ = 180^\circ$

$\angle P = 180^\circ - 130^\circ = 50^\circ$

$\angle R = 90^\circ$

$\angle R + \angle S = 180^\circ$ (angles on the same side of transversal)

$\Rightarrow 90^\circ + \angle S = 180^\circ$

$\Rightarrow \angle S = 180^\circ - 90^\circ = 90^\circ$

Thus, $\angle P = 50^\circ$ and $\angle S = 90^\circ$

Yes, there are more than one method to find m∠P.
Sum of measures of all angles of a quadrilateral is 360°.
$\angle Q = 130°, \angle R = 90°$ and $\angle S = 90°$
$\angle P + 130° + 90° + 90° = 360°$
$\Rightarrow \angle P + 310° = 360°$
$\Rightarrow \angle P = 360° - 310° = 50°$

EXERCISE- 3.4

NCERT SOLUTION

1. State whether True or False.

(a) All rectangles are squares.

Ans.

False (All the sides of a square are equal)
(b) All rhombuses are parallelograms.

Ans.

True
(c) All squares are rhombuses and also rectangles.

Ans.

True
(d) All squares are not parallelograms.

Ans.

False (All squares have the same property of a parallelogram)
(e) All kites are rhombuses.

Ans.

False (Since all kites do not equal sides)

(f) All rhombuses are kites.

Ans.

True

(g) All parallelograms are trapeziums.

Ans.

True

(h) All squares are trapeziums.

Ans.

True

2. Identify all the quadrilaterals that have.

(a) Four sides of equal length

Ans.

Square and Rhombus

(b) Four right angles

Ans.

Rectangle ad square

3. Explain how a square is.

(i) A quadrilateral

Ans.

A square has 4 sides; so it is a quadrilateral.

(ii) A parallelogram

Ans.

A square has its opposite sides parallel and opposite angles are equal; so it is a parallelogram.

(iii) A rhombus

Ans.

A square is a parallelogram with all the 4 sides equal; so it is a rhombus.

(iv) a rectangle

Ans.

A square is a parallelogram with each angle a right angle; so it is a rectangle.

4. Name the quadrilaterals whose diagonals.

(i) bisect each other

Ans.

Rectangle, square, Rhombus and Parallelogram.

(ii) are perpendicular bisectors of each other

Ans

Rhombus and Square

(iii) are equal

Ans.

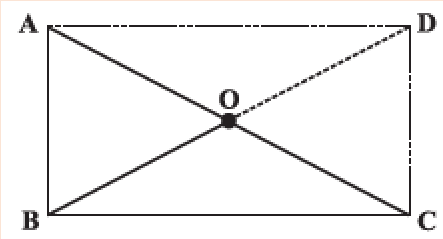
Rectangle and Square

5. Explain why a rectangle is a convex quadrilateral?

Ans.

A rectangle is a convex quadrilateral because both of its diagonals lie inside the rectangle.

6. ABC is a right-angled triangle and O is the midpoint of the side opposite to the right angle. Explain why O is equidistant from A, B and C. (The dotted lines are drawn additionally to help you).



Ans.

AD and DC are drawn so that AD || BC and AB || DC
AD = BC and AB = DC
(ABCD is a rectangle as opposite sides are equal and parallel to each other and all the interior angles are of 90°.In a rectangle, diagonals are of equal length and also bisect each other.)

Hence, AO = OC = BO = OD
Thus, O is equidistant from A, B and C.