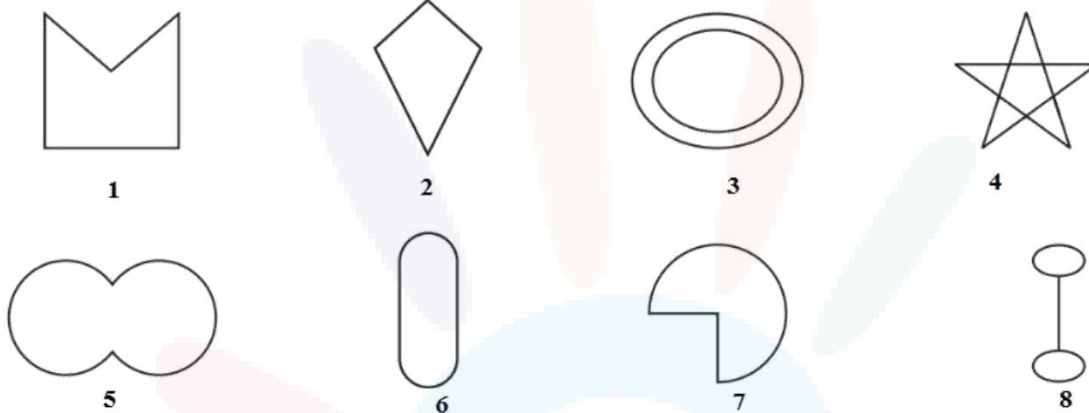


CLASS VIII: Maths

Chapter 3: Understanding Quadrilaterals

Questions and Solutions | Exercise 3.1 - NCERT Books

Question 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

Solution:

- a) Simple curve = 1, 2, 5, 6, 7
- b) Simple closed curve = 1, 2, 5, 6, 7
- c) Polygon = 1, 2
- d) Convex polygon = 2
- e) Concave polygon = 1

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

**Solution:**

Regular Polygon is a polygon with equal sides and equal angles.

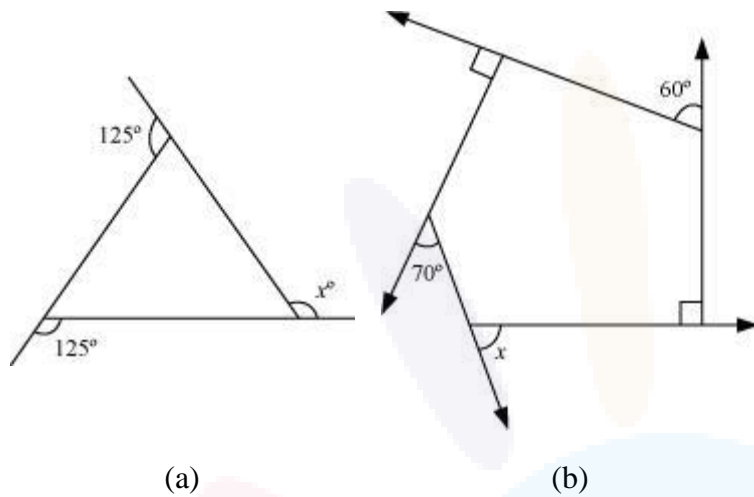
- (i) 3 sides : Equilateral triangle
- (ii) 4 sides : Square
- (iii) 6 sides : Regular Hexagon



Questions and Solutions | Exercise 3.2 - NCERT Books

Question 1.

Find x in the following figures.



Answer :

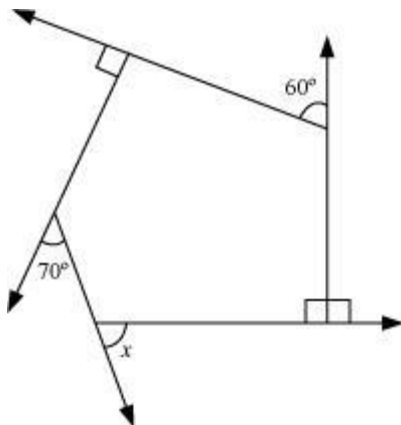
We know that the sum of all exterior angles of any polygon is 360° .

(a) $125^\circ + 125^\circ + x = 360^\circ$

$250^\circ + x = 360^\circ$

$x = 110^\circ$

(b)



$60^\circ + 90^\circ + 70^\circ + x + 90^\circ = 360^\circ$



$$310^\circ + x = 360^\circ$$

$$x = 50^\circ$$

Q2 :

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

(i) 9 sides

(ii) 15 sides

Answer :

(i) Sum of all exterior angles of the given polygon = 360°

Each exterior angle of a regular polygon has the same measure.

Thus, measure of each exterior angle of a regular polygon of 9 sides

$$= \frac{360^\circ}{9} = 40^\circ$$

(ii) Sum of all exterior angles of the given polygon = 360°

Each exterior angle of a regular polygon has the same measure.

Thus, measure of each exterior angle of a regular polygon of 15 sides

$$= \frac{360^\circ}{15} = 24^\circ$$

Q3 :

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

Answer :

Sum of all exterior angles of the given polygon = 360°



Measure of each exterior angle = 24°

Thus, number of sides of the regular polygon $= \frac{360^\circ}{24^\circ} = 15$

Q4 :

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

Answer :

Measure of each interior angle = 165°

Measure of each exterior angle = $180^\circ - 165^\circ = 15^\circ$

The sum of all exterior angles of any polygon is 360° .

Thus, number of sides of the polygon $= \frac{360^\circ}{15^\circ} = 24$

Q5 :

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

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

Answer :

The sum of all exterior angles of all polygons is 360° . Also, in a regular polygon, each exterior angle is of the same measure. Hence, if 360° is a perfect multiple of the given exterior angle, then the given polygon will be possible.

(a) Exterior angle = 22°

360° is not a perfect multiple of 22° . Hence, such polygon is not possible.

(b) Interior angle = 22°

Exterior angle = $180^\circ - 22^\circ = 158^\circ$



Such a polygon is not possible as 360° is not a perfect multiple of 158° .

Q6 :

(a) What is the minimum interior angle possible for a regular polygon

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

Answer :

Consider a regular polygon having the lowest possible number of sides (i.e., an equilateral triangle). The exterior angle of this triangle will be the maximum exterior angle possible for any regular polygon.

$$\text{Exterior angle of an equilateral triangle} = \frac{360^\circ}{3} = 120^\circ$$

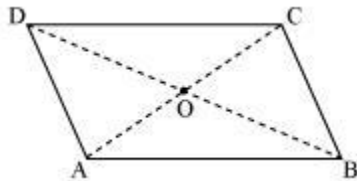
Hence, maximum possible measure of exterior angle for any polygon is 120° . Also, we know that an exterior angle and an interior angle are always in a linear pair.

$$\text{Hence, minimum interior angle} = 180^\circ - 120^\circ = 60^\circ$$

Questions and Solutions | Exercise 3.3 - NCERT Books

Q1 :

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



(i) AD = ...

(ii) $\angle DCB = \dots$

(iii) OC = ...

(iv) $m\angle DAB + m\angle CDA = \dots$

Answer :

(i) In a parallelogram, opposite sides are equal in length.

$$AD = BC$$

(ii) In a parallelogram, opposite angles are equal in measure.

$$\angle DCB = \angle DAB$$

(iii) In a parallelogram, diagonals bisect each other.

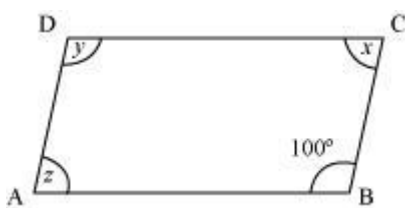
$$\text{Hence, } OC = OA$$

(iv) In a parallelogram, adjacent angles are supplementary to each other.

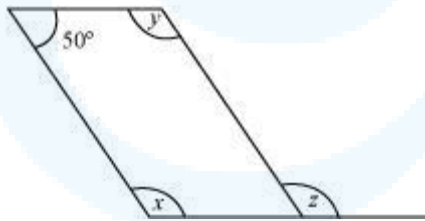
$$\text{Hence, } m\angle DAB + m\angle CDA = 180^\circ$$

Q2 :

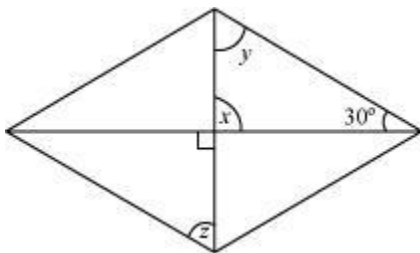
Consider the following parallelograms. Find the values of the unknowns x, y, z .



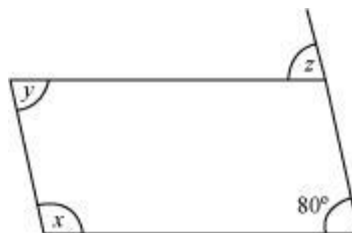
(i)



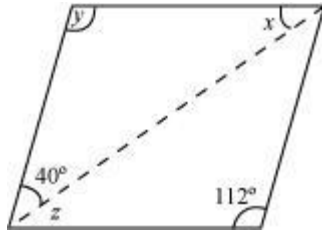
(ii)



(iii)



(iv)



(v)

Answer :(i) $x + 100^\circ = 180^\circ$ (Adjacent angles are supplementary)

$$x = 80^\circ$$

 $z = x = 80^\circ$ (Opposite angles are equal) $y = 100^\circ$ (Opposite angles are equal)(ii) $50^\circ + y = 180^\circ$ (Adjacent angles are supplementary)

$$y = 130^\circ$$

 $x = y = 130^\circ$ (Opposite angles are equal) $z = x = 130^\circ$ (Corresponding angles)(iii) $x = 90^\circ$ (Vertically opposite angles) $x + y + 30^\circ = 180^\circ$ (Angle sum property of triangles)

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

$$y = 60^\circ$$

 $z = y = 60^\circ$ (Alternate interior angles)(iv) $z = 80^\circ$ (Corresponding angles) $y = 80^\circ$ (Opposite angles are equal) $x + y = 180^\circ$ (Adjacent angles are supplementary)

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



(v) $y = 112^\circ$ (Opposite angles are equal)

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

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

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

$$x = 28^\circ$$

$z = x = 28^\circ$ (Alternate interior angles)

Q3 :

Can a quadrilateral ABCD be a parallelogram if

(i) $\angle D + \angle B = 180^\circ$

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

(iii) $\angle A = 70^\circ$ and $\angle C = 65^\circ$

Answer :

(i) For $\angle D + \angle B = 180^\circ$, quadrilateral ABCD may or may not be a parallelogram. Along with this condition, the following conditions should also be fulfilled.

The sum of the measures of adjacent angles should be 180° .

Opposite angles should also be of same measures.

(ii) No. Opposite sides AD and BC are of different lengths.

(iii) No. Opposite angles A and C have different measures.

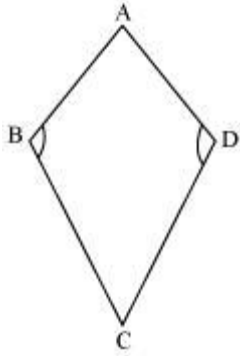
Q4 :

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



Answer :

Here, quadrilateral ABCD (kite) has two of its interior angles, $\angle B$ and $\angle D$, of same measures. However, still the quadrilateral ABCD is not a parallelogram as the measures of the remaining pair of opposite angles, $\angle A$ and $\angle C$, are not equal.



Q5 :

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.

Answer :

Let the measures of two adjacent angles, $\angle A$ and $\angle B$, of parallelogram ABCD are in the ratio of 3:2. Let $\angle A = 3x$ and $\angle B = 2x$

We know that the sum of the measures of adjacent angles is 180° for a parallelogram.

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

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

$$5x = 180^\circ$$

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

$$\angle A = \angle C = 3x = 108^\circ \text{ (Opposite angles)}$$

$$\angle B = \angle D = 2x = 72^\circ \text{ (Opposite angles)}$$



Thus, the measures of the angles of the parallelogram are 108° , 72° , 108° , and 72° .

Q6 :

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

Answer :

Sum of adjacent angles = 180°

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

$$2\angle A = 180^\circ \quad (\angle A = \angle B)$$

$$\angle A = 90^\circ$$

$$\angle B = \angle A = 90^\circ$$

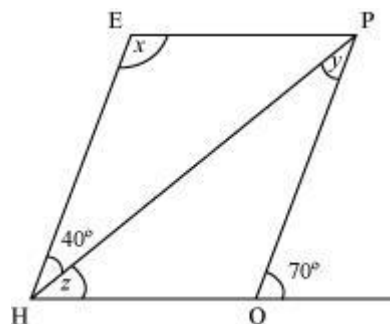
$$\angle C = \angle A = 90^\circ \quad (\text{Opposite angles})$$

$$\angle D = \angle B = 90^\circ \quad (\text{Opposite angles})$$

Thus, each angle of the parallelogram measures 90° .

Q7 :

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



Answer :

$$y = 40^\circ \text{ (Alternate interior angles)}$$

$$70^\circ = z + 40^\circ \text{ (Corresponding angles)}$$

$$70^\circ - 40^\circ = z$$

$$z = 30^\circ$$

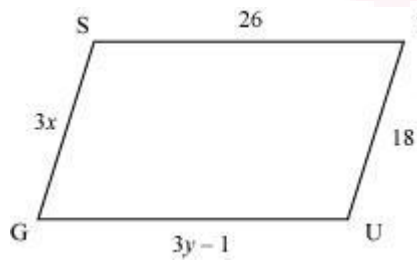
$$x + (z + 40^\circ) = 180^\circ \text{ (Adjacent pair of angles)}$$

$$x + 70^\circ = 180^\circ$$

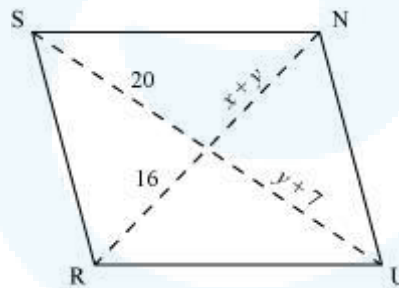
$$x = 110^\circ$$

Q8 :

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



(i)



(ii)

Answer :

(i) We know that the lengths of opposite sides of a parallelogram are equal to each other.

$$GU = SN$$

$$3y - 1 = 26$$

$$3y = 27$$

$$y = 9$$

$$SG = NU$$

$$3x = 18$$

$$x = 6$$

Hence, the measures of x and y are 6 cm and 9 cm respectively.

(ii) We know that the diagonals of a parallelogram bisect each other.

$$y + 7 = 20$$

$$y = 13$$

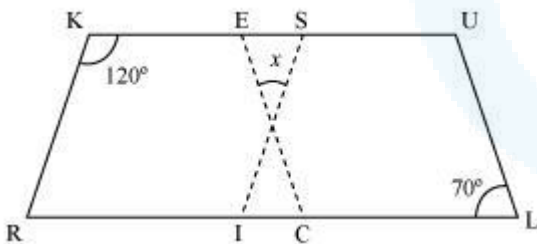
$$x + y = 16$$

$$x + 13 = 16$$

$$x = 3$$

Hence, the measures of x and y are 3 cm and 13 cm respectively.

Q9 :



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

Answer :

Adjacent angles of a parallelogram are supplementary.

In parallelogram RISK, $\angle RKS + \angle ISK = 180^\circ$

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



$$\angle ISK = 60^\circ$$

Also, opposite angles of a parallelogram are equal.

In parallelogram CLUE, $\angle ULC = \angle CEU = 70^\circ$

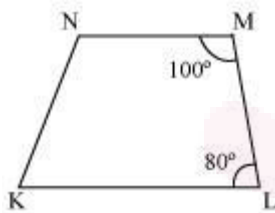
The sum of the measures of all the interior angles of a triangle is 180° .

$$x + 60^\circ + 70^\circ = 180^\circ$$

$$x = 50^\circ$$

Q10 :

Explain how this figure is a trapezium. Which of its two sides are parallel



Answer :

If a transversal line is intersecting two given lines such that the sum of the measures of the angles on the same side of transversal is 180° , then the given two lines will be parallel to each other.

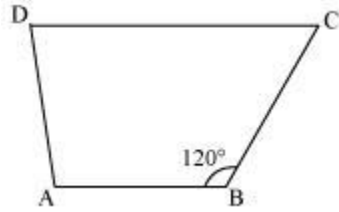
$$\text{Here, } \angle NML + \angle MLK = 180^\circ$$

Hence, $NM \parallel LK$

As quadrilateral KLMN has a pair of parallel lines, therefore, it is a trapezium.

Q11 :

Find $m\angle C$ in the following figure if $\overline{AB} \parallel \overline{DC}$



Answer :

Given that, $\overline{AB} \parallel \overline{DC}$

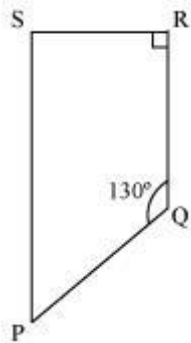
$\angle B + \angle C = 180^\circ$ (Angles on the same side of transversal)

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

$$\angle C = 60^\circ$$

Q12 :

Find the measure of $\angle P$ and $\angle S$, if $\overline{SP} \parallel \overline{RQ}$ in the following figure. (If you find $m\angle R$, is there more than one method to find $m\angle P$)



Answer :

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

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

$$\angle P = 50^\circ$$



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

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

$$\angle S = 90^\circ$$

Yes. There is one more method to find the measure of $m\angle P$.

$m\angle R$ and $m\angle Q$ are given. After finding $m\angle S$, the angle sum property of a quadrilateral can be applied to find $m\angle P$.

Questions and Solutions | Exercise 3.4 - NCERT Books

Q1 :

State whether True or False.

- (a) All rectangles are squares.
- (b) All rhombuses are parallelograms.
- (c) All squares are rhombuses and also rectangles.
- (d) All squares are not parallelograms.
- (e) All kites are rhombuses.
- (f) All rhombuses are kites.
- (g) All parallelograms are trapeziums.
- (h) All squares are trapeziums.

Answer :

- (a) False. All squares are rectangles but all rectangles are not squares.
- (b) True. Opposite sides of a rhombus are equal and parallel to each other.
- (c) True. All squares are rhombuses as all sides of a square are of equal lengths. All squares are also rectangles as each internal angle measures 90° .
- (d) False. All squares are parallelograms as opposite sides are equal and parallel.



- (e) False. A kite does not have all sides of the same length.
- (f) True. A rhombus also has two distinct consecutive pairs of sides of equal length.
- (g) True. All parallelograms have a pair of parallel sides.
- (h) True. All squares have a pair of parallel sides.

Q2 :

Identify all the quadrilaterals that have

- (a) four sides of equal length**
- (b) four right angles**

Answer :

- (a) Rhombus and Square are the quadrilaterals that have 4 sides of equal length.
- (b) Square and rectangle are the quadrilaterals that have 4 right angles.

Q3 :

Explain how a square is.

- (i) a quadrilateral**
- (ii) a parallelogram**
- (iii) a rhombus**
- (iv) a rectangle**

Answer :

- (i) A square is a quadrilateral since it has four sides.
- (ii) A square is a parallelogram since its opposite sides are parallel to each other.



- (iii) A square is a rhombus since its four sides are of the same length.
- (iv) A square is a rectangle since each interior angle measures 90° .

Q4 :

Name the quadrilaterals whose diagonals.

- (i) bisect each other**
- (ii) are perpendicular bisectors of each other**
- (iii) are equal**

Answer :

- (i) The diagonals of a parallelogram, rhombus, square, and rectangle bisect each other.
- (ii) The diagonals of a rhombus and square act as perpendicular bisectors.
- (iii) The diagonals of a rectangle and square are equal.

Q5 :

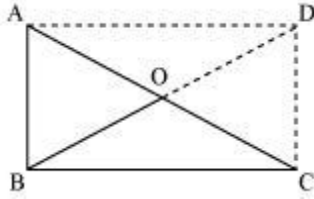
Explain why a rectangle is a convex quadrilateral.

Answer :

In a rectangle, there are two diagonals, both lying in the interior of the rectangle. Hence, it is a convex quadrilateral.

Q6 :

ABC is a right-angled triangle and O is the mid point 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).



Answer :

Draw lines AD and DC such that $AD \parallel BC$, $AB \parallel DC$

$AD = BC$, $AB = DC$

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 these bisect each other.

Hence, $AO = OC = BO = OD$

Thus, O is equidistant from A, B, and C.