CBSE NCERT Solutions for Class 8 Mathematics Chapter 3

Back of Chapter Questions

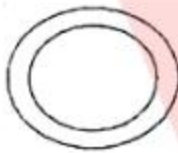## Exercise 3.1

1.   Given here are some figure:

(A)

(B)

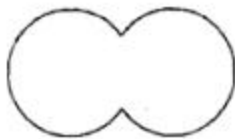(C)
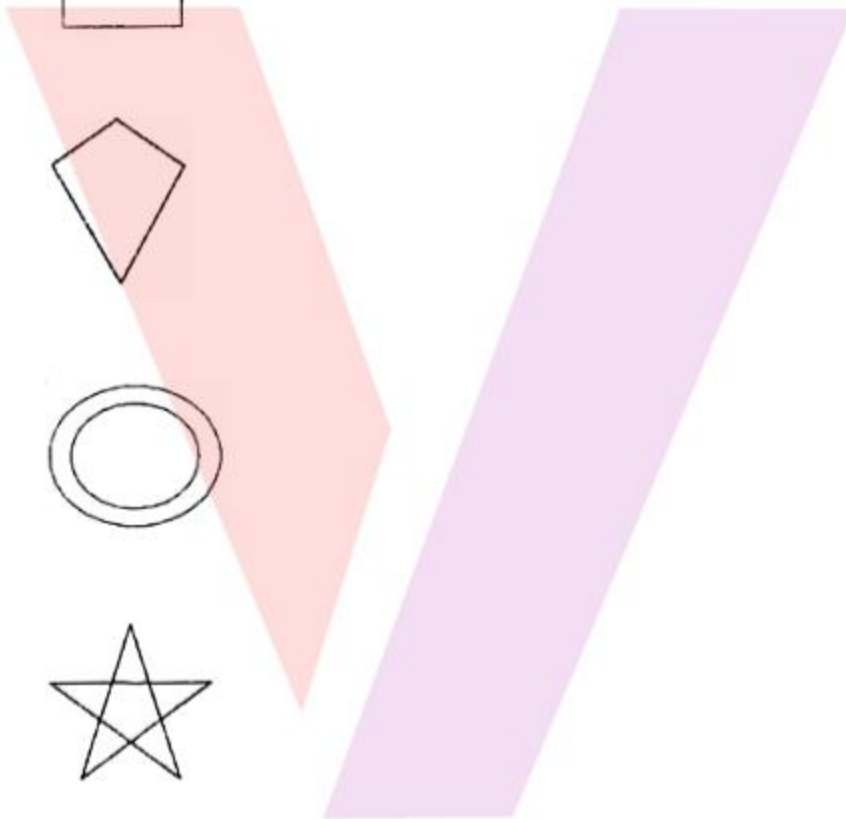
(D)

(E)

(F)

(G)

(H)

Classify each them on the basis of the following:

(i)   Simple curve

(ii)   Simple closed curve

(iii)   polygon

(iv)   Convex polygon

(v)   Concave polygon

Solution:

(i)   **Simple curve:** A simple curve is a curve that does not cross itself.

The following are the simple curves.

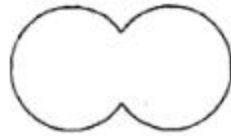(A)

(B)

(E)

(F)

(G)

(ii) **Simple closed curve:** A connected curve that does not cross itself and ends at the same point where it begins is called a simple closed curve.
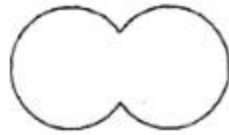
The following are the simple closed curves.

(A)

(B)

(E)

(F)

(G)

(iii) **Polygon:** A polygon is a plane figure enclosed by three or more line segments.

The following are the polygons

(A)

(B)

(D)

(iv) **Convex polygon:** A convex polygon is defined as a polygon with all its interior angles less than 180°. This means that all the vertices of the polygon will point outwards, away from the interior of the shape.

The following is the convex polygon.

(A)

(v)   **Concave polygon:** A concave polygon is defined as a polygon with one or more interior angles greater than 180°.
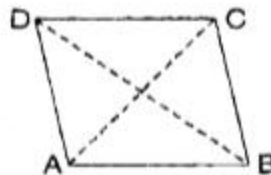
The following are the concave polygons.

(A)

(D)

2.   How many diagonals does each of the following have?

(A)   A convex quadrilateral

(B)   A regular hexagon

(C)   A triangle

Solution:

(A)   A convex quadrilateral has two diagonals.
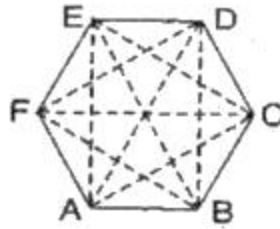
For e.g.

In above convex quadrilateral, AC and BD are only two diagonals.
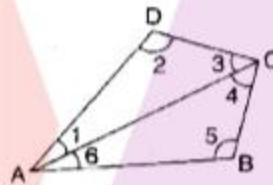
(B)   A regular hexagon has 9 diagonals.

For e.g.

In above hexagon, diagonals are AD, AE, BD, BE, FC, FB, AC, EC and FD.

So, there are total 9 diagonals in regular hexagon.

(C)   In a triangle, there is no diagonal.

3.   What is the sum of the measures of the angles of a convex quadrilateral? Will this property hold if the quadrilateral is not convex? (Make a non-convex quadrilateral and try)

Solution:

Let ABCD is a convex quadrilateral.

Now, draw a diagonal AC which divided the quadrilateral in two triangles.

$\angle A + B + \angle C + \angle D = \angle 1 + \angle 6 + \angle 5 + \angle 4 + \angle 3 + \angle 2$

$= (\angle 1 + \angle 2 + \angle 3) + (\angle 4 + \angle 5 + \angle 6)$

$= 180° + 180°$ (By Angle sum property of triangle)

$= 360°$

Hence, the sum of measures of the triangles of a convex quadrilateral is $360°$.

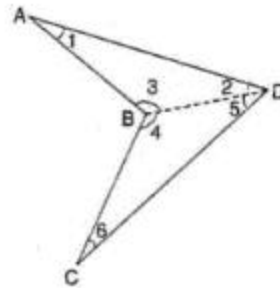And this property still holds even if the quadrilateral is not convex.

E.g.

Let ABCD be a non-convex quadrilateral.

Now, join BD, which also divides the quadrilateral ABCD in two triangles.

Using angle sum property of triangle,

In ΔABD, $\angle 1 + \angle 2 + \angle 3 = 180°$.......... (i)

In ΔBDC, $\angle 4 + \angle 5 + \angle 6 = 180°$.......... (ii)

Adding equation (i) and (ii), we get

$\angle 1 + \angle 2 + \angle 3 + \angle 4 + \angle 5 + \angle 6 = 360^o$

$\Rightarrow \angle 1 + (\angle 3 + \angle 4) + \angle 6 + (\angle 2 + \angle 5) = 360^o$

$\Rightarrow \angle A + \angle B + \angle C + \angle D = 360^o$

Hence, the sum of measures of the triangles of a non-convex quadrilateral is also 360°.

4. Examine the table. (Each figure is divided into triangles and the sum of the angles deduced from that.)

Figure				
Side	3	4	5	6
Angle	1×180° $= (3 - 2) \times 180^o$	2×180° $= (4 - 2) \times 180^o$	3×180° $= (5 - 2) \times 180^o$	4×180° $= (6 - 2) \times 180^o$

What can you say about angle sum of a convex polygon with number of sides?

Solution:

(A) When n = 7, then

Angle sum of a polygon = $(n - 2) \times 180^o = (7 - 2) \times 180^o = 5 \times 180^o = 900^o$

(B) When n = 8, then

Angle sum of a polygon = $(n - 2) \times 180^o = (8 - 2) \times 180^o = 6 \times 180^o = 1080^o$

(C) When n = 10, then

Angle sum of a polygon $= (n - 2) \times 180° = (10 - 2) \times 180° = 8 \times 180° = 1440°$

(D)   When n = n, then, angle sum of polygon $= (n - 2) \times 180°$

5.   What is a regular polygon? State the name of a regular polygon of:

(A)   3 sides
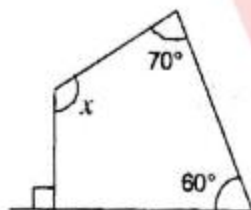
(B)   4 sides

(C)   6 sides

Solution:

A regular polygon is a polygon which have all sides of equal length and the interior angles of equal size.

(i)   3 sides. Polygon having three sides is called a triangle.

(ii)   4 sides. Polygon having four sides is called a quadrilateral.

(iii)   6 sides. Polygon having six sides is called a hexagon.

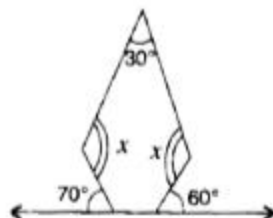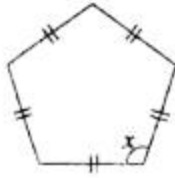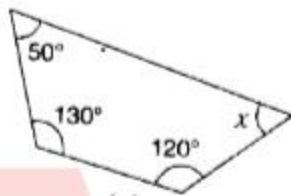6.   Find the angle measures x in the following figures:

(A)
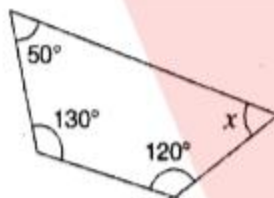
(B)

(C)

(D)

Solution:

We know in any quadrilateral, sum of interior angles will be 180°

$50° + 130° + 120° + x = 360°$ (Angle sum Property of a quadrilateral)

$\Rightarrow 300° + x = 360°$

$\Rightarrow x = 360° - 300°$

$\Rightarrow x = 60°$

Therefore, the value of x is 60°.

(B)
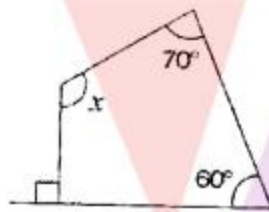
We know in any quadrilateral, sum of interior angles will be 180°

$90° + 60° + 70° + x = 360°$ (Angle sum Property of a quadrilateral)

$\Rightarrow 220° + x = 360°$

$\Rightarrow x = 360° - 220°$

$\Rightarrow x = 140°$

Therefore, the value of x is 140°.

(C)
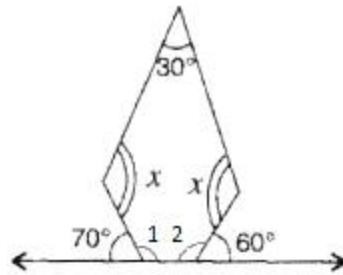
First base interior angle $\angle 1 = 180° - 70° = 110°$

Second base interior angle $\angle 2 = 180° - 60° = 120°$

Since, there are 5 sides.

Therefore, n = 5

We know that Angle sum of a polygon = $(n - 2) \times 180°$

$= (5 - 2) \times 180° = 3 \times 180° = 540°$

$\therefore\ 30° + x + 110° + 120° + x = 540°$ (Angle sum property)

$\Rightarrow 260° + 2x = 540° \Rightarrow 2x = 540° - 260°$

$\Rightarrow 2x = 280°$

$\Rightarrow x = 140°$

Therefore, the value of x is 140°.

(D)

Since, there are 5 sides.

Therefore, n = 5.

We know that Angle sum of a polygon = $(n - 2) \times 180°$
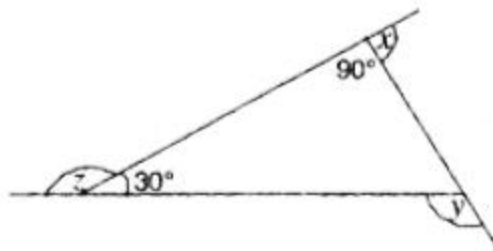
$= (5 - 2) \times 180° = 3 \times 180° = 540°$

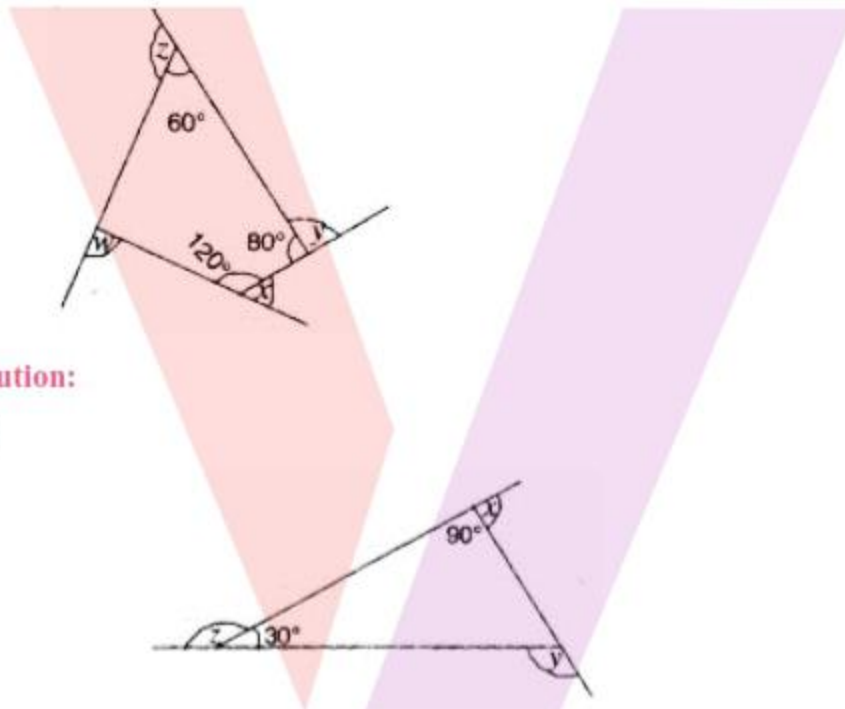$\therefore\ x + x + x + x + x = 540°$ (Angle sum property)

$\Rightarrow 5x = 540°$

$\Rightarrow x = 108°$

Hence each interior angle of the given polygon is 108°.

7. (A) Find x + y + z

(B) Find x + y + z + w

Solution:

(A)
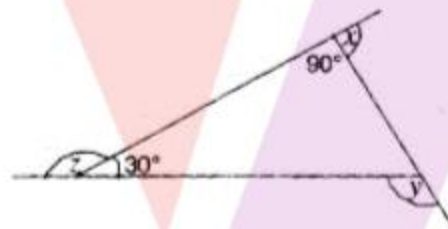
$90° + x = 180°$ (∵ sum of linear pair angles is 180°)

$\Rightarrow x = 180° - 90° = 90°$

And $z + 30° = 180°$ (∵ sum of linear pair angles is 180°)

$\Rightarrow z = 180° - 30° = 150°$

Also $y = 90° + 30° = 120°$ [∵ Exterior angle property]

$x + y + z = 90° + 120° + 150° = 360°$

Hence, $x + y + z = 90° + 120° + 150° = 360°$

(B)
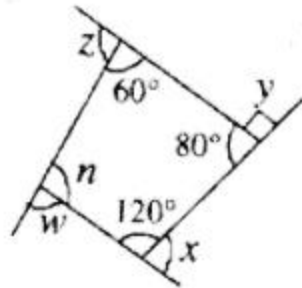
$60° + 80° + 120° + n = 360°$ ($\because$ Angle sum property of a quadrilateral)

$\Rightarrow 260° + n = 360°$

$\Rightarrow n = 360° - 260°$

$\Rightarrow n = 100°$

$w + n = 180°$ ($\because$ Sum of linear pair angles is $180°$)

$\therefore w + 100° = 180°$ ……………(i)

Similarly, $x + 120° = 180°$ ……………. (ii)

And $y + 80° = 180°$. (iii)

And $z + 60° = 180°$ ………………. (iv)

Adding eq. (i), (ii), (iii) and (iv),

$\Rightarrow x + y + z + w + 100° + 120° + 80° + 60°$

$= 180° + 180° + 180° + 180°$

$\Rightarrow x + y + z + w + 360° = 720°$

$\Rightarrow x + y + z + w = 720° - 360°$

$\Rightarrow x + y + z + w = 360°$

Hence, $x + y + z + w = 360°$

Exercise 3.2

1.   Find x in the following figures:

    (A)
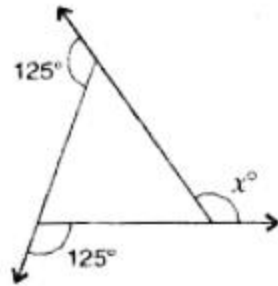
(B)

Solution:

(A)
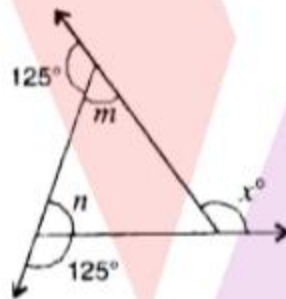
Here, $125° + m = 180°$ [∵ Sum of linear pair angles is $180°$]

$\Rightarrow m = 180° - 125° = 55°$

And similarly, $125° + n = 180°$

$\Rightarrow n = 180° - 125° = 55°$

Now, $x° = m + n$ (∵ Exterior angle property)

$\therefore x° = 55° + 55° = 110°$

Therefore, the value of x is $110°$.

(B)
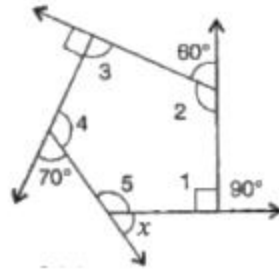
Since, in the given polygon, there are 5 sides.

Therefore, number of sides, n = 5

We know that sum of angles of a pentagon $= (n-2) \times 180°$

$= (5-2) \times 180°$

$= 3 \times 180° = 540°$

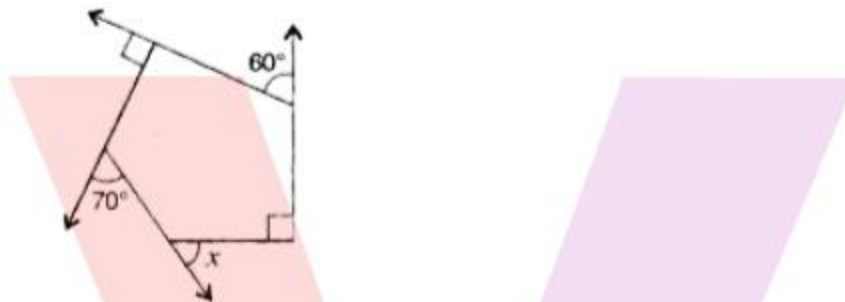Now, $\angle 1 + 90° = 180°$. (i) ($\because$ Sum of linear pair of angle is 180°)

$\angle 2 + 60° = 180°$ .... (ii) ($\because$ Sum of linear pair of angle is 180°)

$\angle 3 + 90° = 180°$ .... (iii) (Sum of linear pair of angle is 180°)

$\angle 4 + 70° = 180°$ .... (iv) (Sum of linear pair of angle is 180°)

$\angle 5 + x = 180°$ ....(v) (Sum of linear pair of angle is 180°)

On adding eq. (i), (ii), (iii), (iv) and (v), we get

$x + (\angle 1 + \angle 2 + \angle 3 + \angle 4 + \angle 5) + 310° = 900°$

$\Rightarrow x + 540° + 310° = 900°$

$\Rightarrow x + 850° = 900°$

$\Rightarrow x = 900° - 850° = 50°$

Therefore, the value of x is 50°.

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

(A) 9 sides

(B) 15 sides

Solution:

(i) It is given that number of sides, n = 9.

We know that sum of angles of a regular polygon $= (n-2) \times 180°$

$= (9-2) \times 180° = 7 \times 180° = 1260°$

Each interior angle $= \dfrac{\text{Sum of interior angles}}{\text{Number of sides}} = \dfrac{1260°}{9} = 140°$

Each exterior angle $= 180° - 140° = 40°$

Hence, each exterior angle of a regular polygon of 9 sides is equal to $40°$.

(ii) It is given that number of sides, n = 15.

We know that sum of exterior angle of a regular polygon $= 360°$

Each interior angle $= \dfrac{\text{Sum of interior angles}}{\text{Number of sides}} = \dfrac{360°}{15} = 24°$

Each exterior angle $= 180° - 24° = 156°$

Hence, each exterior angle of a regular polygon of 15 sides is equal to $156°$.

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

Solution:

We know that sum of exterior angles of a regular polygon $= 360°$

Number of sides $= \dfrac{\text{Sum of exterior angles}}{\text{Each exterior angle}} = \dfrac{360°}{24°} = 15$

Hence, the regular polygon has 15 sides.

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

Solution:

Given interior angle is 165°

Exterior angle $= 180° - 165° = 15°$

We know that sum of exterior angles of a regular polygon $= 360°$

Number of sides $\dfrac{\text{Sum of exterior angles}}{\text{Each exterior angle}} = \dfrac{360°}{15°} = 24$

Hence, the regular polygon has 24 sides.

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

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

Solution:

(A) Since 22 is not a divisor of 360°.

Therefore, it is not possible to have a regular polygon with of each exterior angles as 22°

(B)   It is given that interior angle = 22°

We know that exterior angle = 180° − Interior angle

Exterior angle = 180° − 22° = 158°, which is not a divisor of 360°.

Hence, it is not possible to have a regular polygon with of each interior angles as 22°.

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

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

Solution:

(A)   The equilateral triangle being a regular polygon of 3 sides have the least measure of an interior angle equal to 60°

Let each side of equilateral triangle = x

$\therefore x + x + x = 180°$ (By angle sum Property)

$\Rightarrow 3x = 180°$

$\Rightarrow x = 60°$

(B)   We know that equilateral triangle has least measure of an interior angle equal to 60°.

Also, Exterior angle = 180° − Interior angle

Therefore, greatest exterior angles = 180° − 60° = 120°.

Exercise 3.3

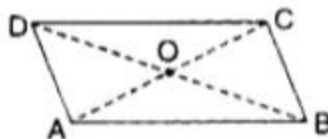1.   Give a parallelogram ABCD. Complete each statement along with the definition or property used.

(A)   AD = _____

(B)   ∠DCB = _____

(C)   OC = _____

(D)   m∠DAB + m∠CDA = _____

Solution:

(A)   We know that opposite sides of a parallelogram are equal

Therefore, AD = BC

(B)   We know that opposite angles of a parallelogram are equal.

Therefore, $\angle DCB = \angle DAB$

(C)   We know that diagonals of a parallelogram bisect each other

Therefore, For diagonal AC, OC = OA

(D)   Since, $\angle DAB$ and $\angle CDA$ are adjacent angles and we know that Adjacent angles in a parallelogram are supplementary

Therefore, $\angle DAB + \angle CDA = 180°$

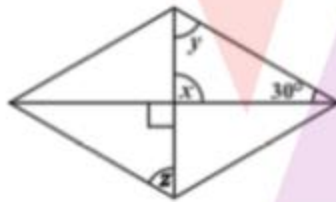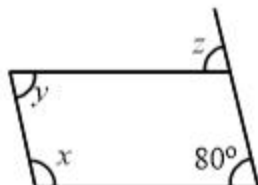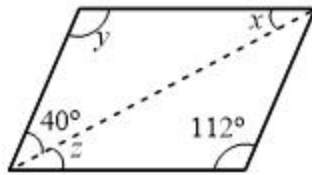2.   Consider the following parallelograms. Find the values of the unknowns x, y, z.
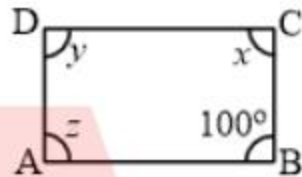
(A)
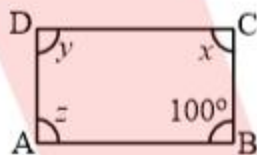
(B)
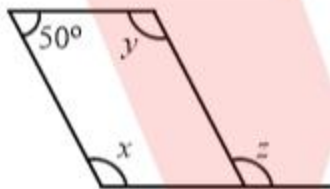
(C)

(D)

(E)

Solution:

(A)

Given that $\angle B = 100°$.

In parallelogram ABCD

Now, $\angle B + \angle C = 180°$ ($\because$ Adjacent angles in a parallelogram are supplementary)

$\Rightarrow 100° + x = 180°$

$\Rightarrow x = 180° - 100° = 80°$

and $z = x = 80°$ ($\because$ Opposite angles of a parallelogram are equal)

and $y = \angle B = 100°$ ($\because$ Opposite angles of a parallelogram are equal)

Hence $x = z = 80°$ and $y = 100°$

(B)

$x + 50° = 180°$ ($\because$ Sum of adjacent angles in a parallelogram is 180°)

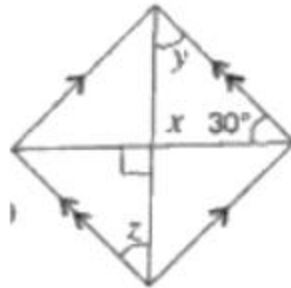$\Rightarrow x = 180° - 50° = 130°$

And $x = y = 130°$ ($\because$ Opposite angles of a parallelogram are equal)

and $z = x = 130°$ ($\because$ Corresponding angles are equal)

Hence, $x = z = y = 130°$

(C)

$x = 90°$ ($\because$ Vertically opposite angles are equal)

And $y + x + 30° = 180°$ (Angle sum property of a triangle)

$\Rightarrow y + 90° + 30° = 180°$

$\Rightarrow y + 120° = 180°$

$\Rightarrow y = 180° - 120° = 60°$

and $z = y = 60°$ ($\because$ Alternate angles are equal)

Hence, $x = 90°$ and $z = y = 60°$

(D)

$z = 80°$ ($\because$ Corresponding angles are equal)
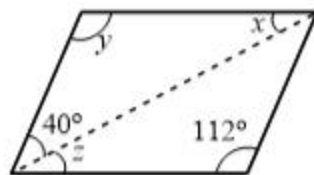
And now $x + 80° = 180°$ ($\because$ Sum of adjacent angles in a parallelogram is 180°)

$\Rightarrow x = 180° - 80° = 100°$

and $y = 80°$ ($\because$ Opposite angles of a parallelogram are equal)

Hence, $x = 100°, y = z = 80°$

(E)

$y = 112°$ ($\because$ Opposite angles of a parallelogram are equal)

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

$\Rightarrow 40° + 112° + x = 180°$

$\Rightarrow 152° + x = 180°$

$\Rightarrow x = 180° − 152° = 28°$

and $z = x = 28°$ ($\because$ Alternate angles are equal)

Hence, $x = z = 28°$ and $y = 112°$
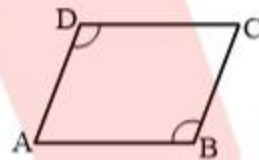
3. Can a quadrilateral ABCD be a parallelogram, if:

(A) $\angle D + \angle B = 180°$?

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

(C) $\angle A = 70°$ and $\angle C = 65°$?

Solution:

(A)

Given quadrilateral ABCD where $\angle D + \angle B = 180°$

If ABCD is a parallelogram then opposite angles are equal.

$\therefore \angle D = \angle B$

But given $\angle D + \angle B = 180°$

$\Rightarrow \angle B + \angle B = 180°$

$\Rightarrow 2\angle B = 180°$
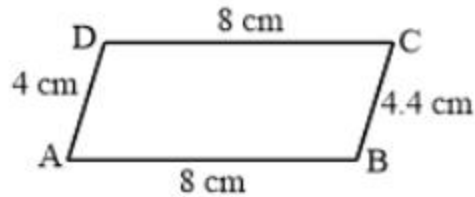
$\Rightarrow \angle B = 90°$

$\therefore \angle D = \angle B = 90°$

So, ABCD is a parallelogram where $\angle D = \angle B = 90°$ which is possible only if ABCD is a square or rectangle.

Hence, may be parallelogram, but in all cases

(B)

Given quadrilateral ABCD where AB = DC = 8 cm, AD = 4 cm and BC = 4.4 cm
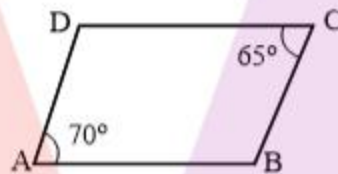
We know opposite sides of parallelogram are equal.

∴ AB = DC and AD = BC

But here AD ≠ BC

Hence, ABCD is not a parallelogram.

(C)

Given quadrilateral ABCD where ∠A = 70° and ∠C = 65°

We know, opposite angles of parallelogram are equal.

∴ ∠A = ∠C

But here ∠A ≠ ∠C

Hence, ABCD 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 measures.
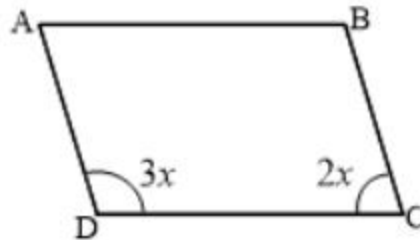
Solution:
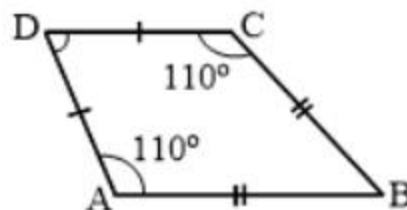
ABCD is quadrilateral in which angles ∠A = ∠C = 110°

Hence, ABCD is a quadrilateral that is not a parallelogram but has exactly two opposite angles of equal measures.

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

Solution:

Let ABCD be the given parallelogram and $\angle C = 3x$ and $\angle D = 2x$.

Since the adjacent angles in a parallelogram are supplementary.

$\therefore 3x + 2x = 180º$

$\Rightarrow 5x = 180º$

$\Rightarrow x = \dfrac{180º}{5} = 36º$

Hence, $\angle C = 3x = 3 \times 36º = 10º$

and $\angle D = 2x = 2 \times 36º = 72º$

Hence, the two required adjacent angles are 108º and 72º.

Now, opposite angles of a parallelogram are equal

Hence, $\angle C = \angle A = 72º$ and $\angle D = \angle B = 108º$

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

Solution:

Let each adjacent angle be x.

Since the adjacent angles in a parallelogram are supplementary.

$\therefore x + x = 180º$

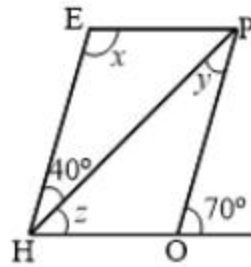$\Rightarrow 2x = 180º$

$\Rightarrow x = \dfrac{180º}{2} = 90º$

Hence, each adjacent angle is 90º.

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

Solution:

Here ∠HOP + 70° = 180° (∵ sum of angles of linear pair is 180°)

⇒ ∠HOP = 180° − 70° = 110°

and ∠E = ∠HOP (∵ Opposite angles of a parallelogram are equal)

⇒ x = 110°

Now, ∠PHE = ∠HPO (∵ Alternate angles are equal)

∴ y = 40°

Since, OP||HE

Therefore, ∠EHO = ∠O = 70° (Corresponding angles)

Since, ∠EHO = 70°

⇒ 40° + z = 70°

⇒ z = 70° − 40° = 30°

Hence, x = 110°, y = 40° and z = 30°

8. The following figures GUNS and RUNS are parallelogram, Find x and y. (Length are in cm)

(A)
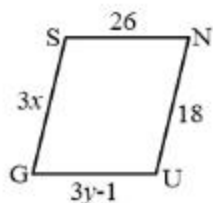
(B)

Solution:

(A)
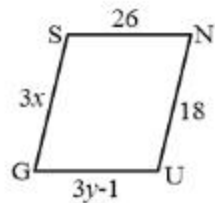
In parallelogram GUNS,

GS = UN (∵ Opposite sides of parallelogram are equal)

$\Rightarrow 3x = 18$

$\Rightarrow x = \dfrac{18}{3} = 6$ cm

Also GU = SN (∵ Opposite sides of parallelogram are equal)

$\Rightarrow 3y - 1 = 26$

$\Rightarrow 3y = 26 + 1$

$\Rightarrow 3y = 27$

$\Rightarrow y = \dfrac{27}{3} = 9$ cm

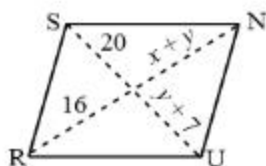Hence, x = 6 cm and y = 9 cm

(B)
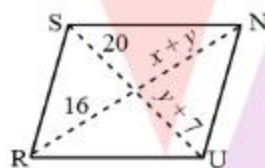
In parallelogram RUNS,

y + 7 = 20 (∵ Diagonals of a parallelogram bisects each other)

$\Rightarrow y = 20 - 7 = 13$ cm

Similarly, x + y = 16

$\Rightarrow x + 13 = 16$

$\Rightarrow x = 16 - 13$

$\Rightarrow x = 3$ cm

Hence, x = 3 cm and y = 13 cm

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

Solution:
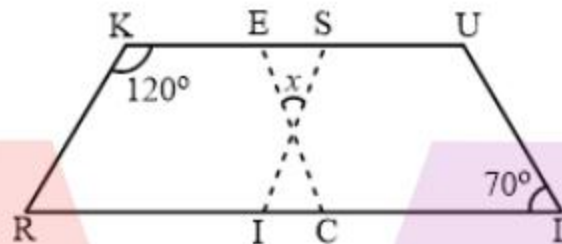
Let angle vertically opposite to x be n

In parallelogram RISK,

$\angle$RIS = $\angle$K = 120° ($\because$ Opposite angles of a parallelogram are equal)

$\angle$SIC + $\angle$RIS = 180° ($\because$ Sum of linear pair of angle is 180°)

$\Rightarrow \angle$SIC + 120° = 180°

$\Rightarrow \angle$SIC = 180° − 120° = 60°

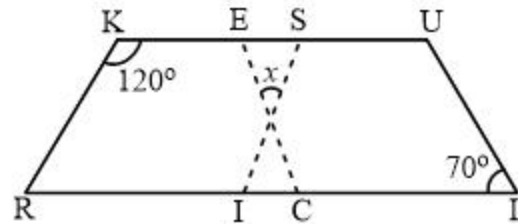and $\angle$ECl = $\angle$L = 70° ($\because$ Corresponding angles are equal)

$\angle$SIC + n + $\angle$ECI = 180° ($\because$ Angle sum property of a triangle)

$\Rightarrow$ 60° + n + 70° = 180°

$\Rightarrow$ 130° + n = 180°

$\Rightarrow$ n = 180° − 130° = 50°

also x = n = 50° ($\because$ Vertically opposite angles are equal)

Hence, the value of x is 50°.

10. Explain how this figure is a trapezium. Which of its two sides are parallel?
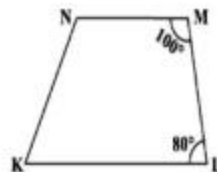
Solution:
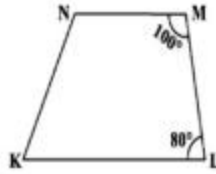
Given a quadrilateral KLMN having $\angle L = 80°$ and $\angle M = 100°$

Now extent the line LM to O as shown in figure
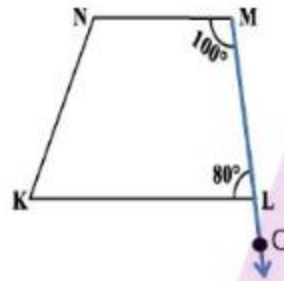
For the line segment NM and KL, with MO is a transversal.

Now $\angle L + \angle M = 180°$

Thus, sum of interior angles on the same side of transversal is 180° which is only possible

If NM and KL are parallel lines

Therefore, NM || KL

Since, KLMN is quadrilateral with KL || NM

$\therefore$ KLMN is a trapezium

11.   Find m$\angle$C in figure, if $\overline{AB}||\overline{DC}$,
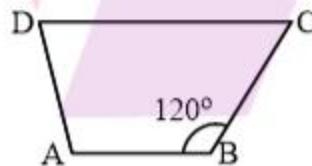
Solution:

In quadrilateral ABCD

Since, it is given that $\overline{AB}||\overline{DC}$

Therefore, $\angle B + \angle C = 180°$

$\Rightarrow 120° + m\angle C = 180°$

$\Rightarrow m\angle C = 180° - 120° = 60°$

Hence, m∠C = 60°

12. Find the measure of ∠P and ∠S if $\overline{SP}||\overline{QR}$ in given figure. (If you find m∠R, is there more than one method to find $m\angle P$)
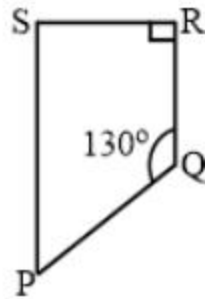
Solution:

∠P + ∠Q = 180° [∵ Sum of co-interior angles is 180°]

⇒ ∠P + 130° = 180°

⇒ ∠P = 180° − 130°

⇒ ∠P = 50°

And ∠S + ∠R = 180° (∵ Sum of co-interior angles is 180°)

⇒ ∠S + 90° = 180° (∠R = 90° (given))

⇒ ∠S = 180° − 90°

⇒ ∠S = 90°

Yes, there is one more method to find ∠P.

In quadrilateral SRQP

∠S + ∠R + ∠Q + ∠P = 360° [Angle sum property of quadrilateral]

⇒ 90° + 90° + 130° + ∠P = 360°

⇒ 310° + ∠P = 360°

⇒ ∠P = 360° − 310°

⇒ ∠P = 50°

Exercise 3.4

1. 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.

Solution:

(A)	False.

In the rectangle all sides may not be equal but in the case of square all sides are equal.

Hence, all rectangles are not squares

(B)	True.

In a parallelogram, opposite angles are equal and also diagonal intersect at the mid- point.

And Since, in rhombus, opposite angles are equal and diagonals intersect at mid-point.

Hence, all rhombuses are parallelograms.

(C)	True.

We know that a rectangle become square when all sides of a rectangle are equal. Hence square is a special case of rectangle. And since, square has same property as that of rhombus.

Hence, all squares are rhombuses and also rectangles

(D)	False.

Since, all squares have the same property as that of parallelogram.

Hence, all squares are parallelograms

(E)	False.

In the rhombus, all sides are equal, but all kites do not have equal sides.

Hence, all kites are rhombuses

(F)	True.

Since, all rhombuses have equal sides and diagonals bisect each other and, in the kite,, all sides may be equal and their diagonal can also bisect each other.

Hence, all rhombuses are kites.

(G) True.

We know that trapezium has only two parallel sides and Since, in the parallelogram two sides are parallel to each other.

Hence, all parallelograms are trapeziums

(H) True.

We know that a trapezium has two sides parallel to each other and Since, in the square two sides are parallel.

Hence, all squares are trapeziums

2. Identify all the quadrilaterals that have:

(A) four sides of equal lengths.

(B) four right angles.

Solution:

(A) Rhombus and square have sides of equal length.

(B) Square and rectangle have four right angles.

3. Explain how a square is:

(A) a quadrilateral

(B) a parallelogram

(C) a rhombus

(D) a rectangle

Solution:

(A) A quadrilateral has 4 sides and a square has 4 sides, hence it is a quadrilateral

(B) A square is a parallelogram, since it contains both pairs of opposite sides are parallel.

(C) A rhombus is a parallelogram where all sides are equal and a square is a parallelogram where all sides are of equal length. Hence it is a rhombus.

(D) A rectangle is a parallel $90°$ and a square is a parallelogram where all angles are $90°$. Hence it is a rectangle.

4. Name the quadrilateral whose diagonals:

(A) bisect each other.

(B) are perpendicular bisectors of each other.

(C) are equal.

Solution:

(A)   If diagonals of a quadrilateral bisect each other then it may be a rhombus, parallelogram, rectangle or square.

(B)   If diagonals of a quadrilateral are perpendicular bisector of each other, then it may be a rhombus or square.

(C)   If diagonals are equal, then it may be a square or rectangle.

5.   Explain why a rectangle is a convex quadrilateral.

Solution:

In convex quadrilateral, all the diagonals lie inside the quadrilateral.

Consider a rectangle ABCD, Its diagonal AC and BD lie inside the rectangle
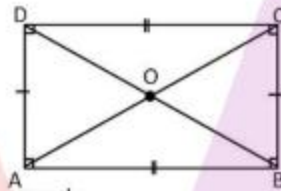
Hence rectangle is a convex quadrilateral.

6.   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.)

Solution:

Given a right-angled triangle ABC and O is the mid-point of AC.

Now draw a line from A parallel to BC and from C parallel to BA.

Let the point of intersection of these lines be D. Now Join OD.

Now in quadrilateral ABCD

AB ∥ DC and BC ∥ AD

⇒ opposite sides are parallel

∴ ABCD is a parallelogram

We know that

Adjacent angles of a parallelogram are supplementary

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

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

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

$\Rightarrow \angle C = 90^\circ$

Also,

Opposite angles of a parallelogram are equal.

$\angle A = \angle C$

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

And $\angle D = \angle B$

$\Rightarrow \angle D = 90^\circ$

Therefore,

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

$\Rightarrow$ Each angle of ABCD is a right angle.

So, ABCD is a parallelogram with all angles 90°

$\therefore$ ABCD is a rectangle

We know that

The diagonals of a rectangle bisect each other

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

$OB = OD = \frac{1}{2}BD \dots (2)$

Also,

The diagonals of a rectangle are equal in length.

$BD = AC$

Dividing both sides by 2

$\Rightarrow \frac{1}{2}BD = \frac{1}{2}AC$

$\Rightarrow OB = OA$ (from (1) and (2))

$\therefore OA = OB = OC$

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

✦✦✦