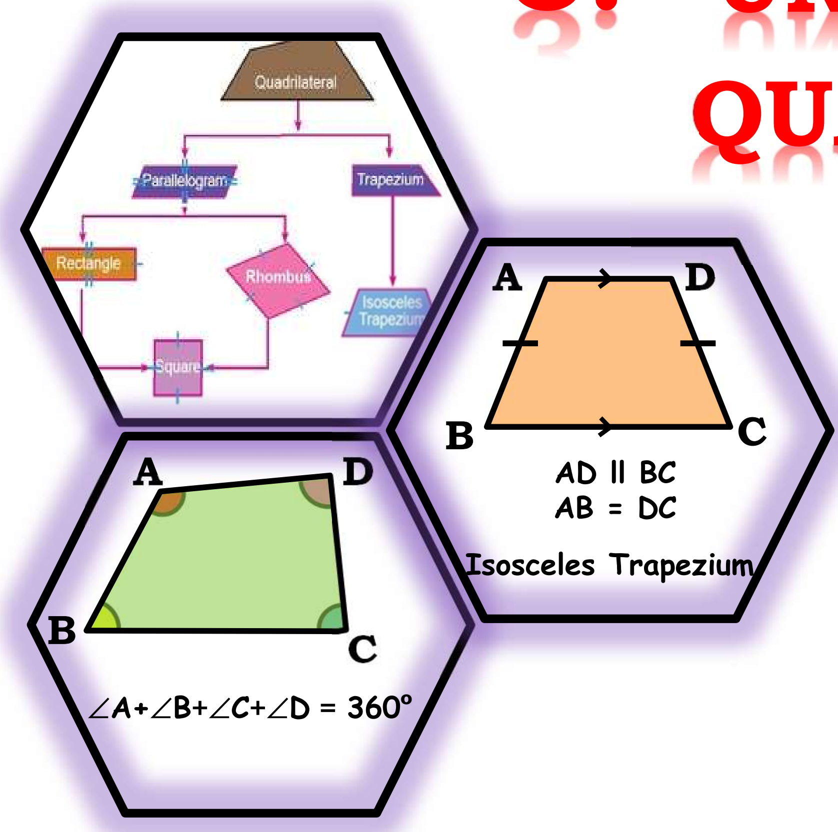
3. UNDERSTANDING QUADRILATERALS

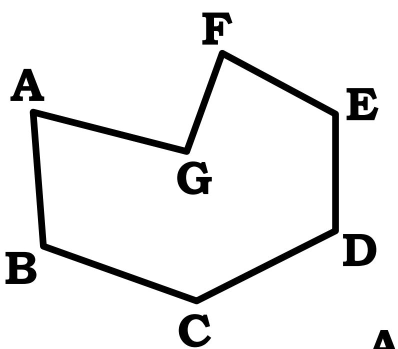


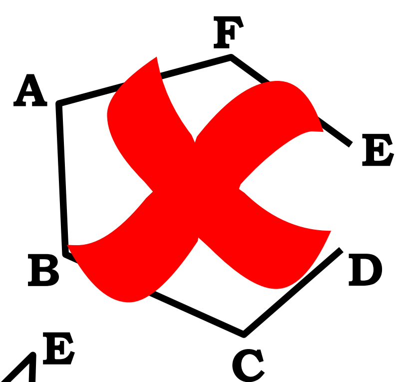
Lecture 1

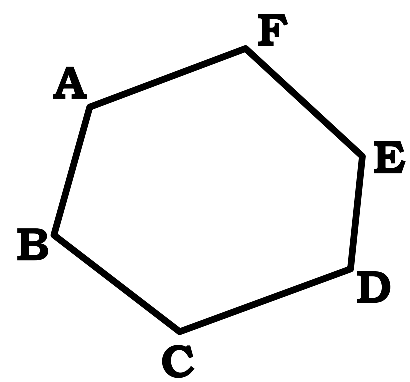
Module 1

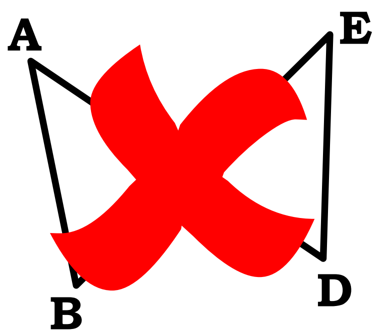
POLYGON

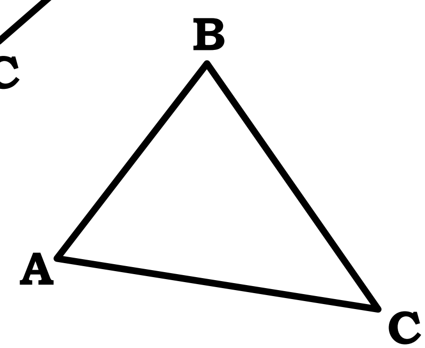
- It is a closed plane figure, bounded by straight-line segments.
- The line segments forming a polygon intersect only at end-points and each end-point is shared by only two line-segments.

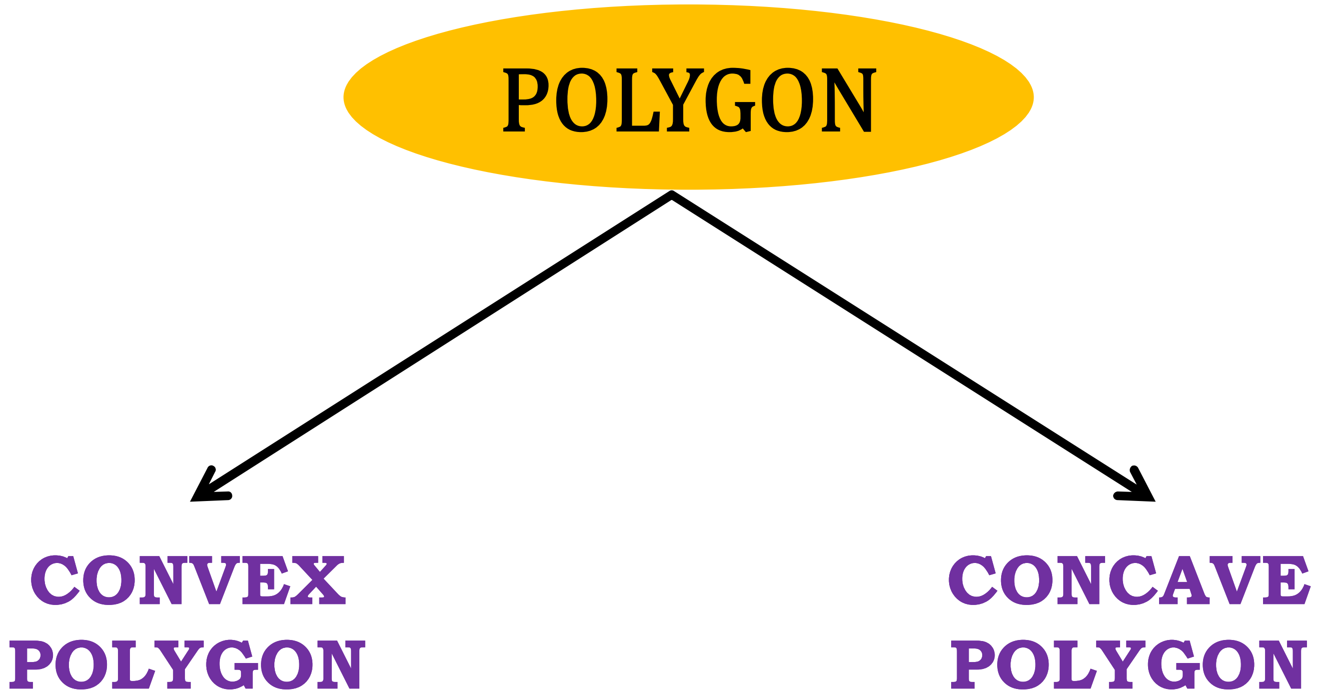






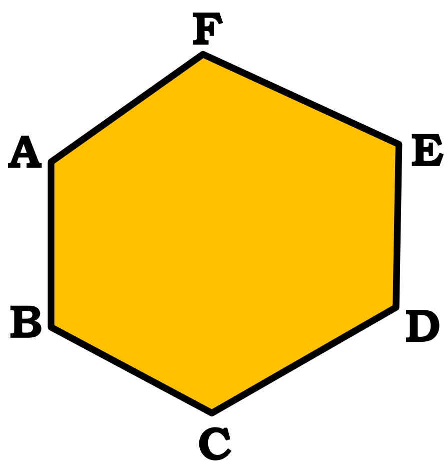


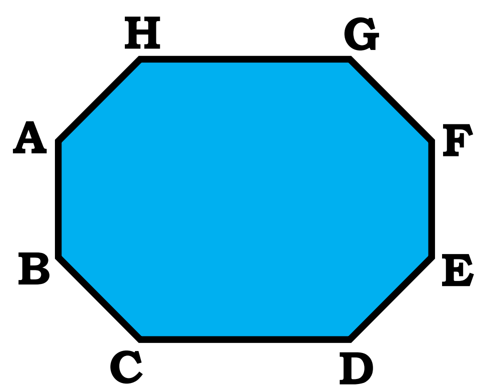



POLYGON
CONVEX POLYGON
CONCAVE POLYGON

CONVEX POLYGON

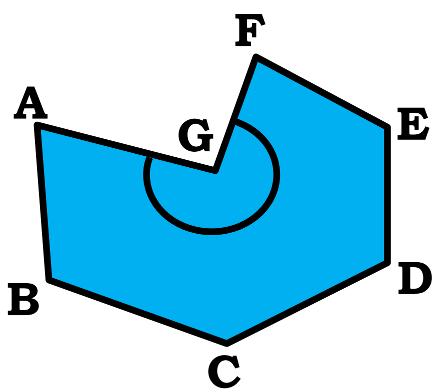
- If each angle of a polygon is less than 180º, it is called a convex polygon.

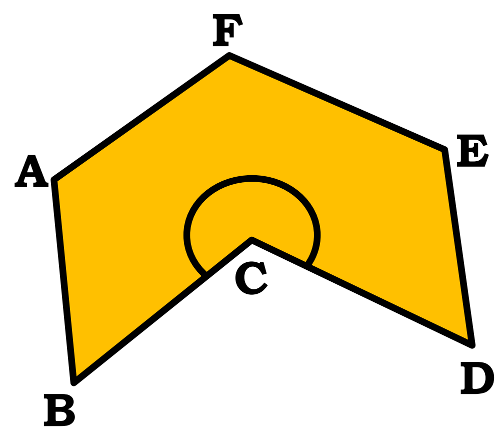




CONCAVE POLYGON

- **If at least one angle of a polygon is more than 180^o, it is called a concave or re-entrant polygon.**



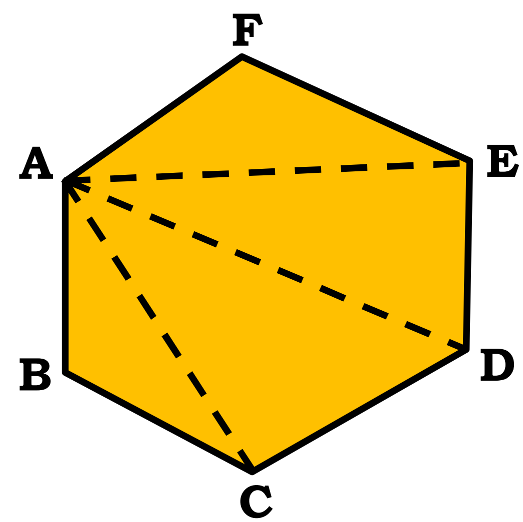


DIAGONAL OF A POLYGON

- A line segment joining any two non-consecutive vertices of a polygon is called its diagonal.

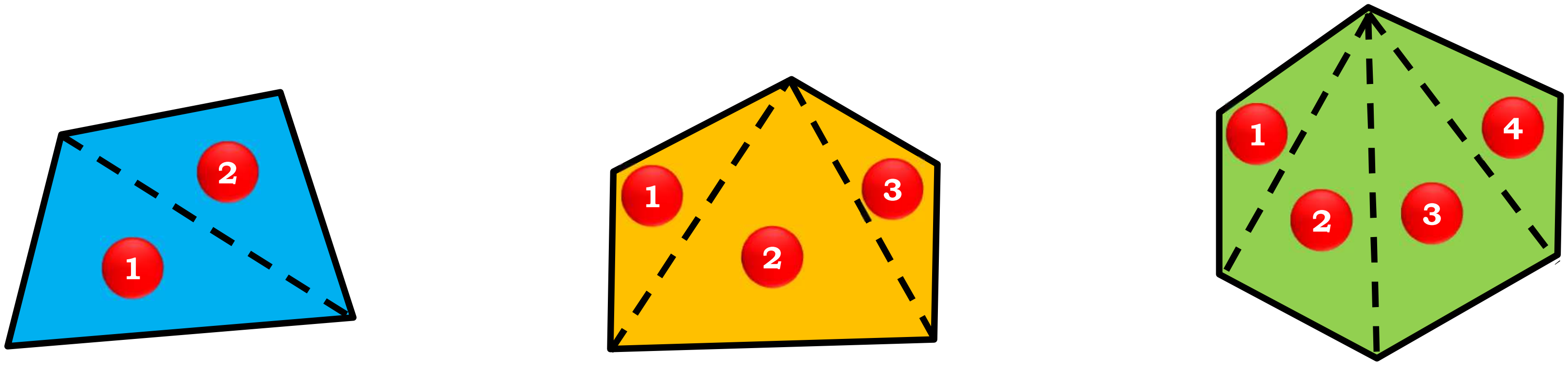
- In the adjoining fig.,

  AC, AD and AE are diagonals of hexagon ABCDEF.



- More diagonals can be drawn through the vertices B, C, D, E and F.

SUM OF ANGLES OF A POLYGON



	No. of Sides	No. of Triangles
Quadrilateral	4	2
Pentagon	5	3
Hexagon	6	4

No. of Triangles = No. of Sides – 2

No. of triangles = No. of sides – 2

If polygon has 'n' sides,

Number of triangle formed = (n – 2)

Sum of angles of a triangle = 180^{o}

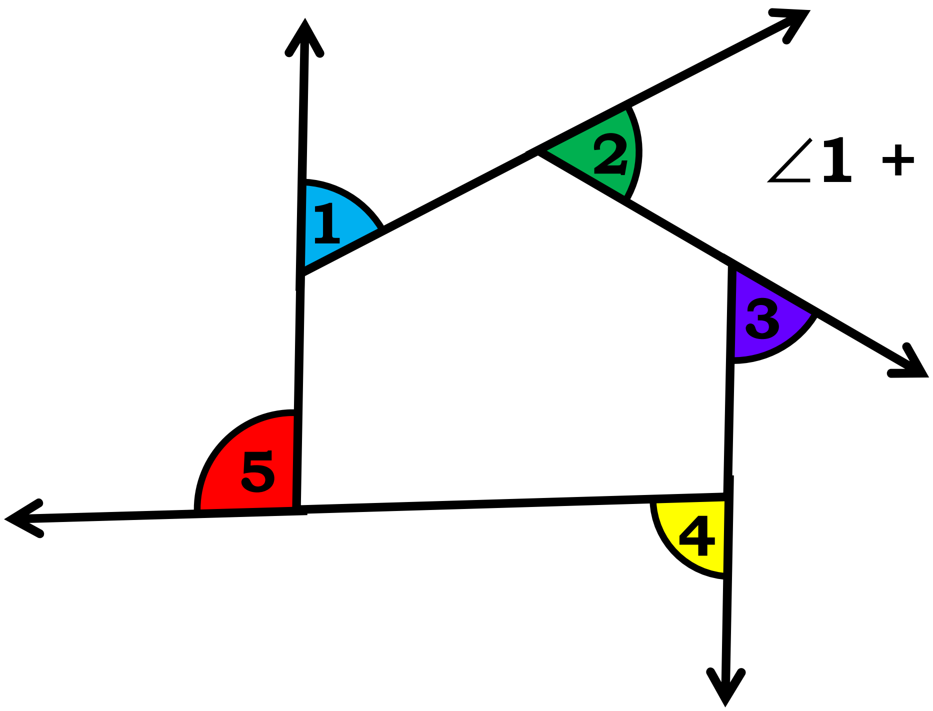
∴ Sum of angles of (n – 2) triangles = $(n - 2) \times 180^{o}$

$$= (2n - 4) \times 90^{o}$$

Sum of Interior angles of a polygon with 'n' sides = $(2n - 4) \times 90^{o}$

SUM OF EXTERIOR ANGLES OF A POLYGON

If the sides of a polygon are produced in order, the sum of exterior angles so formed is always <u>360º</u>.



$\angle 1 + \angle 2 + \angle 3 + \angle 4 + \angle 5 = 360^{\circ}$

Module 2

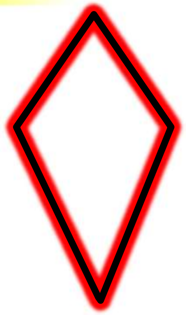
Q. Given here are some figures.

Classify each of them on the basis of the following.

(a) Simple curve

A Simple curve is a curve that does not cross itself

(1)



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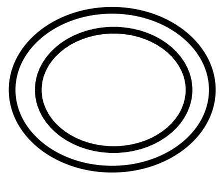

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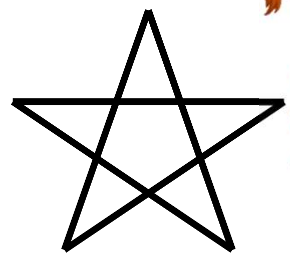

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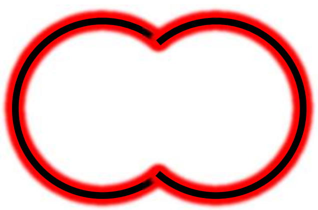

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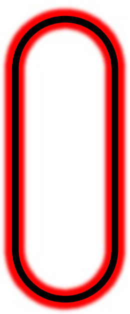

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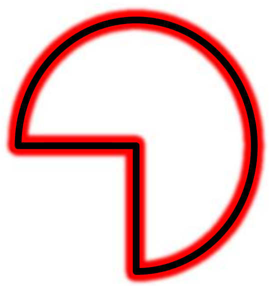

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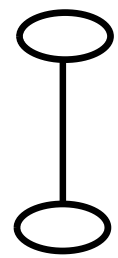
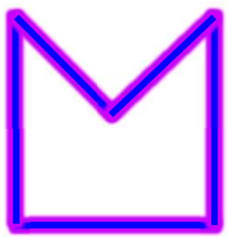


(8)

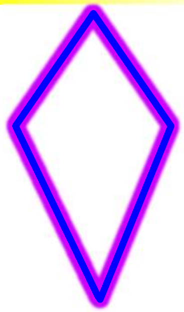
Q. Given here are some figures.

Classify each of them on the basis of the following.

(b) Simple closed curve



(1)



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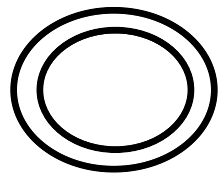

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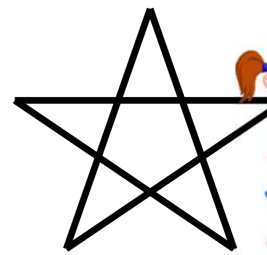
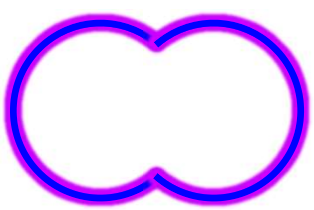


(4)

A closed curve which does not cross itself is called a Simple closed curve.



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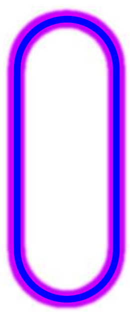

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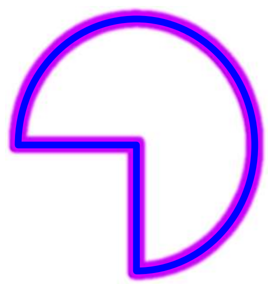

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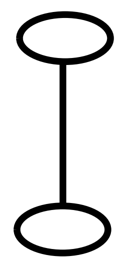


(8)

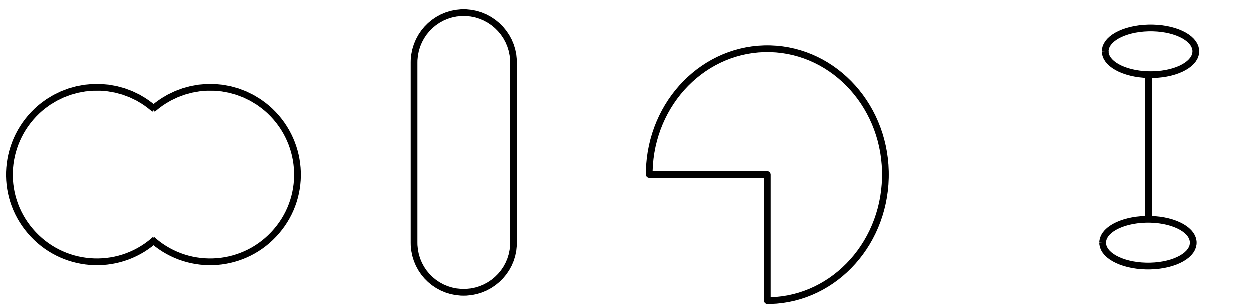
Q. Given here are som

Classify each of them ... **owing.**

A plane figure with at least three straight sides is called a Polygon

(c) Polygon

(1) (2) (3) (4)



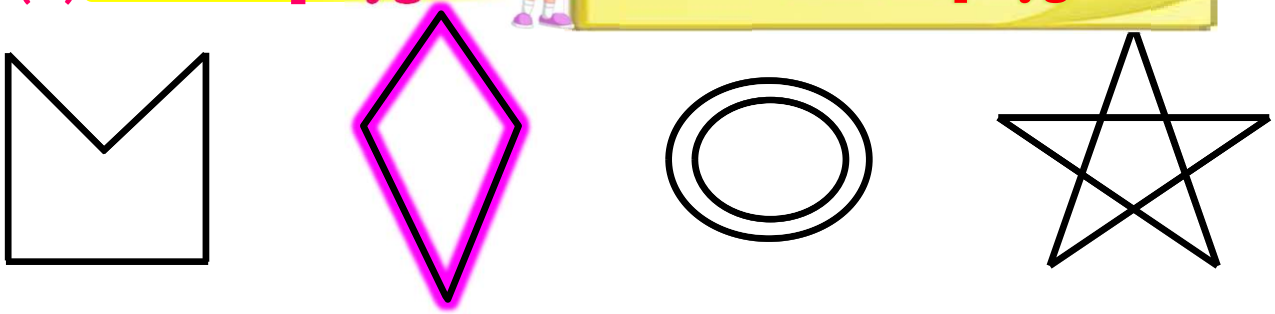
(5) (6) (7) (8)

Q. Given here are som

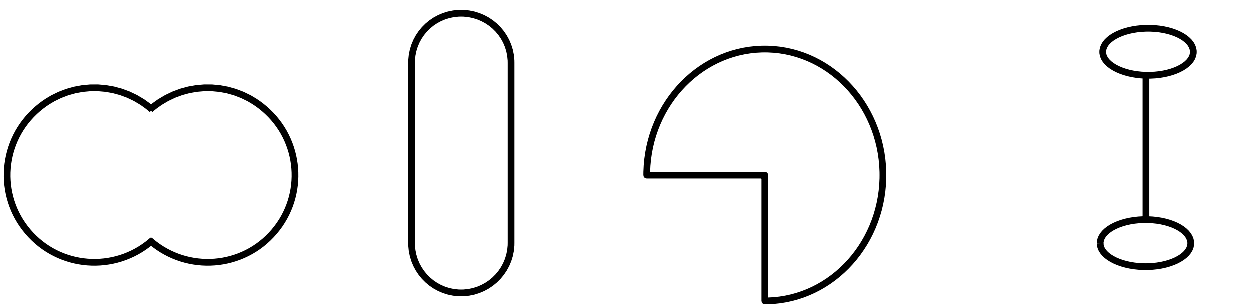
Classify each of ther ng.

(d) Convex polygon

If each angle of a polygon is less than 180° then it is called a **Convex polygon**



(1) (2) (3) (4)



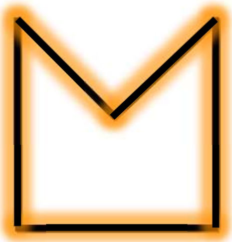
(5) (6) (7) (8)

Q. Given here are so

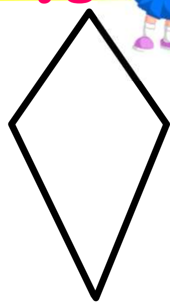
Classify each of the **lowing.**

(e) Concave polygo

If at least one angle of a polygon is more than 180° then it is called a Concave polygon



(1)



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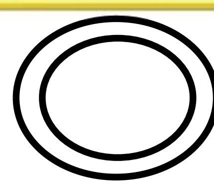

(3)

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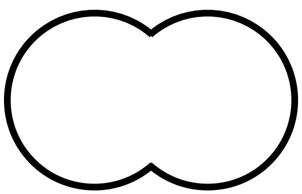

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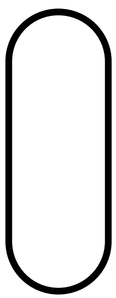

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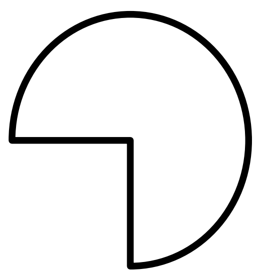

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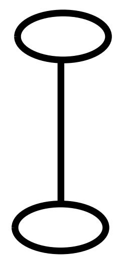
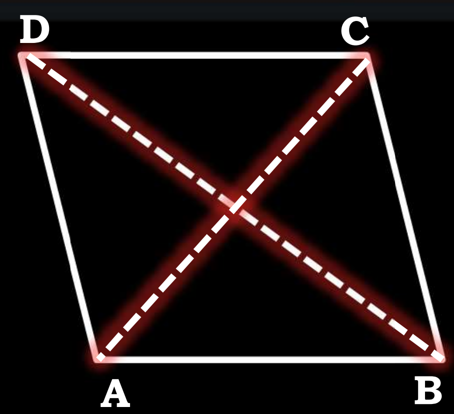


(8)

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

(a) A convex quadrilateral

Sol.



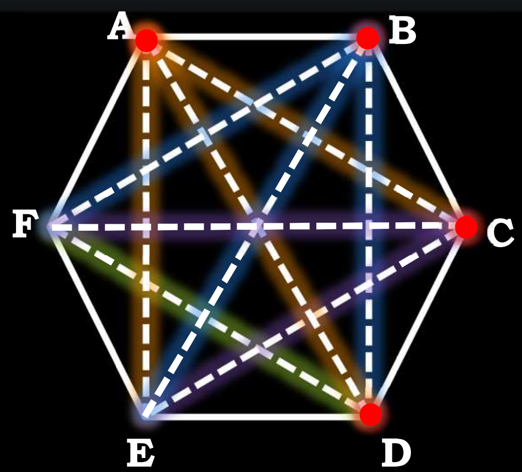
A convex quadrilateral has two diagonals.

1. AC
2. BD

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

(b) A regular hexagon

Sol.



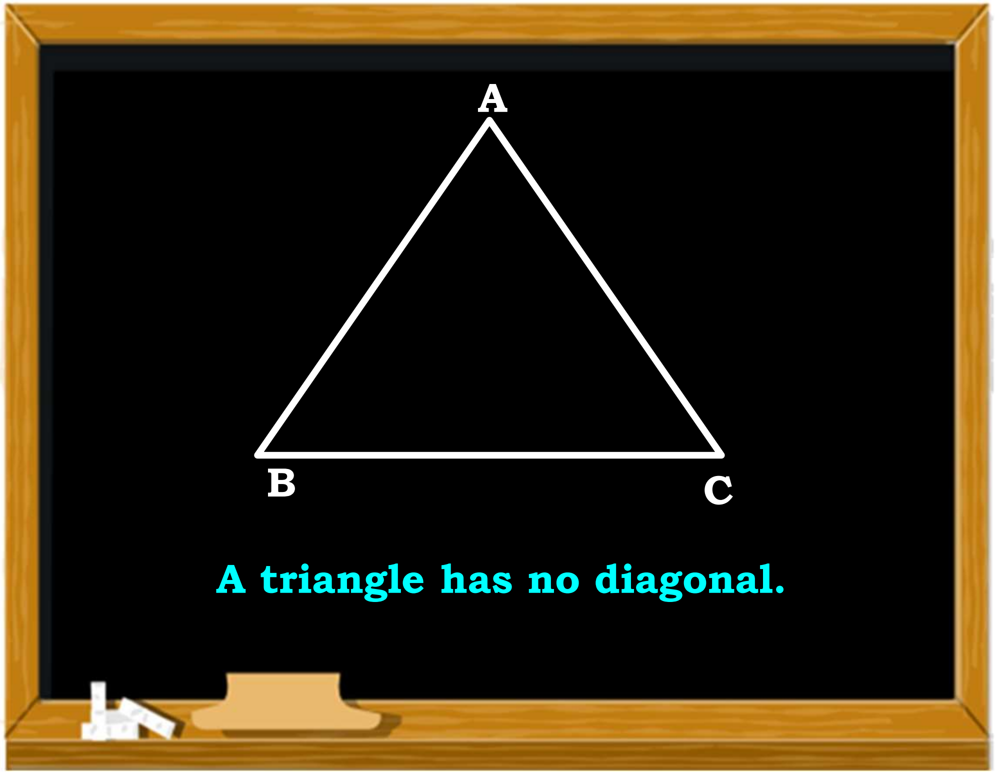
- AE, AD, AB
- BF, BE, BD
- CF, CE
- DF

A regular hexagon has 9 diagonals.

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

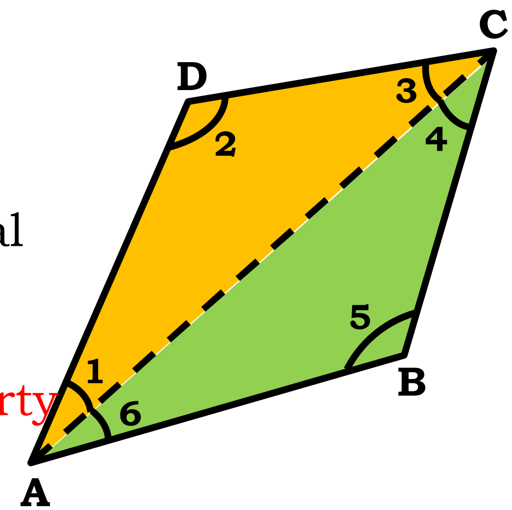
(c) A triangle

Sol.



Module 3

Q. What is the sum of the measures of the angles of a convex quadrilateral? Will the property hold if the quadrilateral is not convex?



Sol. Let, ABCD be a convex quadrilateral

Draw a diagonal AC which divides the quadrilateral in two triangles.

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

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

[By Angle sum property of triangle]

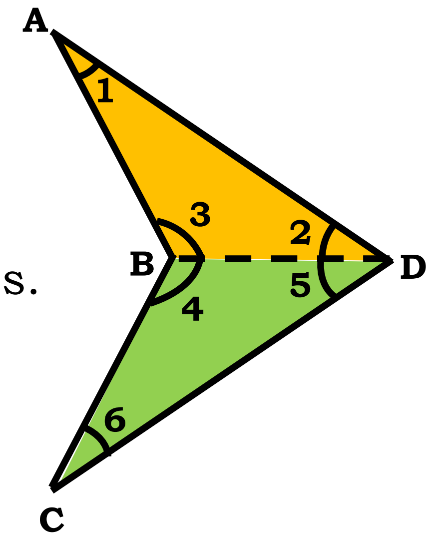
Adding (i) and (ii)

consider ΔABC

$4 + \angle 5 + \angle 6 = 360°$

$\therefore$ s of the angles of convex quadr teral is 360°.

Q. What is the sum of the measures of the angles of a convex quadrilateral? Will the property hold if the quadrilateral is not convex?



Sol. Let ABCD be a non-convex quadrilateral

Draw BD which divides the quadrilateral in two triangles.

$\angle 1 + \angle 2 + \angle 3 = 180°$ ...(iii)

$\angle 4 + \angle 5 + \angle 6 = 180°$ ...(iv)

[By Angle sum property of triangle]

Adding (iii) and (iv)

... $+ \angle 4 + \angle 5 + \angle 6 = 360°$

consider ΔBDC

... of the angles of non-convex quadr...ateral is 360°.

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

Sol. **(a) 7**

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

$= (7 - 2) \times 180$

$= 5 \times 180$

$\therefore$ Angle sum of a convex polygon $= 900°$

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

Where 'n' is number of sides

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

Sol. **(b) 8**

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

$= (8 - 2) \times 180°$

$= 6 \times 180°$

$\therefore$ Angle sum of a convex polygon $= 1080°$

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

Where 'n' is number of sides

Module 4

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

Sol. **(c) 10**

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

$= (10 - 2) \times 180°$

$= 8 \times 180°$

$\therefore$ Angle sum of a convex polygon $= 1440°$

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

Where 'n' is number of sides

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

Sol. **(d) n**

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

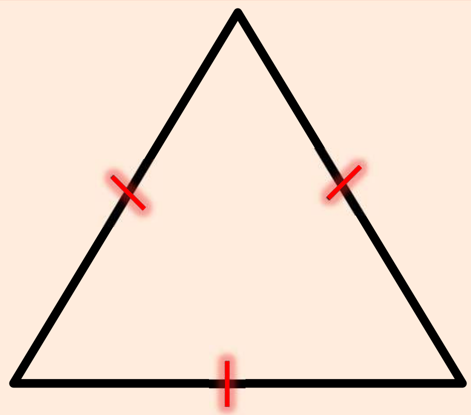
Angle sum of a convex polygon $= (n - 2) \times 180°$

Where 'n' is number of sides

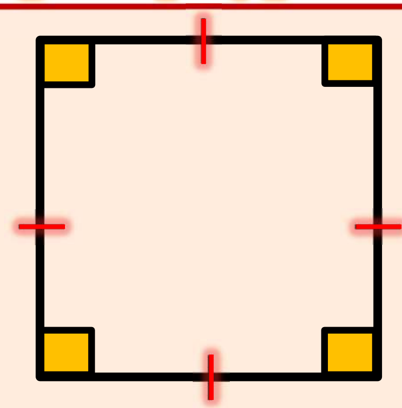
Q. What is a regular polygon? State the name of a regular polygon of:

(i) 3 sides **(ii) 4 sides** **(iii) 6 sides**

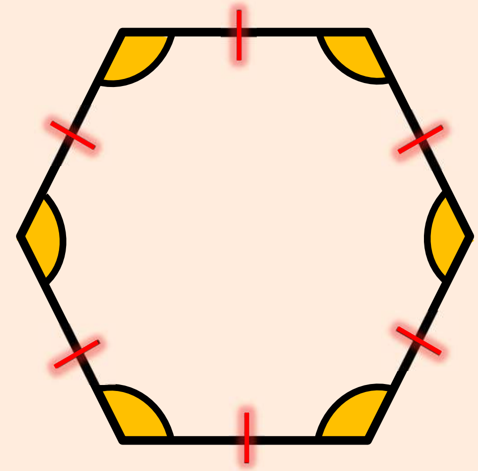
Sol. A polygon having all sides of equal length and the interior angles of equal size is known as regular polygon.



Regular Polygon having three sides is called a and **Equilateral triangle.**



Regular Polygon having four sides is called a **Square**



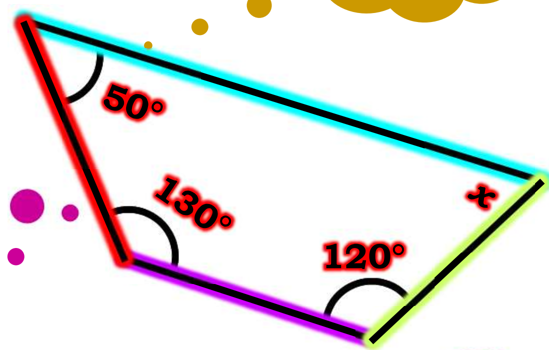
Regular Polygon having six sides is called a **hexagon.**

Module 5

Exercise

Q. Find the angle measure *x* in the following figures.

4 sides



(a)

Sol. The sum of the interior angles of a quadrilateral is 360°

∴ It is an **Quadrilateral**

$$50° + 130° + 120° + x = 360°$$

$$300° + x = 360°$$

$$x = 360° - 300°$$

$$\boxed{x = 60°}$$

The sum of the interior angles of a quadrilateral is 360°

Exercise

Q. Find the angle measure x in the fo

Sol. The sum of the interior angles o quadrilateral is 360°

: It is an Quadrilateral

Fourth angle is forming linear pair with 90°

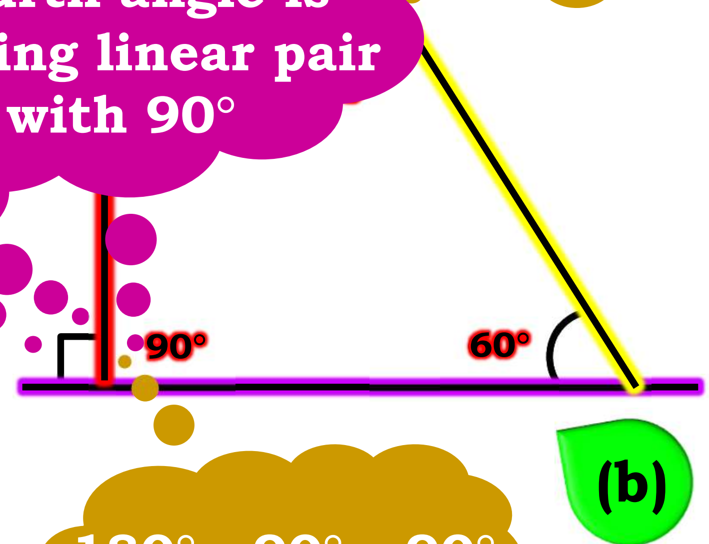
4 sides

$$x + 70° + 60° + 90° = 360°$$

$$x + 220° = 360°$$

$$x = 360° - 220°$$

$$\boxed{x = 140°}$$



180° – 90° = 90°

The sum of the interior angles of a quadrilateral is 360°

Module 6

Exercise

Q. Find the angle measure *x* in the following figures.

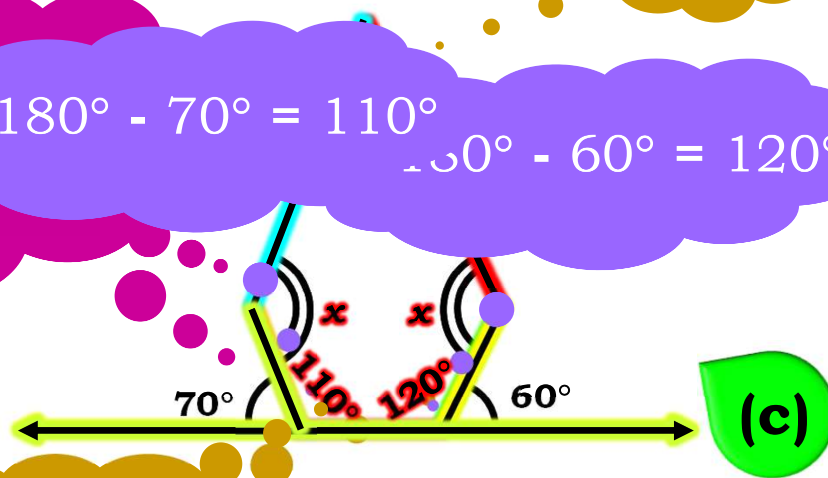
5 sides

Sol. The sum of the interior angles of a pentagon is 540°

Pent…

$\therefore$ 180° - 70° = 110°

…0° - 60° = 120°



$$30° + x + x + 120° + 110° = 540°$$

$$2x + 260° = 540°$$

$$2x = 540° - 260°$$

$$x = \frac{280°}{2} = 140°$$

$\boxed{x = 140°}$

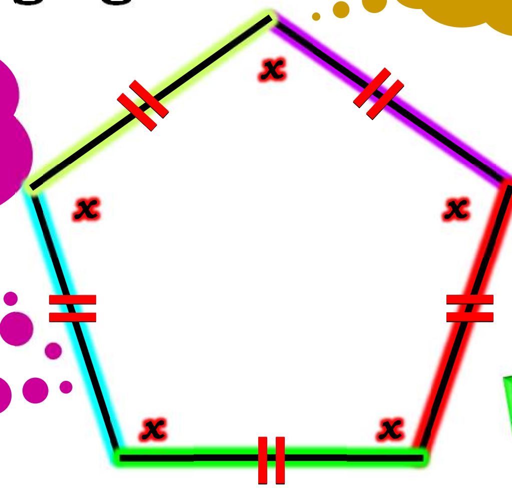
…ngle from linear pair with 70°

The sum of the interior angles of a pentagon is 540°

Exercise

Q. Find the angle measure *x* in the following figures.

5 sides



(d)

Sol. The sum of the interior angles of a pentagon is 540°

It means all sides are equal ?

$x + x + x + x + x = 540°$

$5x = 540°$

$x = \dfrac{540°}{5} = 108°$

∴ It is a regular Pentagon

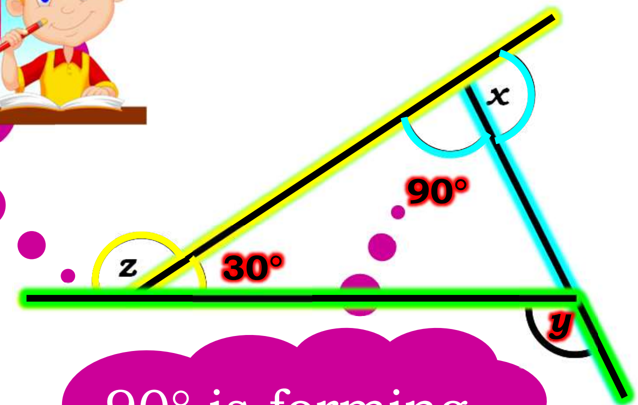
$\boxed{x = 108°}$

In regular polygon all sides and **angles** are **equal**

The sum of the interior angles of a pentagon is 540°

Module 7

The sum of the interior opposite angles is equal to the exterior angle



90° is forming linear pair with x

(a)

Sol. $\therefore\ 90° + x = 180°$ [Linear pair]

$x = 180° - 90°$

$\boxed{x = 90°}$

$\therefore\ z + 30° = 180°$ [Linear pair]

$z = 180° - 30°$

$\boxed{z = 150°}$

$30° + 90° = y$

$\boxed{y = 120°}$

$\therefore\ x + y + z$

$90° + 120° + 150°$

$\boxed{360°}$

Exercise

Q. Find $x + y + z + w$

Sol. The sum of the interior angles of a quadrilateral is 360°

∴ It is an Quadrilateral

Let the fourth angle be $\angle 1$

$60° + 80° + 120° + \angle 1 = 360°$

$\angle 1 + 260° = 360°$

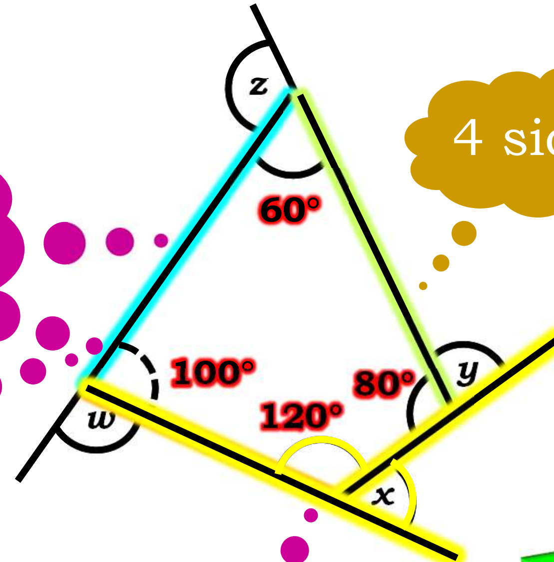
$\angle 1 = 360° - 260° = 100°$

$\therefore\ 120° + x = 180°$ [Linear pair]

$x = 180° - 120°$

$x = 60°$

The sum of the interior angles of a quadrilateral is 360°



4 sides

(b)

120° is forming linear pair with x

Exercise

Q. Find $x + y + z + w$

100° is forming linear pair with w

linear pair with z

Sol. $\therefore 80° + y = 180°$

$y = 180° - 80°$

$\boxed{y = 100°}$

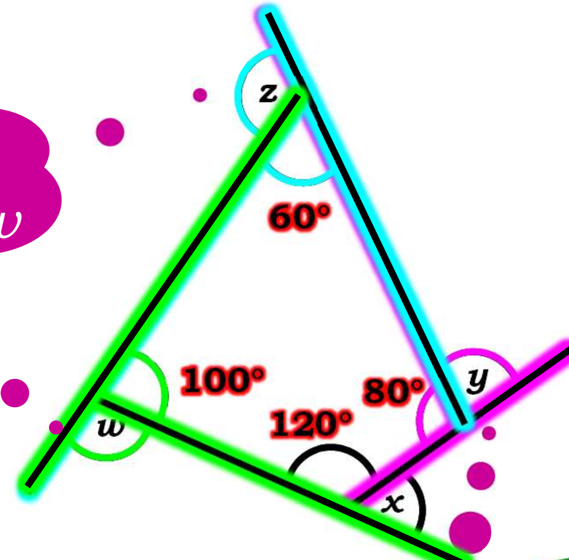
$\therefore 60° + z = 180°$ [Linear pair]

$z = 180° - 60°$

$\boxed{z = 120°}$

$\therefore 100° + w = 180°$ [Linear pair]

$w = 180° - 100°$ $\boxed{w = 80°}$



80° is forming linear pair with y

$\therefore x + y + z + w$

$60° + 100° + 120° + 120°$

$\boxed{360°}$

Lecture 2

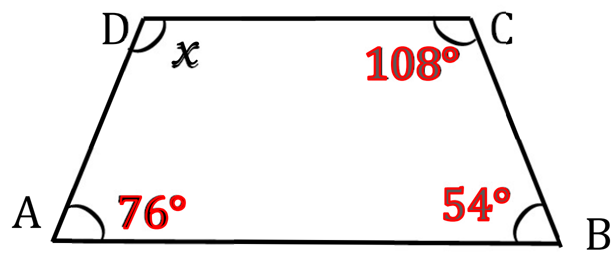
Module 8

Exercise

Q. The three angles of a quadrilateral are 76°, 54° and 108°. Find the measure of the fourth angle.

Sol: Let the fourth angle be x

The sum of measure of angles of a quadrilateral is 360°



$$76° + 54° + 108° + x = 360°$$

$$238° + x = 360°$$

$$x = 360° - 238°$$

$$\boxed{x = 122°}$$

$\therefore$ The fourth angle is 122^0

The sum of measure of angles of a quadrilateral is 360°

Exercise

Q. The angles of a quadrilateral are in the ratio 3 : 5 : 7 : 9. Find the measure of each of these angles.

Sol: Let the measures of angles of the given quadrilateral be $(3x)^0$, $(5x)^0$, $(7x)^0$, $(9x)^0$.

$$\underline{(3x) + (5x) + (7x) + (9x)} = 360°$$

$$(24x) = 360°$$

$$\therefore x = \frac{\cancel{360}^{\,15}}{\cancel{24}_{\,1}}$$

$$\boxed{x = 15°}$$

The sum of measure of angles of a quadrilateral is 360°

Exercise

Q. The angles of a quadrilateral are in the ratio 3 : 5 : 7 : 9. Find the measure of each of these angles.

Sol: So, the measure of angles of the given quadrilateral are

$\angle A = 3x$

$\angle A = 3 \times 15$

$\boxed{\angle A = 45^{0}}$

$\angle B = 5x$

$\angle B = 5 \times 15$

$\boxed{\angle B = 75^{0}}$

$\angle C = 7x$

$\angle C = 7 \times 15$

$\boxed{\angle C = 105^{0}}$

$\angle D = 9x$

$\angle D = 9 \times 15$

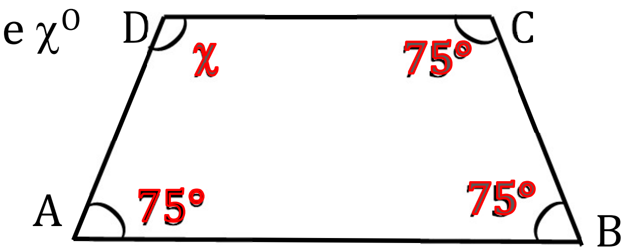
$\boxed{\angle D = 135^{0}}$

i.e., 45^{0}, 75^{0}, 105^{0} and 135^{0}.

Exercise

Q. A quadrilateral has three acute angles, each measuring 75^0. Find the measure of the fourth angles.

Sol: Let the measures of angles of the given quadrilateral be χ^0



$$\underline{75^\circ + 75^\circ + 75^\circ} + x = 360^\circ$$

$$225^\circ + x = 360^\circ$$

$$x = 360^\circ - 225^\circ$$

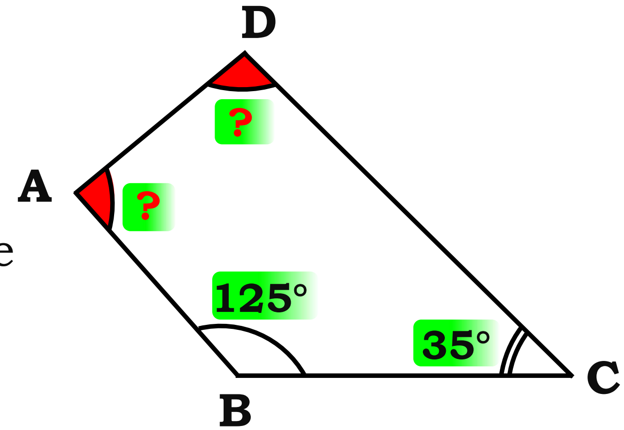
$$\boxed{x = 135^\circ}$$

∴ The fourth angle is 135^0

The sum of measure of angles of a quadrilateral is 360°

Module 9

Q. The measures of two adjacent angles of a quadrilateral are 125° and 35° and the other two angles are equal. Find the measure of each of the equal angles.



Sol : Let ABCD be the quadrilateral such that

$\angle B = 125°$, $\angle C = 35°$ and $\angle A = \angle D$

By angle sum property of a quadrilateral, we have

$$\angle A + \angle B + \angle C + \angle D = 360°$$

$$\therefore \quad \angle A + \underline{125° + 35°} + \angle A = 360° \quad [\because \angle A = \angle D]$$

$$\therefore \quad 160° + 2\angle A = 360°$$

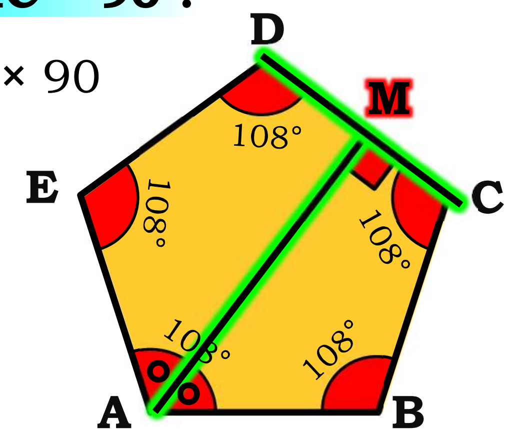
$$\therefore \quad 2\angle A = 360° - 160°$$

$$\therefore \quad 2\angle A = 200°$$

$$\therefore \quad \angle A = \left(\frac{200}{2}\right)^{\circ} = 100°$$

The sum of the interior angles of a quadrilateral is 360°

Q. ABCDE is a regular pentagon. The bisector of $\angle A$ of the pentagon meets the side CD in M. Show that $\angle AMC = 90°$.



Sol : Sum of interior angles of regular polygon $= (2n - 4) \times 90$

$$\text{Measure of each interior angle} = \frac{2\boxed{n} - 4}{n} \times 90$$

$$= \frac{(2 \times 5) - 4}{5} \times 90$$

$$= \frac{10 - 4}{5} \times 90$$

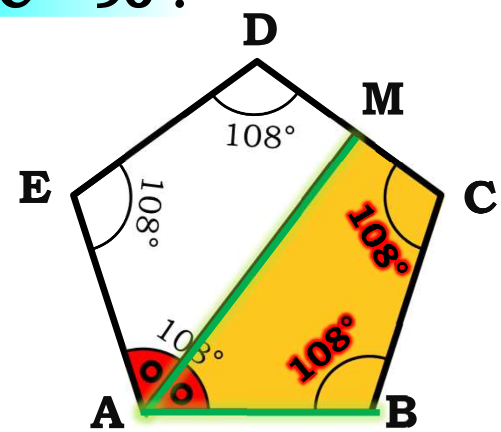
Pentagon has 5 sides

$$= \frac{6}{\cancel{5}_{1}} \times \cancel{90}^{18}$$

$$= 6 \times 18$$

$$\therefore \text{Measure of each interior angle} = 108°$$

Q. ABCDE is a regular pentagon. The bisector of $\angle$A of the pentagon meets the side CD in M. Show that $\angle AMC = 90°$.



Sol : $\angle BAE = 108°$

$$\angle MAB = \frac{1}{2} \times \angle BAE$$

$$= \frac{1}{2} \times 108$$

$$\therefore \angle MAB = 54°$$

Consider □ABCM

In □ABCM,

$$\angle MAB + \angle ABC + \angle BCM + \angle AMC = 360°$$

$$\therefore 54 + 108 + 108 + \angle AMC = 360$$

$$\therefore 270 + \angle AMC = 360$$

0 – 270

The sum of the interior angles of a quadrilateral is 360°

$\therefore$ $\angle$AMC = 90

Module

10

Sum of interior angles = $(n - 2) \times 180$ or $(2n - 4) \times 90$

Measure of each interior angle of regular polygon $= \dfrac{(n-2)\times 180}{n}$ or $\dfrac{(2n-4)\times 90}{n}$

Sum of exterior angles = 360°

For 'n' sided regular polygon :

Measure of each exterior angle $= \dfrac{360}{n}$

When interior angle is given :

Measure of each exterior angle = 180° – Measure of each interior angle

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

$$\text{Number of side} = \frac{360^\circ}{\boxed{\text{Each exterior angle}}}$$

Sol. Measure of an interior angle = **165°**

Let, the number of sides be ***n***

Exterior angle = 180 – interior angle

= 180 – 165

$\therefore$ Exterior angle = 15°

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

$$\text{Number of side} = \frac{360^\circ}{\text{Each exterior angle}}$$

Sol. Let, the number of sides be n

Exterior angle = 15

$$\text{Number of side} = \frac{360}{\text{Each exterior angle}}$$

$$= \frac{\cancel{360}^{\,24}}{\cancel{15}_{\,1}}$$

$\therefore$ Number of side = 24

Q. How many sides has a regular polygon, each angle of which is of measure 108° ?

$$\text{Number of side} = \frac{360°}{\boxed{\text{Each exterior angle}}}$$

Sol. Measure of an interior angle = **108°**

Let, the number of sides be n

Exterior angle = 180 – interior angle

= 180 – 108

∴ Exterior angle = 72°

Q. How many sides has a regular polygon, each angle of which is of measure 108° ?

$$\text{Number of side} = \frac{360^\circ}{\text{Each exterior angle}}$$

Sol. Let, the number of sides be n

Exterior angle = 72

$$\text{Number of side} = \frac{360}{\text{Each exterior angle}}$$

$$= \frac{\cancel{360}^{\,5}}{\cancel{72}_{\,1}}$$

$\therefore$ Number of side = 5

Module

11

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

Sol.

$$\text{Exterior angle of regular polygon} = \frac{360}{\text{Number of sides}}$$

$$22 = \frac{360}{\text{Number of sides}}$$

$$\therefore \quad \text{Number of sides} = \frac{360}{22}$$

$$\therefore \quad \text{Number of sides} = 16.3636$$

Side cannot be decimal or fraction so it is not possible to have a regular polygon with measure of each interior angle as 22°

Q. Is it possible to have a regular polygon with measure of each interior angle as 22°?

Sol.

$$\text{Interior angle of regular polygon} = \frac{2n - 4}{n} \times 90$$

$$22 = \frac{2n - 4}{n} \times 90$$

$$\therefore \quad 22n = 90 \times (2n - 4)$$

$$\therefore \quad 22n = 180n - 360$$

$$\therefore \quad 180n - 22n = 360$$

$$\therefore \quad 158n = 360$$

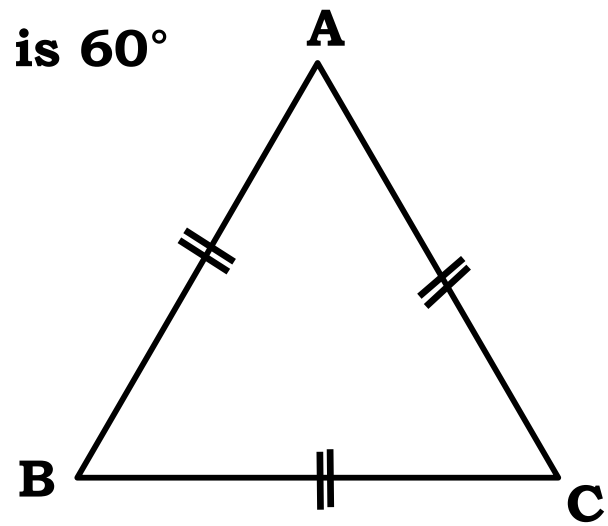
$$\therefore \quad \text{Number of sides} = \frac{360}{158}$$

$$\therefore \quad \text{Number of sides} = 2.27$$

Side cannot be decimal or fraction so it is not possible to have a regular polygon with measure of each interior angle as 22°

Q. What is the minimum interior angles possible for a regular polygon? Why?

Sol. **Interior angle of an Equilateral triangle is 60°**



$\therefore$ **Minimum interior angle possible for a regular polygon is 60°**

A regular polygon with least number of sides is an Equilateral triangle

Q. What is the maximum exterior angle possible for a regular polygon?

Sol. **Minimum interior angle for a regular polygon = 60°**

Maximum exterior angle for a regular polygon

$$= 180^\circ - \text{Minimum interior angle}$$

$$= 180 - 60$$

$$= 120^\circ$$

$\therefore$ **Maximum exterior angle possible for a regular polygon is 120°**

Module

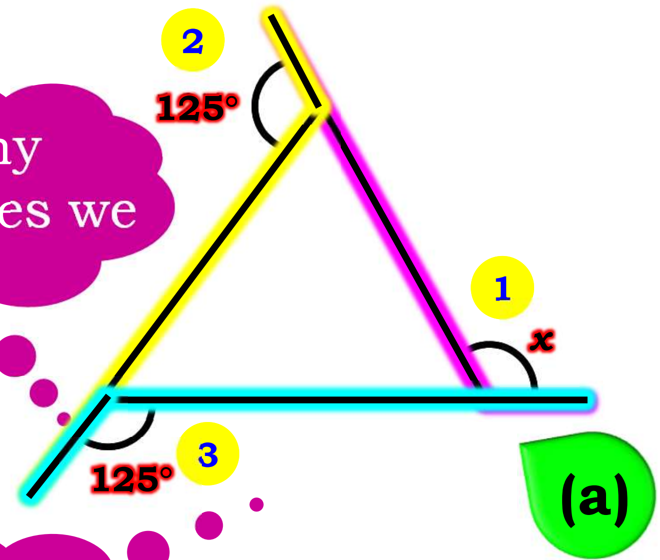
12

Exercise

Q. Find x in the following figures

Sol. The sum of the measures of the exterior angles any polygon is 360°

How many exterior angles we have?



$$x + \underline{125° + 125°} = 360°$$

$$x + 250° = 360°$$

$$x = 360° - 250°$$

$$\boxed{x = 110°}$$

Three exterior angles

The sum of the measures of the exterior angles of any polygon is 360°

Exercise

Q. Find x in the following figures

Sol. The sum of the measures of the exterior angles any polygon is 360°

How many exterior angles we

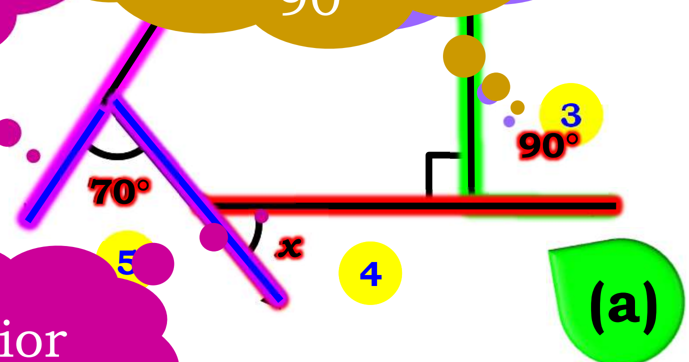
$$70° + 90° + 60° + 90° + x = 360°$$

$$310° + x = 360°$$

$$x = 360° - 310°$$

$$\boxed{x = 50°}$$

This angle from linear pair with 90°



Five exterior angles

The sum of the measures of the exterior angles of any polygon is 360°

Exercise

Find measure of each exterior angle of regular polygon of

i. 9 Sides

Sol. Number of sides = $\boxed{9}$

$\therefore$ Measure of an exterior angles = $\dfrac{\cancel{360}^{40}}{\cancel{9}_{1}}$

Measure of each exterior angle = $\dfrac{360°}{\boxed{\text{Number of sides}}}$

Measure of each exterior angle = 40°

Exercise

Q. Find measure of each exterior angle of regular polygon of

ii. 15 Sides

Sol. Number of sides = $\boxed{15}$

Measure of each exterior angle = $\dfrac{360°}{\boxed{\text{Number of sides}}}$

$\therefore$ Measure of an exterior angles = $\dfrac{\cancel{360}^{24}}{\cancel{15}_{1}}$

Measure of each exterior angle = 24°

Exercise

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

Sol.

Measure of an exterior angle= **24°**

Let, the number of sides be ***x***

Measure of each exterior angle = $\dfrac{360°}{\text{Number of sides}}$

$$24 = \frac{360}{x}$$

$$\therefore\ x = \frac{\cancel{360}^{\,15}}{\cancel{24}_{\,1}}$$

Number of sides = 15

Module

13

Q. Prove that the interior angle of a regular pentagon is three times the exterior angle of a regular decagon

To prove : Interior angle of a regular pentagon $= 3 \times$ Exterior angle of a regular decagon

Measure of each interior angle $= \dfrac{2n - 4}{n} \times 90$

Where 'n' sides of number

Measure of each exterior angle $= \dfrac{360°}{n}$

Where 'n' sides of number

Proof : Interior angle of a regular pentagon $= \dfrac{2\boxed{n} - 4}{n} \times 90$

Pentagon has 5 sides

$= \dfrac{(2 \times 5) - 4}{5} \times 90$

$= \dfrac{10 - 4}{5} \times 90$

$= \dfrac{6}{\cancel{5}_{1}} \times \cancel{90}^{18}$

$= 6 \times 18$

$\therefore$ Interior angle of a regular pentagon $= 108°$ ...(i)

Q. Prove that the interior angle of a regular pentagon is three times the exterior angle of a regular decagon

To prove : Interior angle of a regular pentagon $= \boxed{3 \times}$ $\boxed{\text{Exterior angle of a regular decagon}}$

Measure of each exterior angle $= \dfrac{360°}{n}$

Where 'n' sides of number

Proof : Interior angle of a regular pentagon $= \boxed{108°}$ ...(i)

Exterior angle of a regular decagon $= \dfrac{360°}{\boxed{n}}$

Decagon has 10 sides

$= \dfrac{36\cancel{0}}{1\cancel{0}}$

$= 36°$

$\therefore$ 3 × Exterior angle of a regular decagon $= 3 \times 36$

$\therefore$ 3 × Exterior angle of a regular decagon $= \boxed{108°}$ ...(ii)

Hence, interior angle of a regular pentagon is three times the exterior angle of a regular decagon

Q. The exterior angle of a regular polygon is one-third of its interior angle. How many sides has the polygon ?

Sol : $\boxed{\text{Exterior angle}} = \frac{1}{3}\boxed{\text{(Interior angle)}}$

Measure of each exterior angle $= \dfrac{360°}{n}$

Where 'n' sides of number

Measure of each interior angle $= \dfrac{2\,n - 4}{n} \times 90$

Where 'n' sides of number

$$\therefore \quad \frac{360}{n} = \frac{1}{\cancel{3}} \times \left(\frac{2n - 4}{n} \times \cancel{90}^{\,30}\right)$$

$$\therefore \quad \frac{360}{n} = 30\left(\frac{2n - 4}{n}\right)$$

$$\therefore \quad \frac{360}{\cancel{n}} = 60\left(\frac{n - 2}{\cancel{n}}\right)$$

$$\therefore \quad 360 = 60\,(n - 2)$$

∴ ... 2

∴ ... $n - 2$

Let there be n sides of the polygon.

$$\therefore \quad n = 8$$

∴ **The polygon has 8 sides.**

Lecture 3

Module

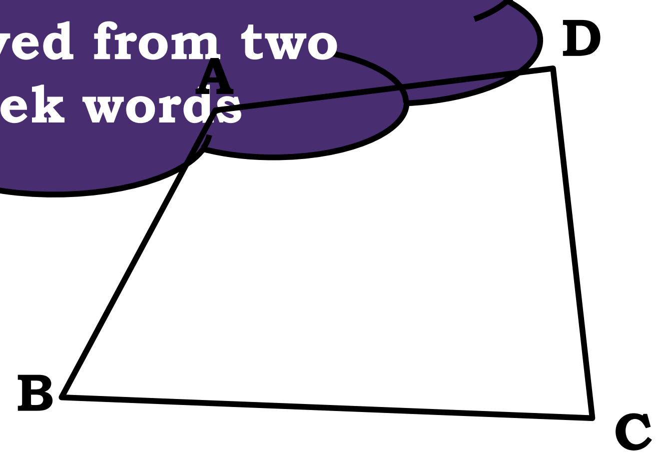
14

QUADRILATERALS

⇒ **FOUR** ⇒ **SIDES**

Definition : **Any four sided closed figure is called a Quadrilateral**

The word "QUADRILATERAL" is derived from two Greek words



ANGLE SUM PROPERTY OF A QUADRILATERAL

❖ **<u>Statement:</u>**

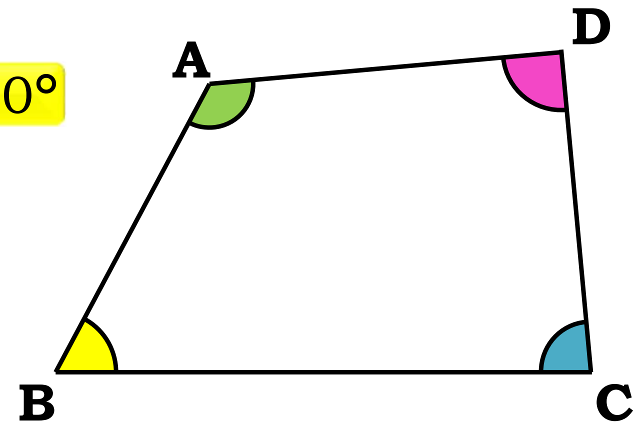
Sum of all the angles of a quadrilateral is 360°

In □ABCD,

∠A + ∠B +

Name all the angles of □ABCD

∠A, ∠B, ∠C & ∠D

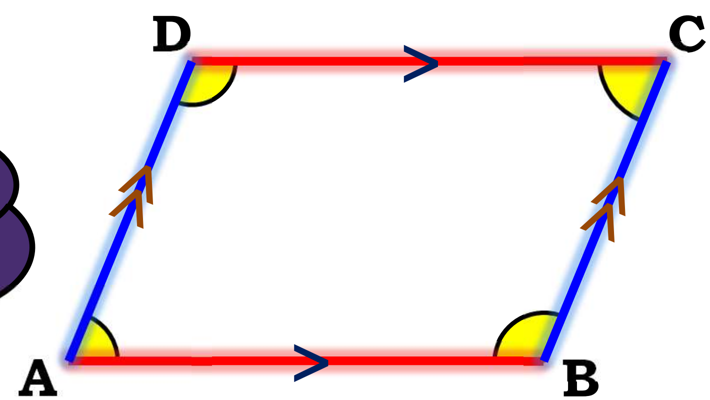


Types of Quadrilaterals

- PARALLELOGRAM
- RECTANGLE
- RHOMBUS
- SQUARE
- TRAPEZIUM
- KITE

➢ PARALLELOGRAM

Definition : **A quadrilateral is called a Parallelogram if its opposite sides are parallel.**



□ABCD is a Parall

∴ AB ∥ CD and
AD ∥ BC

Interior angles
are supplementary

Adjacent angles of a paral … plementary

PROPERTIES OF A PARALLELOGRAM

- **Opposite sides are equal**

  AB = CD

  AD = BC

Name the pairs of opposite sides

- **Opposite a**

  $\angle A = \angle C$

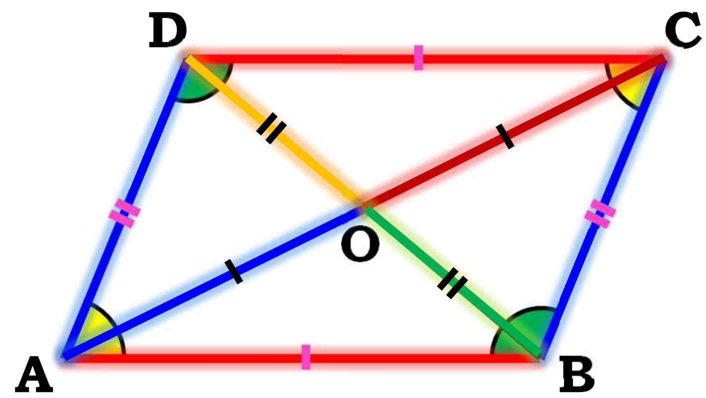
  $\angle B = \angle D$

Name the pairs of opposite angles

- **Diagonals bisect each oth**

  OA = OC

  OB = OD



OA = OC &

OB = OD

Module

15

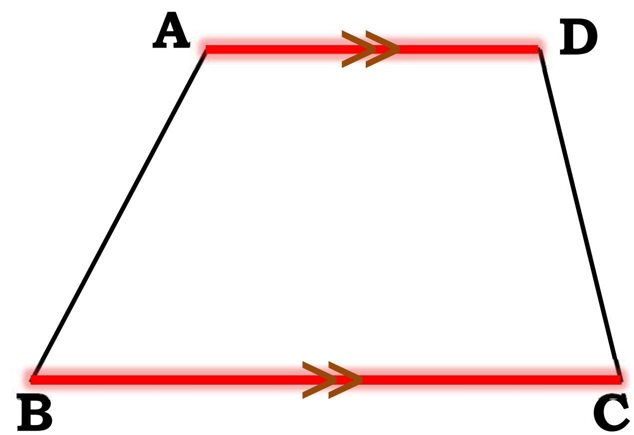
➢ TRAPEZIUM

Definition : **A quadrilateral is said to be a trapezium, if only one pair of opposite sides is parallel.**

AD || BC

□ABCD is a Trapezi

AD || BC



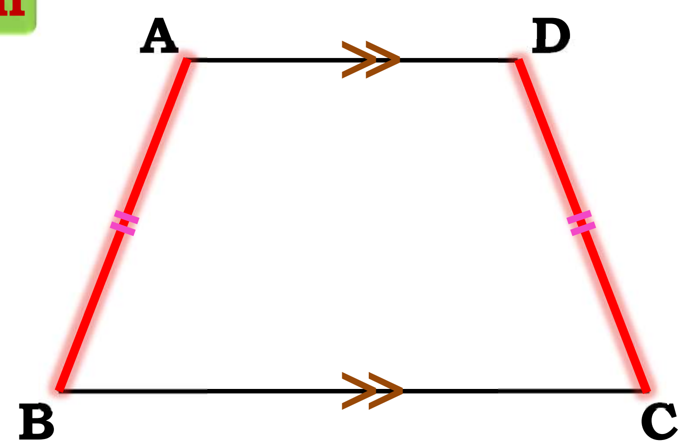
➢ Isosceles Trapezium

Definition : A Trapezium in which the non-parallel sides are equal, is called an isosceles trapezium

Which are non-parallel sides ?

AB & DC

=



□ABCD is an Isosceles Trapezium

➤ KITE

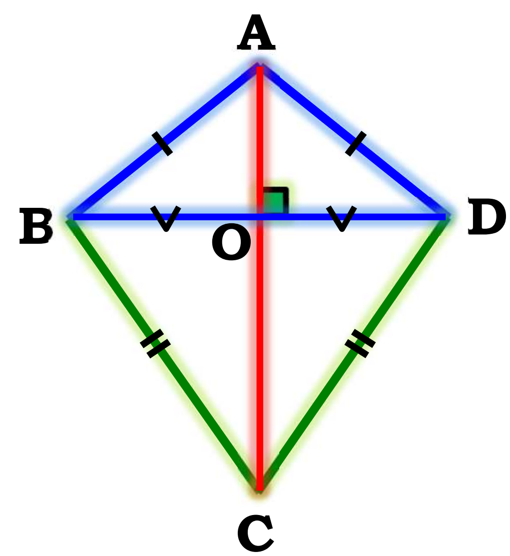
In □ABCD,

$AB = AD$

$BC = DC$

and $AB \neq BC$

$\therefore$ □ABCD is a Kite



PROPERTY OF A KITE

➤ **Longer diagonal is the Perpendicular Bisector of the shorter diagonal.**

$AC \perp BD$

$OB = OD$

Module 16

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

Sol. i. AD = **BC**

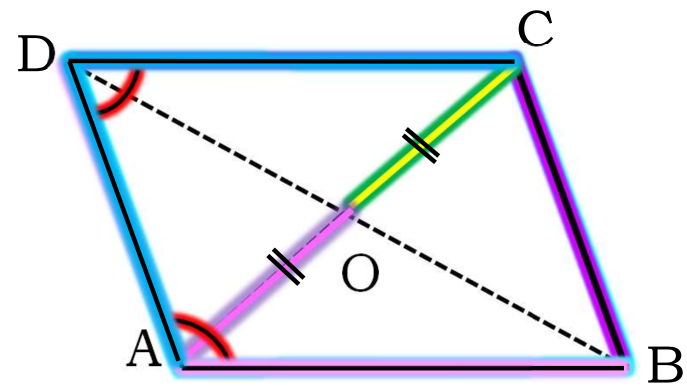
ii. $\angle DCB$ = **$\angle DAB$**

iii. OC = **OA**

iv. $m\angle DAB + m\angle CDA$ = **180°**

Opposite angle of $\angle DCB$?

$\angle DAB$

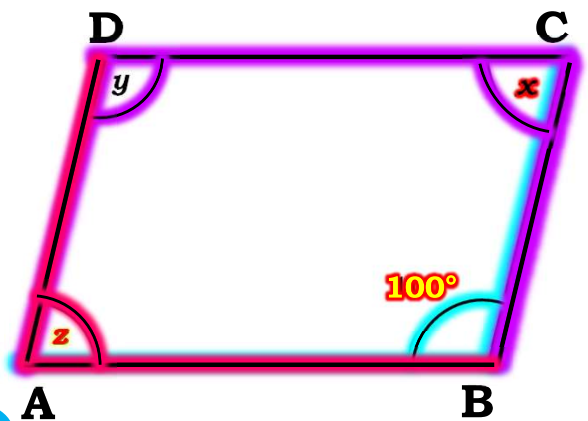


- Opposite sides are equal
- Opposite angles are eq
- Ad
  Supplementa
- Diagonal bisects each other

180°

Divide in two equal parts

Q. Consider the following parallelogram. Find the values of the unknowns *x*, *y*, *z*.



(i)

Sol.

$\angle D = \angle B$ [Opposite angles are equal]

$\therefore$ $\boldsymbol{y = 100}$

∠A

$\therefore \angle B + \angle C = 180°$ [Adjacent angles are supplementary]

$\therefore 100° + x = 180°$

$\therefore x = 180 - 100$

$\therefore$ $\boldsymbol{x = 80}$

Name the adjacent angle of ∠B

$\therefore \angle A = \angle C$

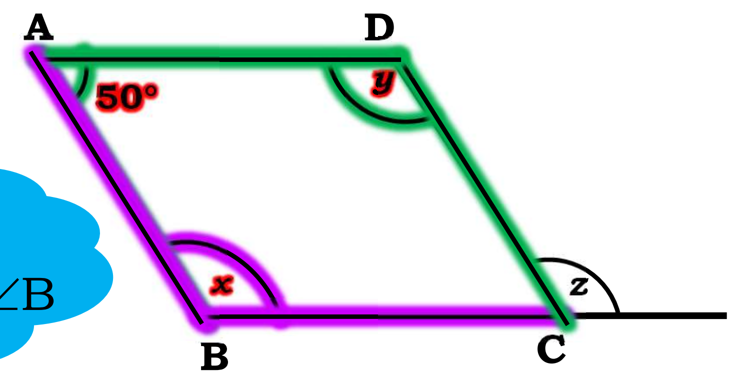
$\therefore$ $\boldsymbol{z = 80}$

- Opposite angles are equal
- Adjacent angles are Supplementary

180°

Name the angle opposite to ∠C

Q. Consider the following parallelogram. Find the values of the unknowns *x*, *y*, *z*.



(ii)

Sol.

$\therefore \angle A + \angle B = 180°$ [Adjacent angles are supplementary]

$\therefore 50 + x = 180$

$\therefore x = 180 - 50$

$\therefore$ $\boldsymbol{x = 130}$

Name the angle opposite to angle $\angle B$

$\angle D$

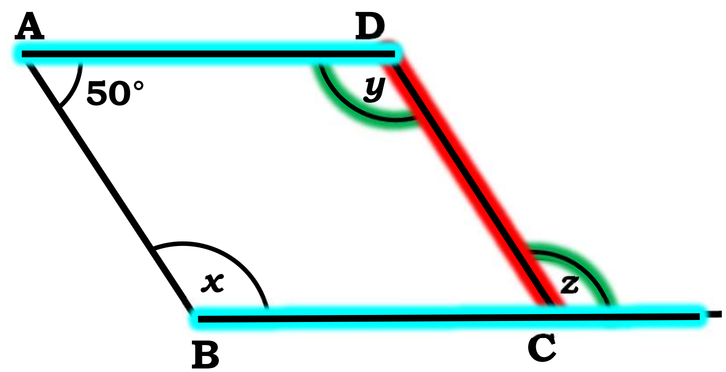
$\therefore \angle D = \angle B$ (Opposite angles are equal)

$\therefore$ $\boldsymbol{y = 130}$

- Opposite angles are equal
- Adjacent angles are Supplementary

180°

Q. Consider the following parallelogram. Find the values of the unknowns *x*, *y*, *z*.



(ii)

Sol. $\therefore x = 130, y = 130$

$\therefore$ AD ∥ BC and DC is transversal

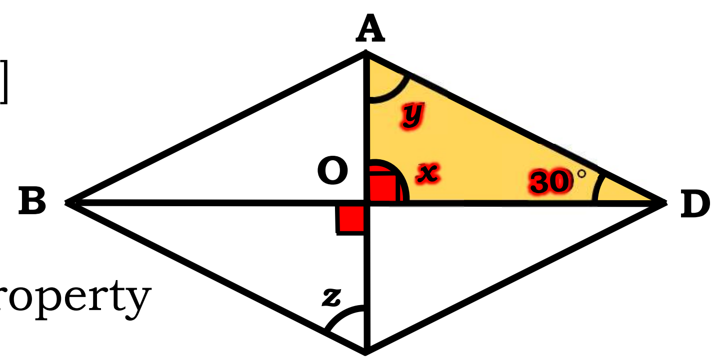
$\therefore y = z$ [Alternate angles]

$\therefore z = 130$

$\therefore$ **$x = 130$, $y = 130$ and $z = 130$**

Module 17

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



(iii)

Sol. $\angle AOD = \angle BOC$ [Vertically opposite angles]

$\therefore$ $\boldsymbol{x = 90}$

Consider ΔAOD

In ΔAOD,

$\angle OAD + \angle AOD + \angle ADO = 180°$ [Angle sum property of a triangle]

$$y + \underline{90 + 30} = 180°$$

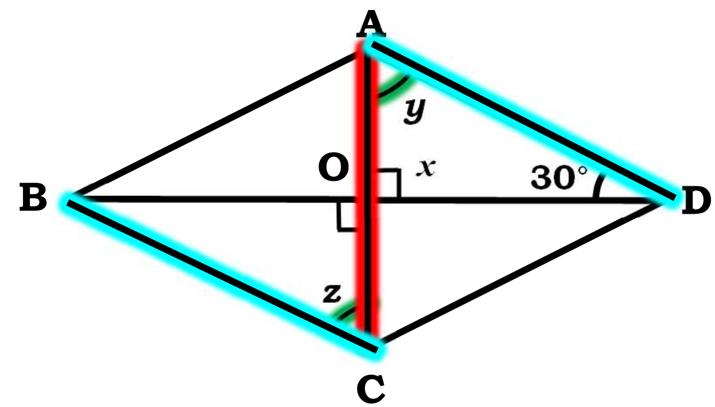
$$y + 120 = 180$$

$$y = 180 - 120$$

$$\therefore y = 60$$

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

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



(iii)

Sol. $\therefore x = 90, y = 60$

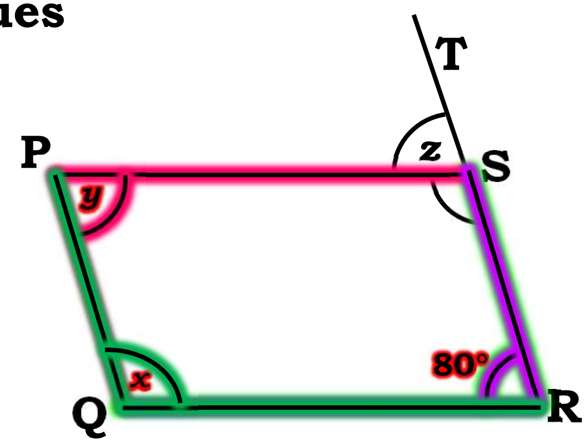
$\therefore$ AD $\parallel$ BC and AC is transversal

$\therefore y = z$ [Alternate angles]

$\therefore z = 60$

$\therefore$ **$x = 90$, $y = 60$ and $z = 60$**

Q. Consider the following parallelogram. Find the values of the unknowns *x*, *y*, *z*.



(iv)

Sol. $\therefore \angle P = \angle R$ (Opposite angles are equal)

$\therefore$ ***y* = 80**

$\therefore \angle Q + \angle R = 180°$ [Adjacent angles are supplementary]

$\therefore \quad x + 80 = 180$

$\therefore \quad x = 180 - 80$

$\therefore$ ***x* = 100**

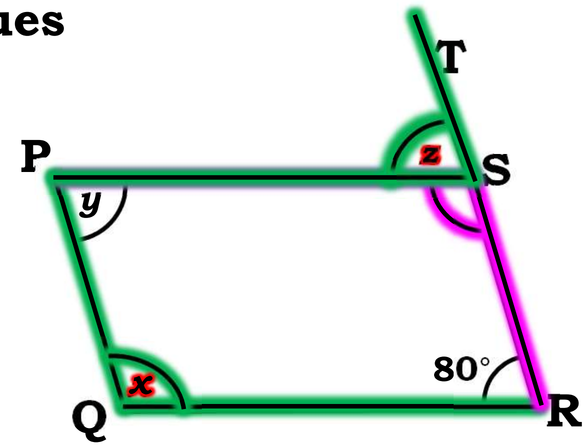
∠P

Name the adjacent angle of ∠R

- Opposite angles are equal
- Adjacent angles are Supplementary

180°

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



(iv)

Sol. $\therefore x = 100$

$\angle S = \angle Q$

$\therefore \angle S = 100$

∠PSR & ∠PST forms linear pair

∠S

$\angle PSR + \angle PST = 180°$

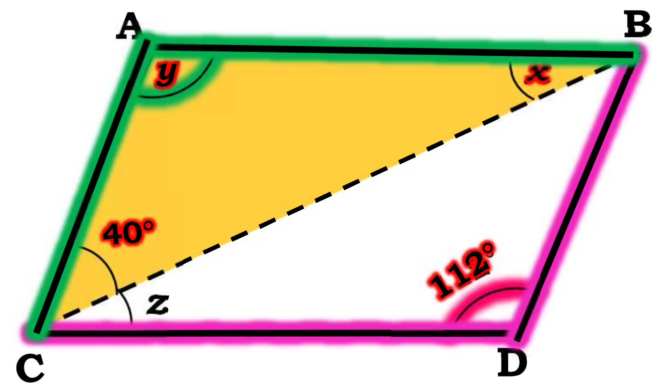
$100 + z = 180$

$z = 180 - 100$

$\boxed{z = 80}$

Module 18

Q. **Consider the following parallelogram. Find the values of the unknowns x, y, z.**



(v)

Sol. $\angle A = \angle D$ (Opposite angles are equal)

$\therefore$ $y = 112$

$\angle A$

In ΔACB,

$\angle ABC + \angle CAB + \angle ACB = 180°$

$x + 112 + 40 = 180$

$x + 152 = 180$

$x = 180 - 152$

$\therefore$ $x = 28$

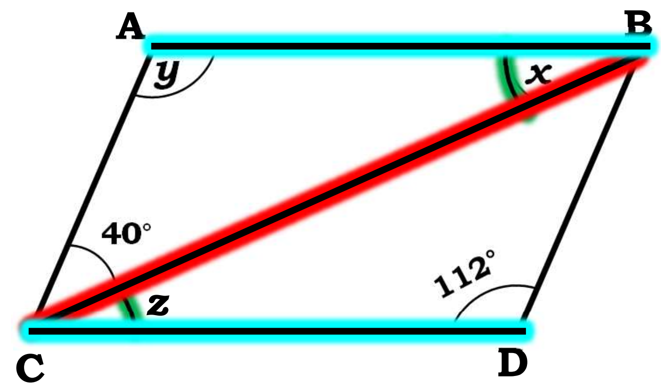
Name the angle opposite to $\angle D$

- Opposite angles are equal

sures of all

s 180°

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



(v)

Sol. $\therefore x = 28, y = 112$

$\therefore$ AB ∥ CD and BC is transversal

$\therefore x = z$ [Alternate angles]

$\therefore z = 28$

$\therefore$ $\boxed{x = 28, y = 112 \text{ and } z = 28}$

Q. **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.**

Sol. Let ABCD be a parallelogram.

Let, $\angle A = 3x$, $\angle B = 2x$

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

$\therefore \quad 3x + 2x = 180$

$\therefore \quad 5x = 180$

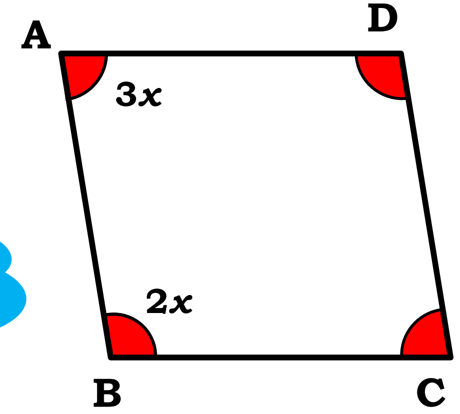
$\therefore \quad x = \dfrac{\cancel{180}^{36}}{\cancel{5}_{1}}$

$\therefore \quad x = 36$

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

$\therefore \angle B = 2x = 2 \times 36 = 72^\circ$

Adjacent angles are supplementary



Q. **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.**

Sol. $\therefore\ \angle A = 108°$

$\therefore\ \angle B = 72°$

$\angle A = \angle C$

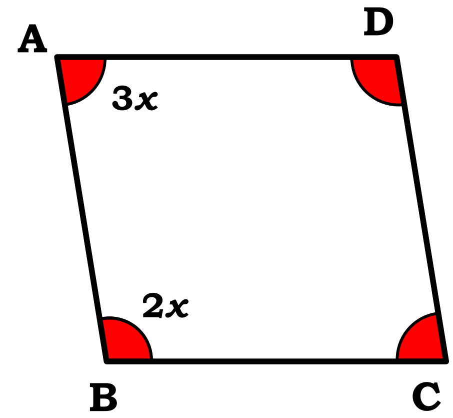
$\therefore\ \angle C = 108°$

$\angle B = \angle D$

$\therefore\ \angle D = 72°$

$\therefore\ \boldsymbol{\angle A = 108°,\ \angle B = 72°,\ \angle C = 108°\ \text{and}\ \angle D = 72°}$

Opposite angles are equal



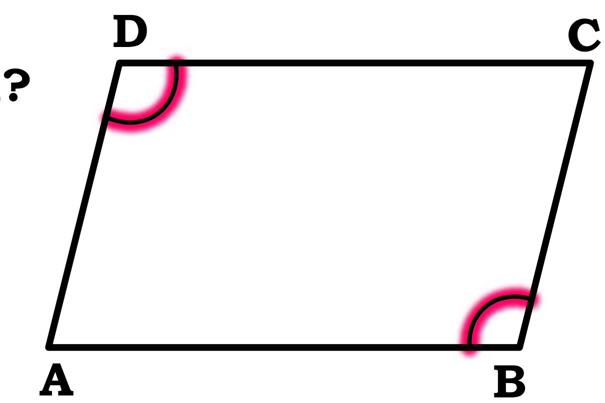
Module 19

Q. Can a quadrilateral ABCD be a parallelogram if

(i) $\angle D + \angle B = 180°$?

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

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



Sol. $\angle D$ and $\angle B$ are opposite angles

But, in a parallelogram adjacent angles are supplementary

$\therefore$ If $\angle D + \angle B = 180°$

then □ABCD is not a parallelogram.

- Opposite sides are equal
- Opposite angles are equal
- Opposite sides are parallel

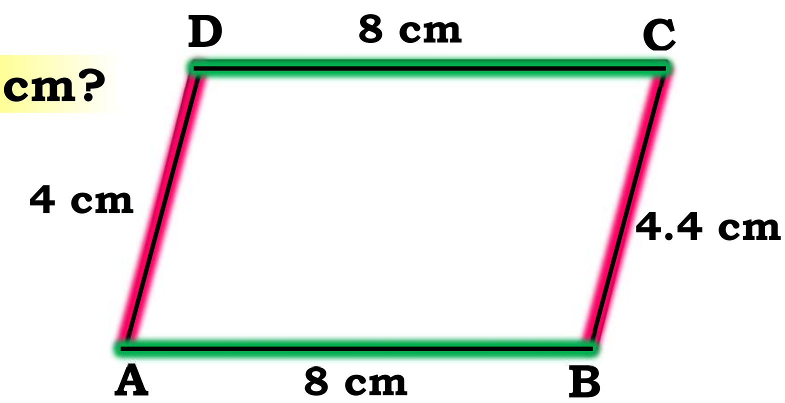
But, according to given condition $\angle B$ and $\angle D$ are supplementary

Q. Can a quadrilateral ABCD be a parallelogram if

(i) $\angle D + \angle B = 180°$?

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

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



Sol. $AB = DC$

$AD \neq BC$

$\therefore$ According to given condition

□ABCD can not be a parallelogram.

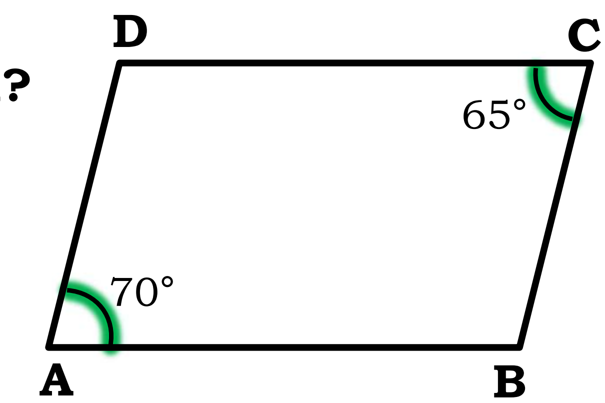
- Opposite sides are equal
- Opposite angles are equal
- Opposite sides are parallel

Q. Can a quadrilateral ABCD be a parallelogram if

(i) $\angle D + \angle B = 180°$?

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

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



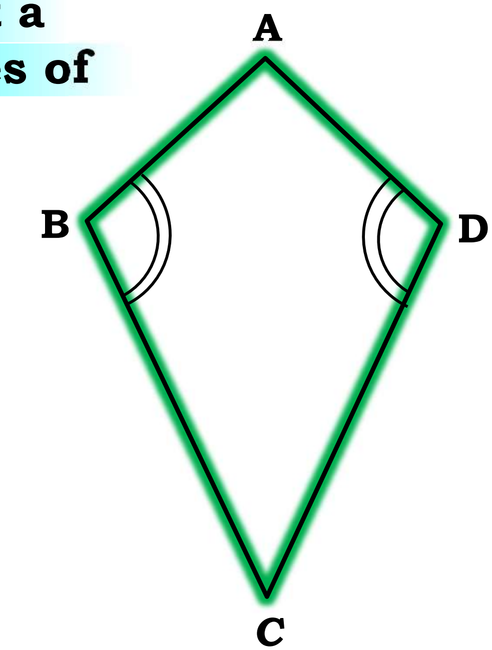
Sol. $\angle A \neq \angle C$

$\therefore$ According to given condition

□ABCD can not be a parallelogram.

- Opposite sides are equal
- Opposite angles are equal
- Opposite sides are parallel

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



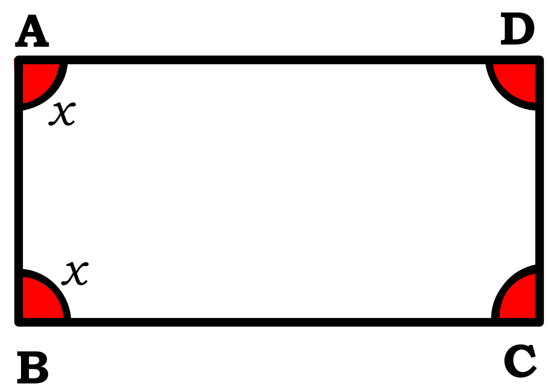
Sol. □ABCD is a quadrilateral

$\angle B = \angle D$

□ABCD is not a Parallelogram

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

To Find : ∠A, ∠B, ∠C, ∠D



Sol. $\angle A = \angle B = x$

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

- Opposite angles are equal
- Adjacent angles are Supplementary

180°

$\therefore \quad \underline{x + x} = 180^\circ$

$\therefore \quad 2x = 180^\circ$

$\therefore \quad x = \dfrac{\cancel{180}^{\,90}}{\cancel{2}_{\,1}}$

$\therefore \quad \boxed{\angle A = \angle B = 90^\circ}$

$\angle A = \angle C$ [Opposite angles are equal]

$\therefore \quad \angle C = 90^\circ$

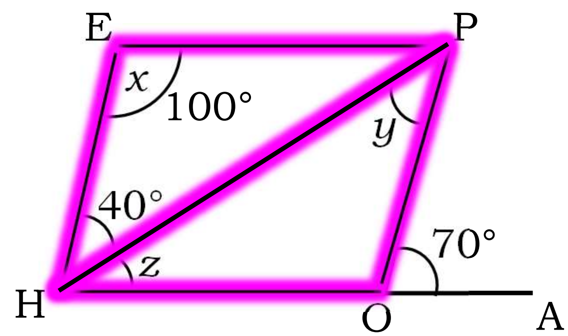
$\angle B = \angle D$ [Opposite angles are equal]

$\therefore \quad \angle D = 90^\circ$

Module 20

Exercise

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



Sol. In ΔHOP,

$\angle HOP = 180 - ($ y

$= 180 - 70$

$= 110$

$\angle HOP = 110$

$\angle HOP = x$

$\therefore \; x = 110$

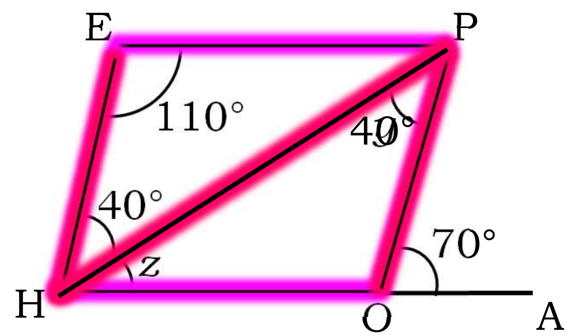
$\angle HOP$ is a part of Δ HOP

Opposite angles are equal

The sum of the measure of all angles of a triangle is 180°

Exercise

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



Sol. $\therefore$ EH ∥ OP and PH is transversal

$\angle EHP = \angle HPO$

$\therefore y = 40°$

$40° + z = 70°$

$z = 70°$

that

ed to

ngles

qual

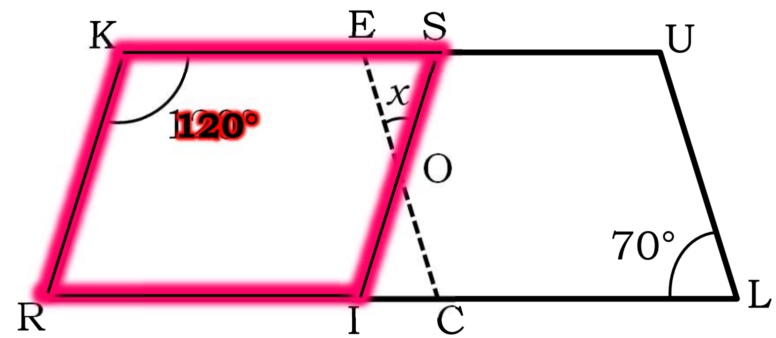
$\therefore$ z = 30°

$\therefore$ x = 110°, y = 40° and z = 30°

In a triangle, exterior angles is equal to the sum of interior angles opposite.

Exercise

Q. In the following figure, both RISK and CLUE are parallelogram. Find the value of *x*.



Sol. RISK is a parallelogram.

$\therefore \angle R + \angle K = 180°$

$\therefore \angle R + 120° = 180°$

$\angle R = 180 - 120°$

$\boxed{\angle R = 60°}$

But $\angle R$ and $\angle S$ are opposite angles.

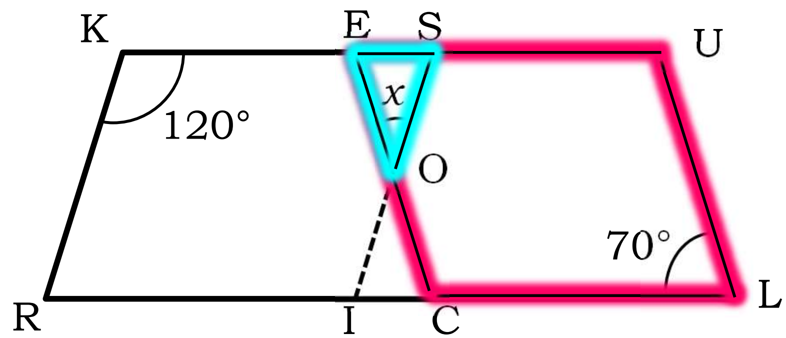
$\boxed{\angle S = 60°}$

Adjacent angles are supplementary

Opposite angles are equal.

Exercise

Q. In the following figure, both RISK and CLUE are parallelogram. Find the value of x.



Sol. CLUE is a parallelogram.

$\angle E = \angle L = 70°$

In Δ ESO

$\angle E + \angle S + x = 180°$

$70° + 60° + x = 18$

$x = 180° - 60$

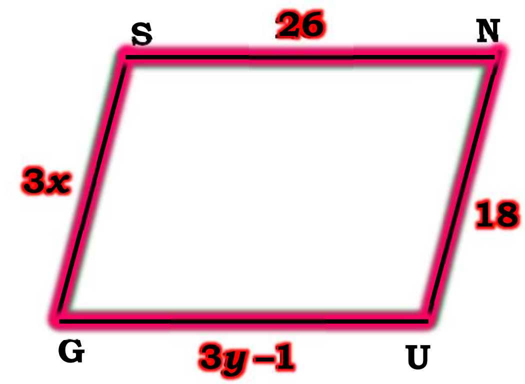
x is part of ΔESO

$\boxed{x = 50°}$

The sum of the measure of all angles of the triangle 180°

Module 21

Q. The following figure GUNS is a parallelogram. Find x and y. (Lengths are in cm)



(i)

Sol. In parallelogram GUNS,

$GS = UN$ [Opposite sides of parallelogram are equal]

$\therefore \quad 3x = 18$

$\therefore \quad x = \dfrac{\cancel{18}^{6}}{\cancel{3}}$

$\therefore \quad x = 6$ cm

Also, $GU = SN$

$\therefore \quad 3y - 1 = 26$

$\therefore \quad 3y = 26 + 1$

$\therefore \quad 3y = 27$

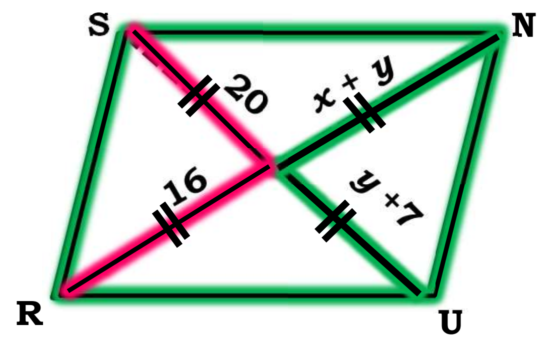
$\therefore \quad y = \dfrac{\cancel{27}^{9}}{\cancel{3}}$

$\therefore \quad y = 9$ cm

$\therefore \quad \boxed{x = 6 \text{ cm and } y = 9 \text{ cm}}$

Opposite sides of parallelogram are equal

Q. The following figure RUNS is a parallelograms. Find *x* and *y*. (Lengths are in cm)



(ii)

Sol. In parallelogram RUNS,

$y + 7 = 20$ [Diagonals of parallelogram bisects each other]

$\therefore \quad y = 20 - 7$

$\therefore \quad y = 13$ cm

$x + y = 16$

$\therefore \quad x + 13 = 16$

$\therefore \quad x = 16 - 13$

$\therefore \quad x = 3$ cm

$\therefore \quad x = 3$ cm and $y = 13$ cm

Diagonals of parallelogram bisects each other

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

Sol.

$\angle M + \angle L = 100$

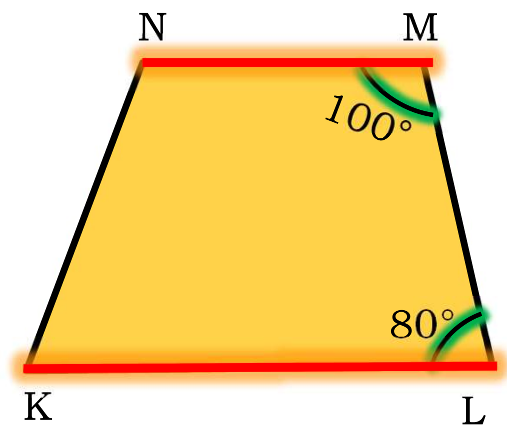
$\angle M + \angle L = 180$

A quadrilateral having one pair of opposite sides parallel is called trapezium

$\therefore$ MN $\parallel$ KL [Interior angles]

Since, one pair of opposite side is parallel

$\therefore$ □MNKL is a trapezium.



Lecture 4

Module 22

Exercise

Q. In the given figure ABCD is a square. Find the measure of $\angle CAD$.

Sol: In ΔCDA

$AD = DC$

$\therefore \quad \angle DAC = \angle DCA =$

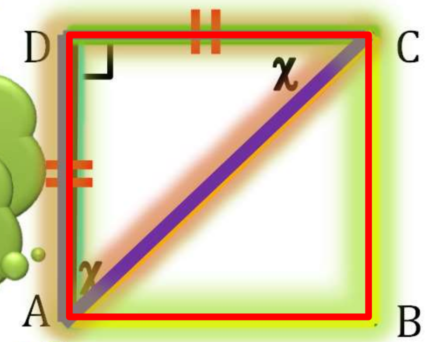
Opposite sides are equal

$\angle CAD$ is

Let see what is

Given is a

AC divides □ABCD into two triangles



$\angle DAC + \angle DCA + \angle ADC = 180$

$\underline{x + x} + 90 = 180$

$2x + 90 = 18$

$2x =$

$\therefore x = \frac{\quad}{2}$

1

$= 45°$

The sum of measure of angles of a triangles is 180°

Exercise

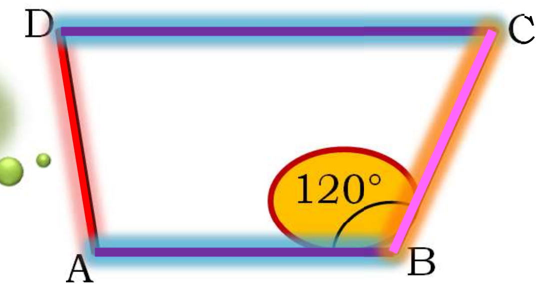
Q. Find $m\angle C$ in the adjoining figure if $\overline{AB} \parallel \overline{DC}$.

Sol: ABCD is a trapezium

❖ **Interior angles are supplementary.**

Let see what is given.

Given is a trapezium



$\therefore\ m\angle B + m\angle C = 180°$

$m\angle C = 180° - m\angle B$

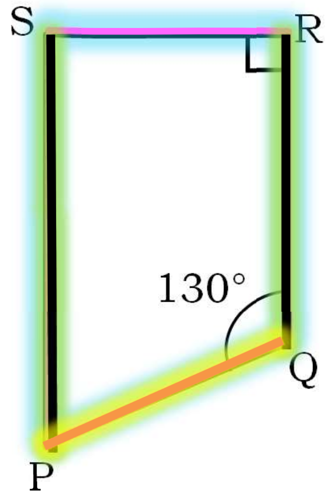
$m\angle C = 180° - 120°$

$\boxed{m\angle C = 60°}$

Module 23

Exercise

Q. Find the measure of $\angle P$ and $\angle S$ if $\overline{SP} \parallel \overline{RQ}$ in figure.



Sol: PQRS is a trapezium

$\overline{SP} \parallel \overline{RQ}$

PQ is a transversal.

❖ **Interior angles are supplementary.**

$m\angle P + m\angle Q = 180°$

$m\angle P + 130° = 180°$

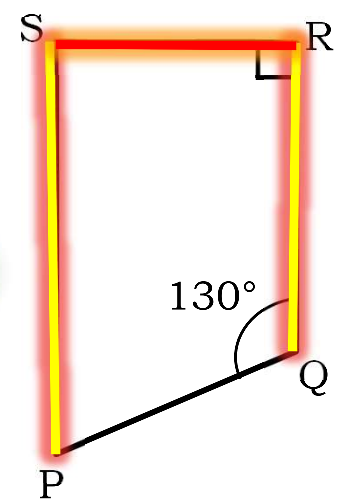
$m\angle P = 180° - 130°$

$m\angle P = 50°$

Now let us find $m\angle S$

Exercise

Q. Find the measure of $\angle P$ and $\angle S$ if $\overline{SP} \parallel \overline{RQ}$ in figure.



Sol: $\overline{SP} \parallel \overline{RQ}$

RS is a transversal.

❖ **Interior angles are supplementary.**

$m\angle S + m\angle R = 180°$

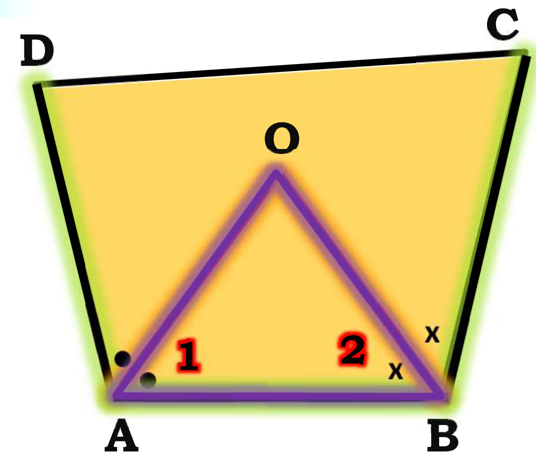
$m\angle S + 90° = 180°$

$m\angle S = 180° - 90°$

$\boxed{m\angle S = 90°}$

Module 24

Q. In a quadrilateral ABCD, AO and BO are the bisectors of $\angle A$ and $\angle B$ respectively. Prove that $\boxed{\angle AOB} = \frac{1}{2}(\angle C + \angle D)$.



Sol : $\angle 1 = \frac{1}{2}\angle A$, $\angle 2 = \frac{1}{2}\angle B$

In ΔAOB,

$\angle AOB + \angle OAB + \angle ABO = 180°$

$\angle AOB + \angle 1 + \angle 2 = 180°$

$\therefore \quad \angle AOB = 180° - (\angle 1 + \angle 2)$

$\therefore \quad \angle AOB = 180° - \left(\frac{1}{2}\angle A + \frac{1}{2}\angle B\right)$

$\therefore \quad \angle AOB = 180° - \frac{1}{2}(\angle A + \angle B) \ldots(i)$

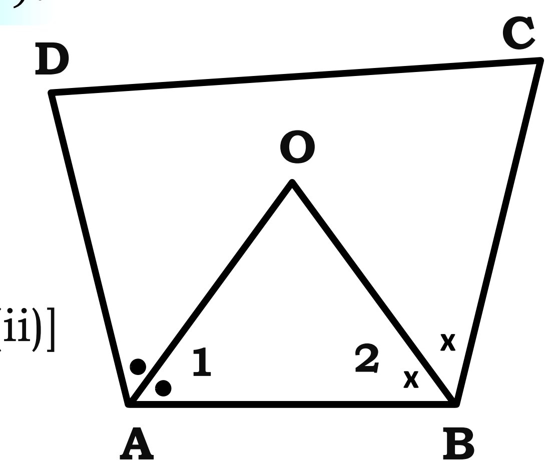
In $\square ABCD$,

$\angle A + \angle B + \angle C + \angle D = 360°$

D) $\ldots$(ii)

The sum of the interior angles of a quadrilateral is 360°

Q. In a quadrilateral ABCD, AO and BO are the bisectors of $\angle A$ and $\angle B$ respectively. Prove that $\angle AOB = \frac{1}{2}(\angle C + \angle D)$.



Sol : $\angle AOB = 180° - \frac{1}{2}(\angle A + \angle B)$ ...(i)

$\angle A + \angle B = 360° - (\angle C + \angle D)$ ...(ii)

$\angle AOB = 180° - \frac{1}{2}[360° - (\angle C + \angle D)]$ [From (i) and (ii)]

$\therefore \angle AOB = 180° - \frac{1}{\cancel{2}} \times \overset{180}{\cancel{360}}° + \frac{1}{2}(\angle C + \angle D)$

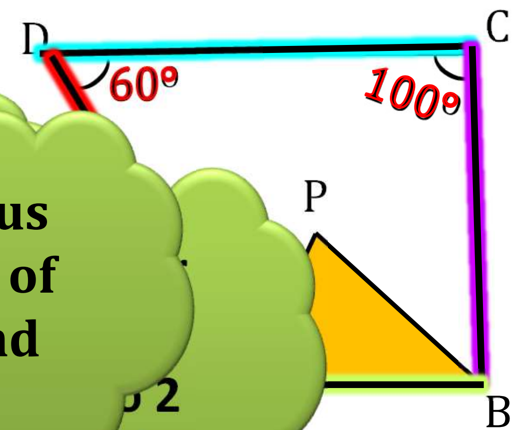
$\therefore \angle AOB = \cancel{180}° - \cancel{180}° + \frac{1}{2}(\angle C + \angle D)$

$\therefore \boxed{\angle AOB = \frac{1}{2}(\angle C + \angle D)}$

Module 25

Exercise

Q. In the adjacent figure, the bisectors of $\angle A$ and $\angle B$ meet in a point P. If $\angle C=100^0$ and $\angle D=60^0$, find the measure of $\angle APB$.



Sol:

$$\angle A + \angle B + \angle C + \angle D = 360$$

$$\angle A + \angle B + \underline{60 + 100} = 36$$

$$\angle A + \angle B + 160 = 3$$

$$\angle A + \angle B = 360$$

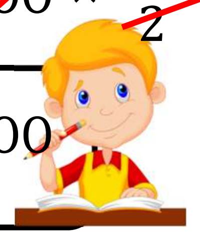
$$\angle A + \angle B = 200$$

$$\therefore \frac{1}{2}\angle A + \frac{1}{2}\angle B = \cancel{200}^{100} \times \frac{1}{\cancel{2}_{1}}$$

$$\therefore \frac{1}{2}\angle A + \frac{1}{2}\angle B = 100$$

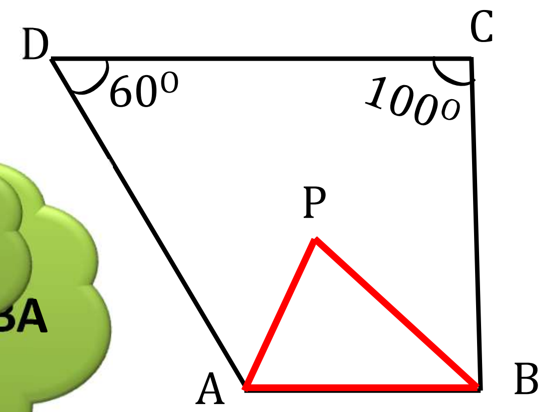
The sum of measure of angles of a quadrilateral is 360°

Now, let us find sum of $\angle PAB$ and $\angle PBA$



Exercise

Q. In the adjacent figure, the bisectors of $\angle A$ and $\angle B$ meet in a point P. If $\angle C = 100^0$ and $\angle D = 60^0$, find the measure of $\angle APB$.



Sol:

$\therefore \quad \angle PAB + \angle PBA = 100$

In Δ APB,

$\angle BAP + \angle ABP + \angle APB = 180$

∠APB is part of Δ ABP

BA

2

$\frac{1}{2}$ **∠A= ∠DAP=∠PAB**

$100 + \angle APB = 180$

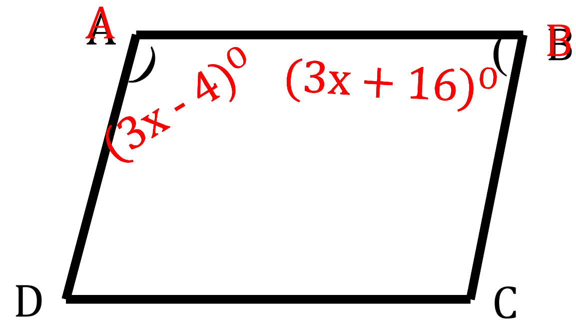
$\angle APB = 180 - 100$

$\boxed{\angle APB = 80^\circ}$

$\therefore$ The measure of $\angle APB = 80^0$

Exercise

Q. Two adjacent angles of a parallelogram are $(3x - 4)^0$ and $(3x + 16)^0$. find the value of 'x' and hence find the measure of each of its angles.



Sol: We know that the sum of two adjacent angles of a parallelogram is 180

$$\therefore \quad \angle A + \angle B = 180$$

$$3x - 4 + 3x + 16 = 180$$

$$6x + 12 = 180$$

$$6x = 180° - 12$$

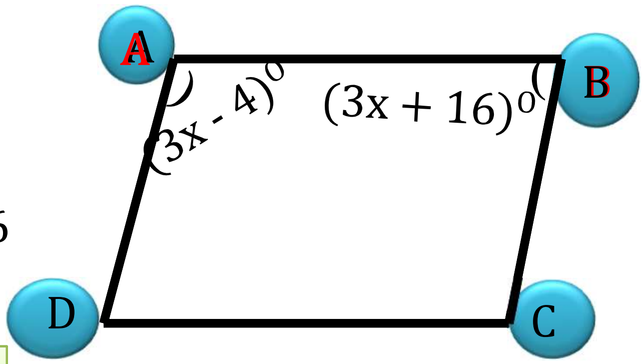
$$\boxed{6x = 168°}$$

$$\therefore x = \frac{168}{6}$$

$$\boxed{x = 28°}$$

Exercise

Q. Two adjacent angles of a parallelogram are $(3x - 4)^0$ and $(3x + 16)^0$. find the value of x and hence find the measure of each of its angles.



Sol:

$\therefore \quad \angle A = 3x - 4$

$= 3(28) - 4$

$= 80$

$\boxed{\angle A = 80^\circ}$

$\therefore \quad \angle B = 3x - 16$

$= 3(28) - 16$

$= 100$

$\boxed{\angle B = 100^\circ}$

Opposite angles of a parallelogram are equal

$\angle A = \angle C$

$80 = \angle C$

$\therefore \boxed{\angle C = 80^\circ}$

$\angle B = \angle D$

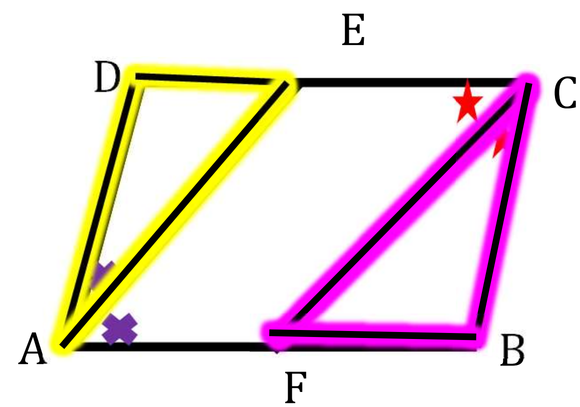
$100 = \angle D$

$\therefore \boxed{\angle D = 100^\circ}$

Module 26

Exercise

Q. In the adjacent figure, $ABCD$ is a parallelogram and line segments AE and CF bisect the angles A and C respectively. Show that AE || CF.



Sol: In triangles ADE and CBF,

$\therefore$ We have AD= BC, ...(1)

$\angle B = \angle D$ ...(2)

$\because$ $\angle A = \angle C$

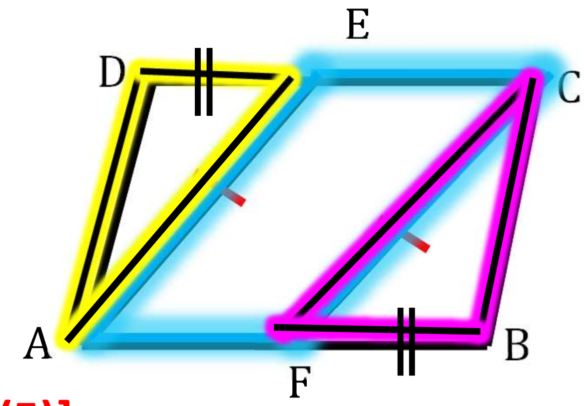
$\therefore \frac{1}{2}\angle A = \frac{1}{2}\angle C$

$\therefore \angle DAE = \angle BCF$ ...(3)

- *Opposite sides are equal*
- *Opposite angles are equal*

Exercise

Q. In the adjacent figure, *ABCD* is a parallelogram and line segments AE and CF bisect the angles A and C respectively. Show that $\boxed{AE \parallel CF}$.



Sol: $\Delta ADE \cong \Delta CBF$ **(ASA test)**

$\boxed{AE = CF}$ **(c.p.c.t)**

$DE = BF$ **...(4)** **(c.p.c.t)**

$CD = AB$ **...(5)** **(Opposite sides are equal)**

$\therefore$ $CD - DE = AB - BF$ **[Subtracting (4) from (5)]**

so, $\boxed{CE = AF}$ **[D-E-C, A-F-B]**

$\therefore$ AECF is a parallelogram.

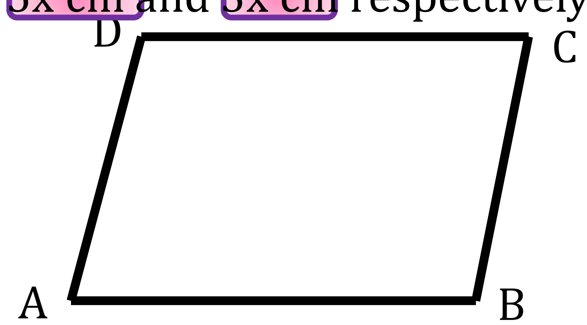
[A quadrilateral is a parallelogram if opposite sides are equal]

Hence, $\boxed{AE \parallel CF}$

Exercise

Q. Two sides of a parallelogram are in the ratio 5 : 3. If its perimeter is 64cm , find the lengths of its sides.

Sol: Let the lengths of two sides of the parallelogram be 5x cm and 3x cm respectively.



$$\text{perimeter} = 2(\boxed{l} + \boxed{b})\text{cm}$$

$$= 2(\boxed{5x} + \boxed{3x})\text{cm}$$

$$= 2 \times (8x)$$

$$= 16x.$$

But perimeter = 64

$$\therefore\ 16x = 64$$

$$\therefore\ x = \frac{\cancel{64}^{\,4}}{\cancel{16}_{\,1}}$$

$$\boldsymbol{x = 4°}$$

But perimeter is 64

= 20 cm

$$\therefore \text{ Other side } = (3 \times 4)\text{cm}$$

= 12 cm

Module 27

➢ RECTANGLE

Definition : A quadrilateral in which **each angle is a right angle** is called a **Rectangle**

AD || BC

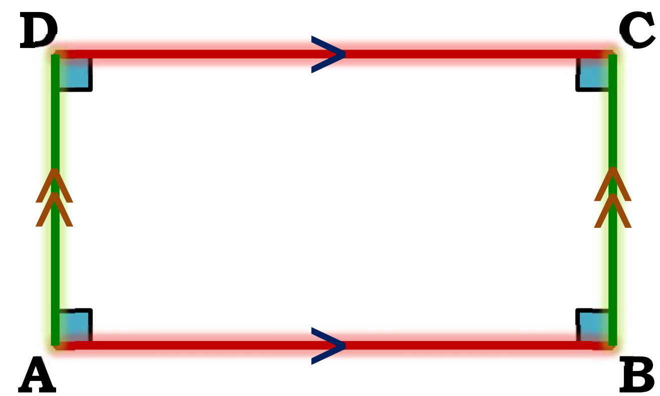
□ABCD is a r

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

Both the pairs of opposite sides are parallel

So, □ABCD is also a parallelogram

Every Recta... arallelogram



Properties Of A Rectangle

- **Opposite sides are equal**

  AB = CD

  AD = BC

Name the pairs of opposite sides

- **Diagonals** ...

  OA = OC

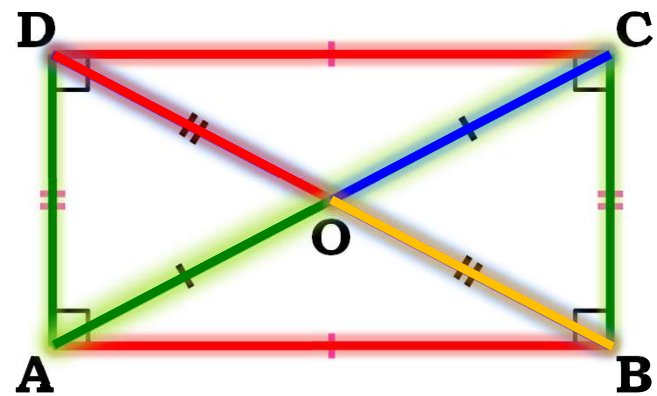
  OB = OD

OA = OC & OB = OD

- **Diagonals are equal**

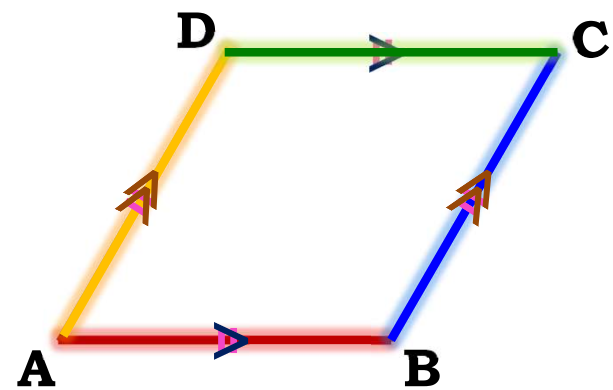
  AC = BD

AC = BD



➢ RHOMBUS

Definition : A quadrilateral having **all sides equal** is called a **Rhombus**



Name all the sides of □ABCD

AB = BC= CD = AD

□ABCD is a Rhombus

∴ AB = BC = CD = AD

BC

□ABCD is also a parallelogram

Every Rhom... ...allelogram

Properties Of A Rhombus

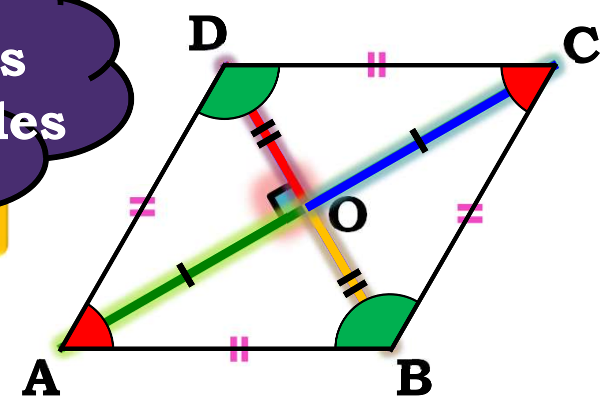
➢ Opposite angles are equal

$\angle A = \angle C$

$\angle B = \angle D$

Let
Rh

Name the pairs of opposite angles



➢ Diagonals er

$OA = OC$

$OB = OD$

OA = OC &
OB = OD

➢ Diagonals are perpendicular to each other

$AC \perp BD$

➢ SQUARE

Definition : A quadrilateral in which each angle is a right angle and all sides are equal is called a Square

AD || BC

□ABCD is a

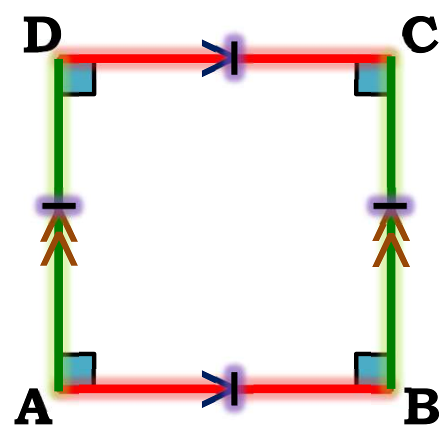
$\therefore$ $\angle A = \angle B = \angle C = \angle D$

$AB = BC = C$

Both the pairs of opposite sides are parallel

So, □ABCD is also a parallelogram

Every Square ... llelogram



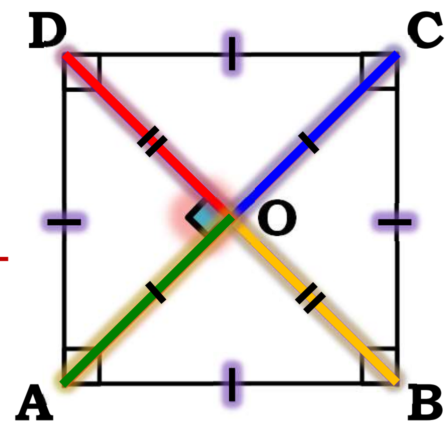
PROPERTIES OF A SQUARE

- **Diagonals bisect each other**

  $OA = OC$

  $OB = OD$

Let us consider a Square ABCD



- **Diagonals are perpendicular to each other**

  $AC \perp BD$

$OA = OC$ &

$OB = OD$

- **Diagonals are equal**

  $AC = BD$

$AC = BD$

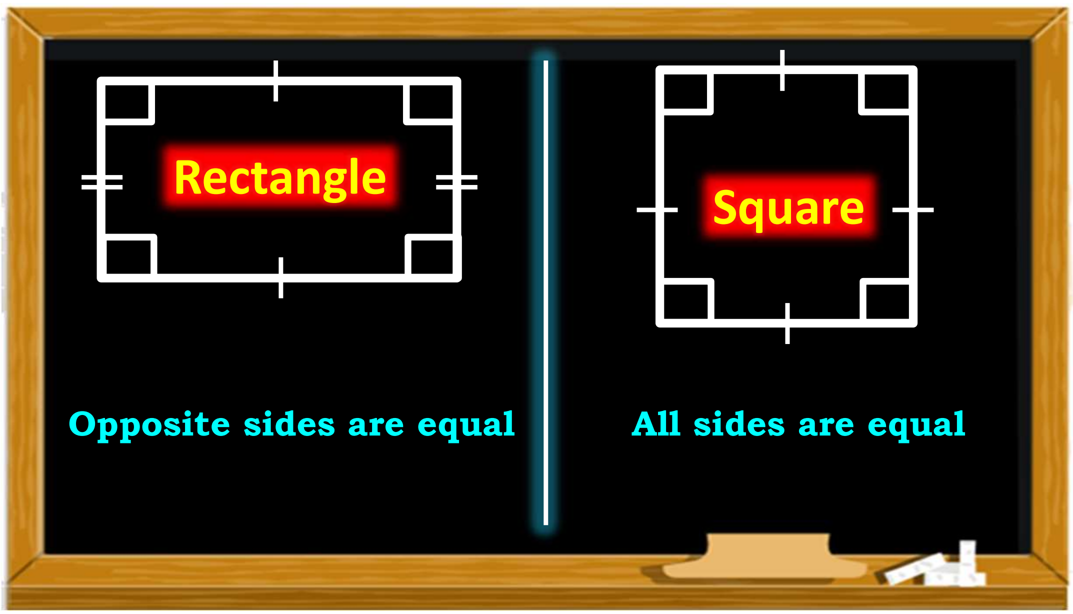
Module 28

Q. State whether true or false:

a) All rectangles are squares.

Sol. False

All Squares are Rectangles but,
all Rectangles are not Squares

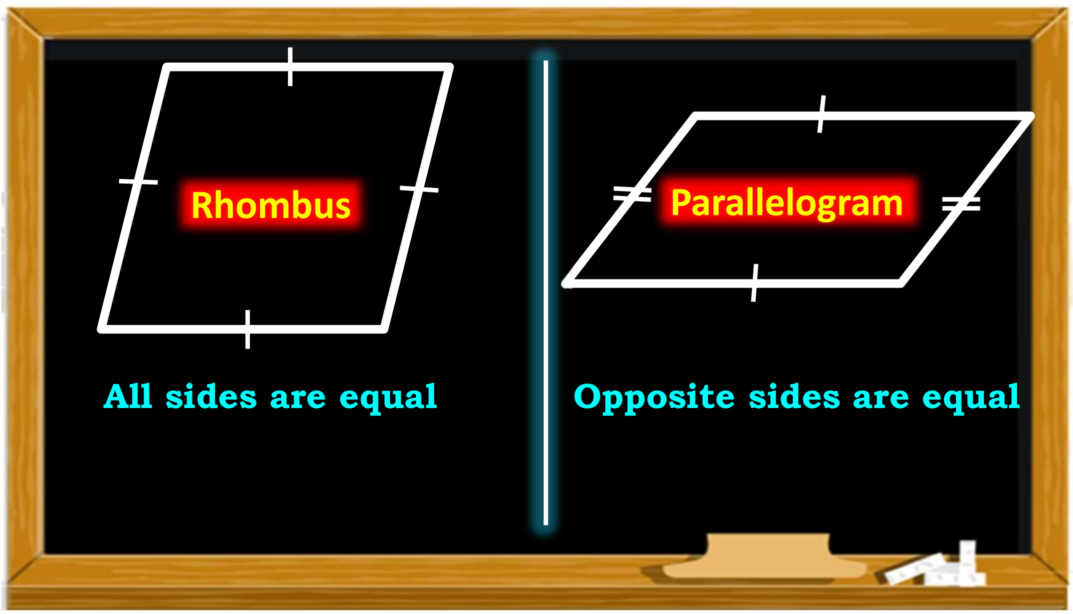


Q. State whether true or false:

b) All rhombuses are parallelograms

Sol. **True**

Since, Rhombus possesses all properties of Parallelogram.

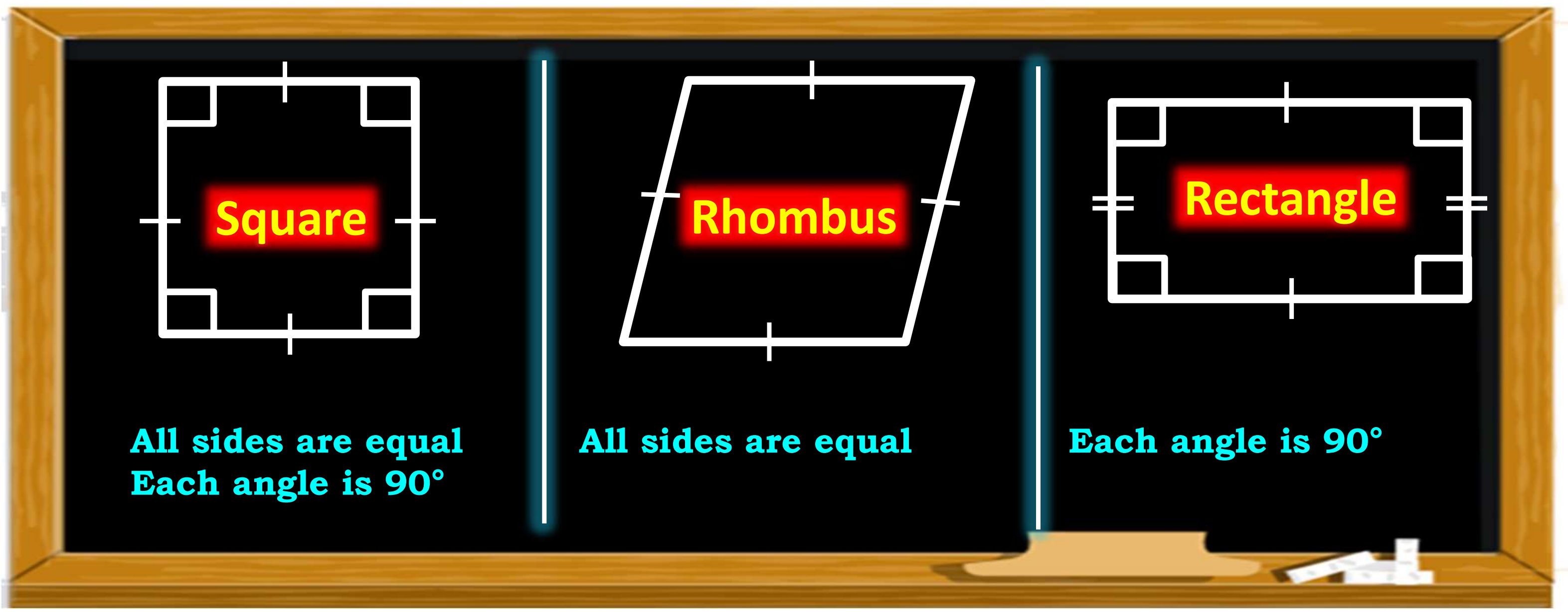


Q. State whether true or false:

c) All squares are rhombuses and also rectangles.

Sol. True

A Square possesses all the properties of Rhombus and Rectangle.

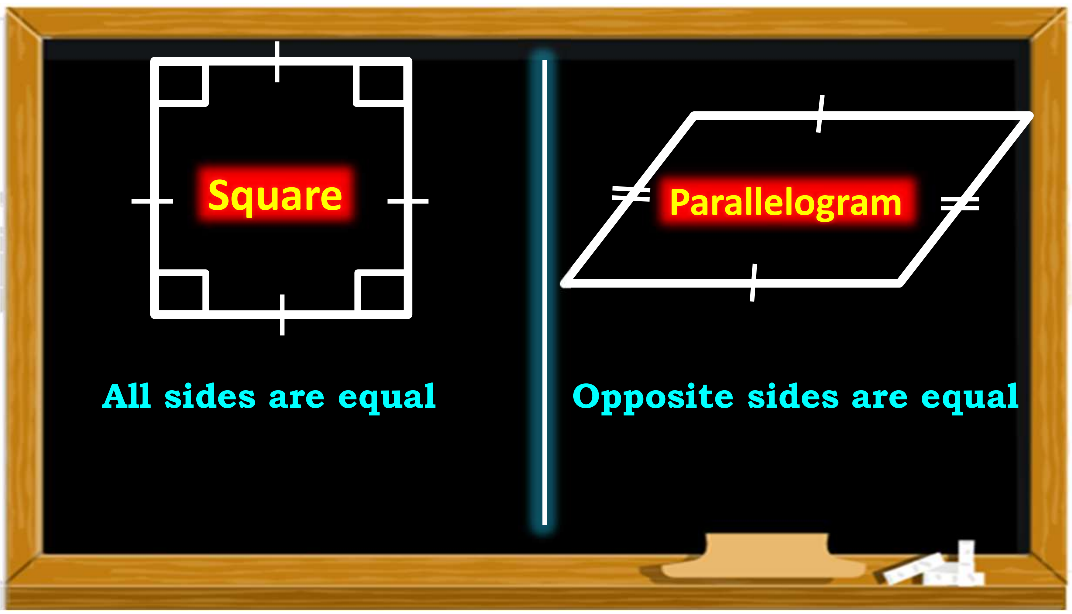


Q. State whether true or false:

d) All squares are not parallelograms.

Sol. **False**

Since, squares have all the properties of parallelogram.

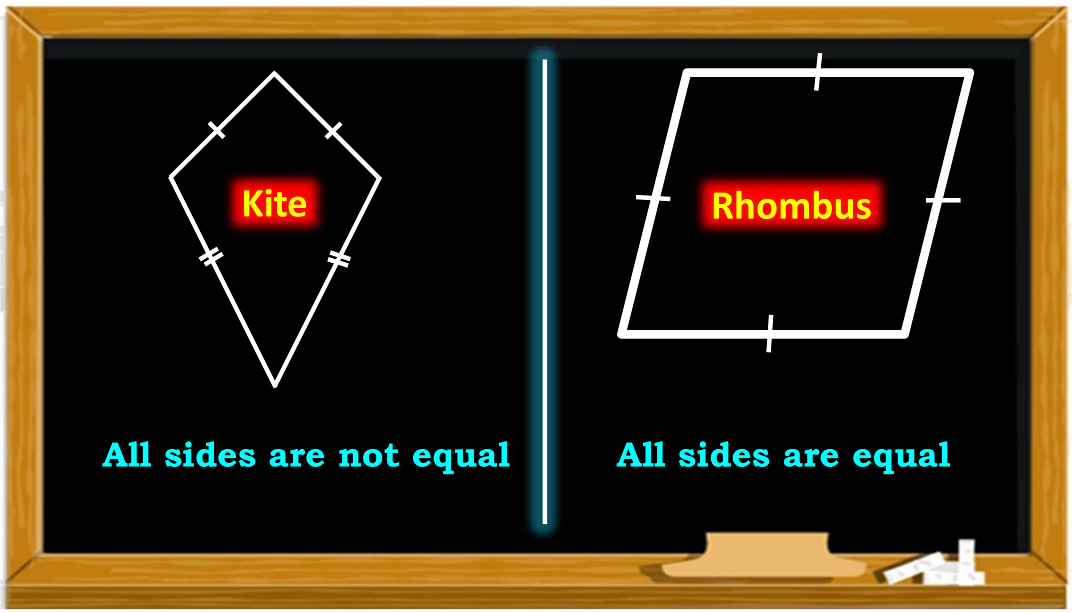


Q. State whether true or false:

e) All kites are rhombuses.

Sol. **False**

Since, Kites do not have equal sides.

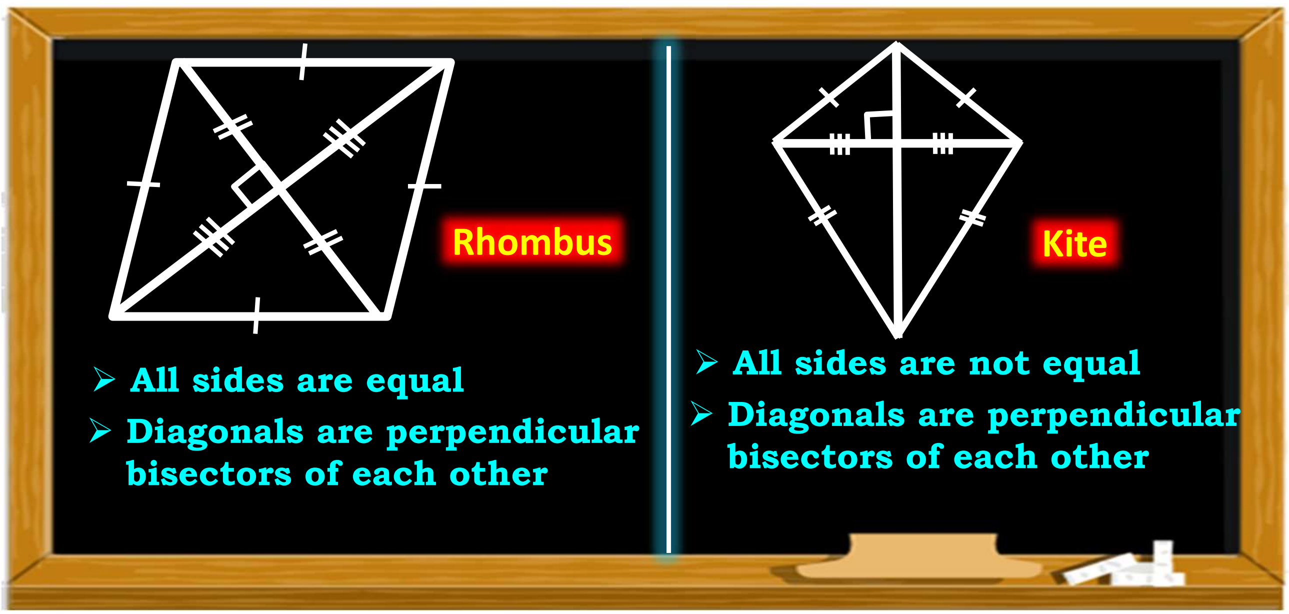


Q. State whether true or false:

f) All rhombuses are kites

Sol. True

Since, all rhombuses have equal sides and diagonals bisect each other.

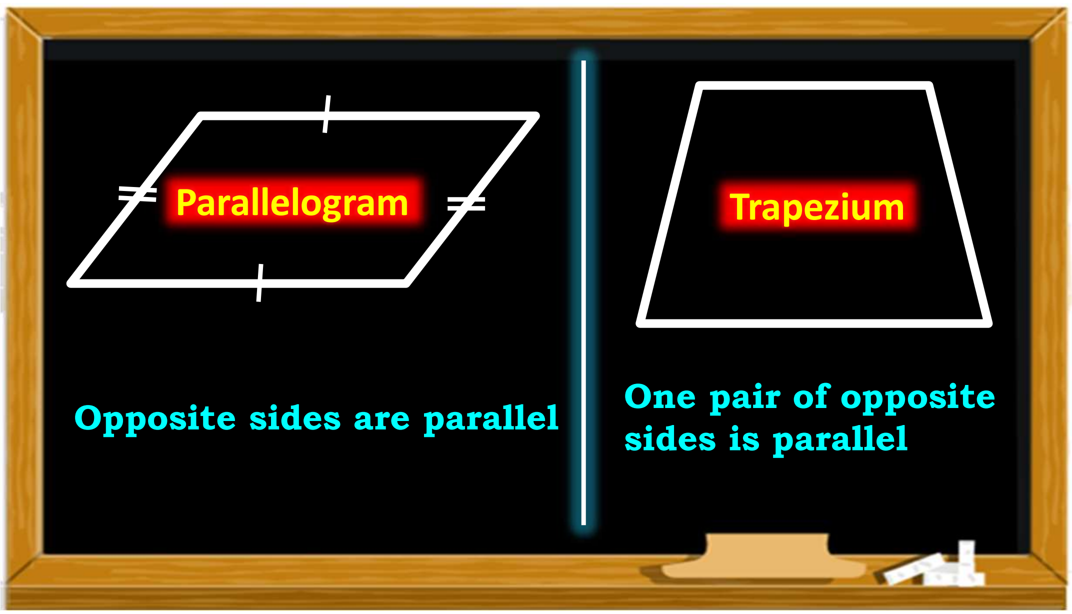


Q. State whether true or false:

g) All parallelograms are trapeziums.

Sol. **True**

Since, trapezium has one pair of opposite sides parallel.

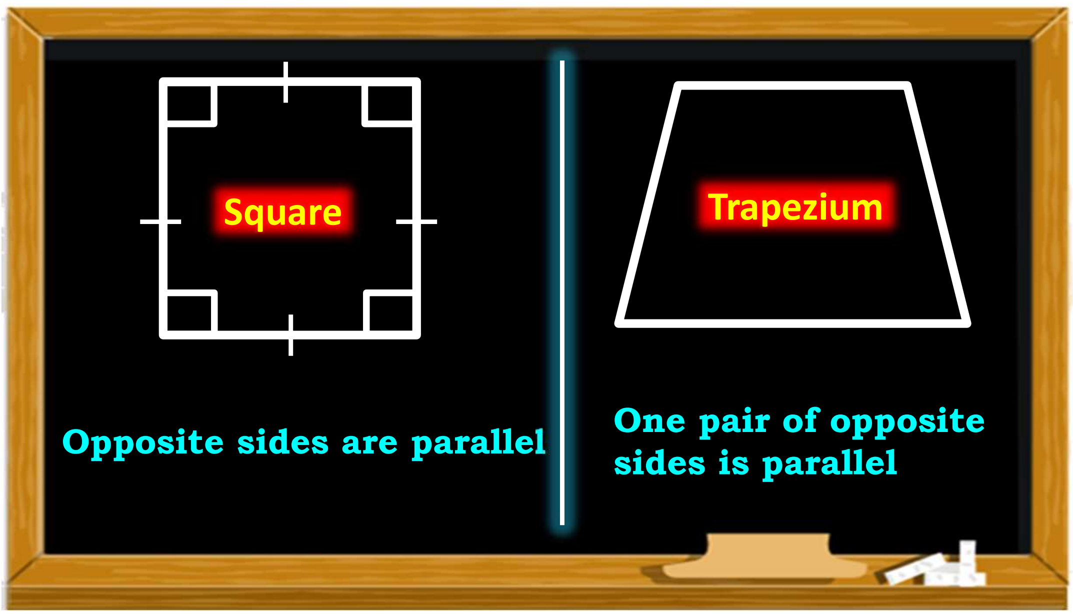


Q. State whether true or false:

h) All squares are trapeziums.

Sol. **True**

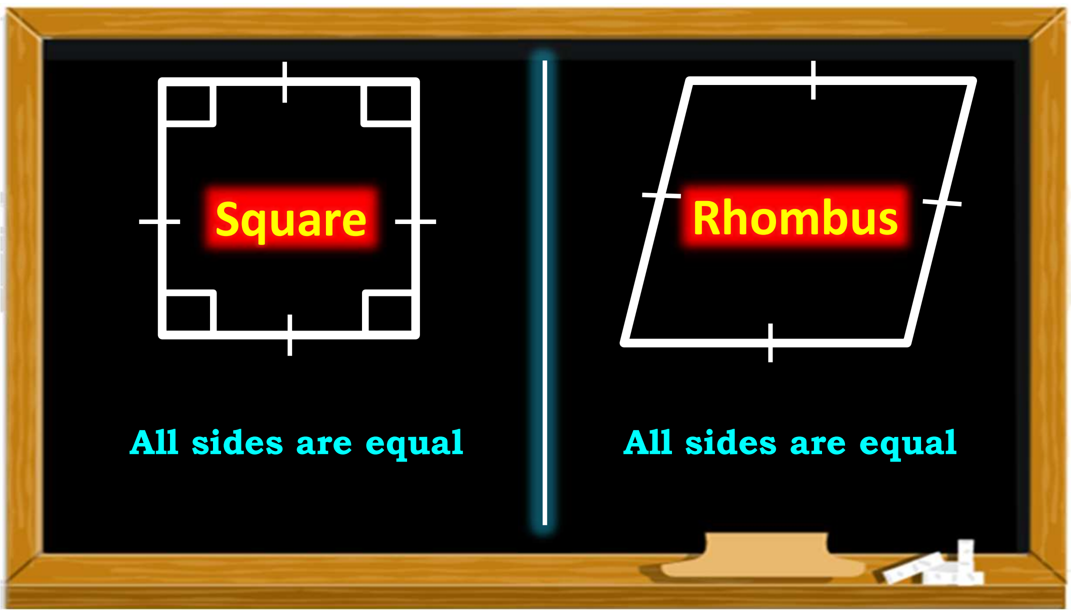
Since, trapezium has one pair of opposite sides parallel.



Q. Identify all the quadrilaterals that have.

a) Four sides of equal length

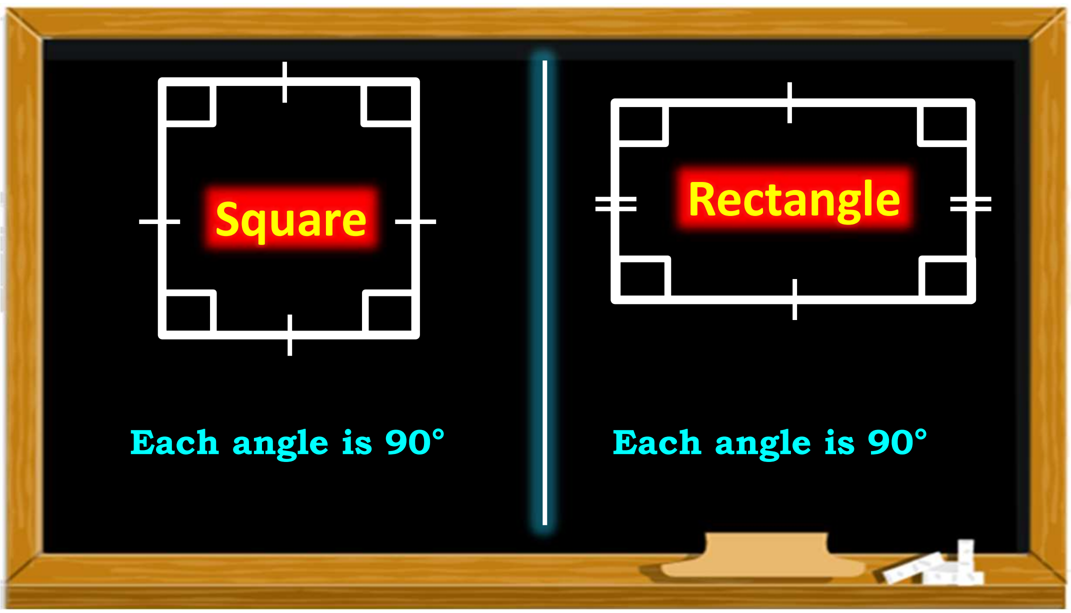
Sol. **Square and Rhombus have four sides of equal length.**



Q. Identify all the quadrilaterals that have.

b) Four right angles

Sol. **Square and Rectangle have four right angles.**



Q. Expl… is.

Any four sided closed figure

(a) a quadrilateral

A square is a quadrilateral, because it has four sides

Quadrilateral having opposite sides parallel

(b) a parallelogram

A square is a parallelogram, because it has opposite sides …allel

Quadrilateral having all sides equal

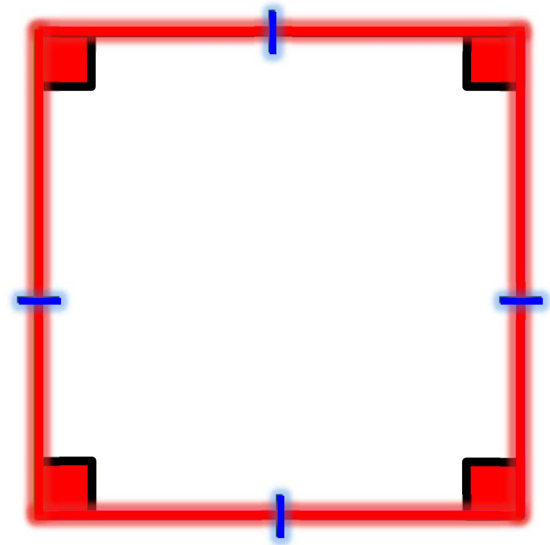
(c) a rhombus

A square is a rhombus, because it has all four sides equal

Quadrilateral with each angle 90°

(d) a rectangle

A square is a rectangle, because it has each angle 90°

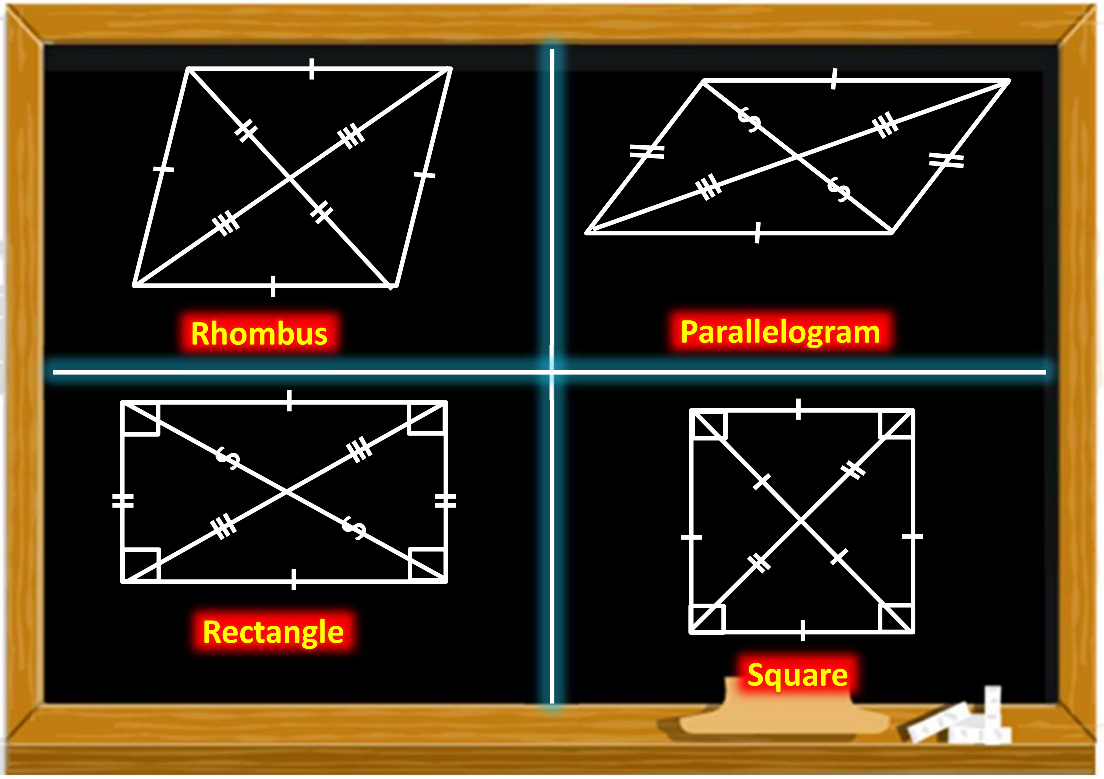


Module 29

Q. Name the quadrilateral whose diagonals:

a) bisect each other

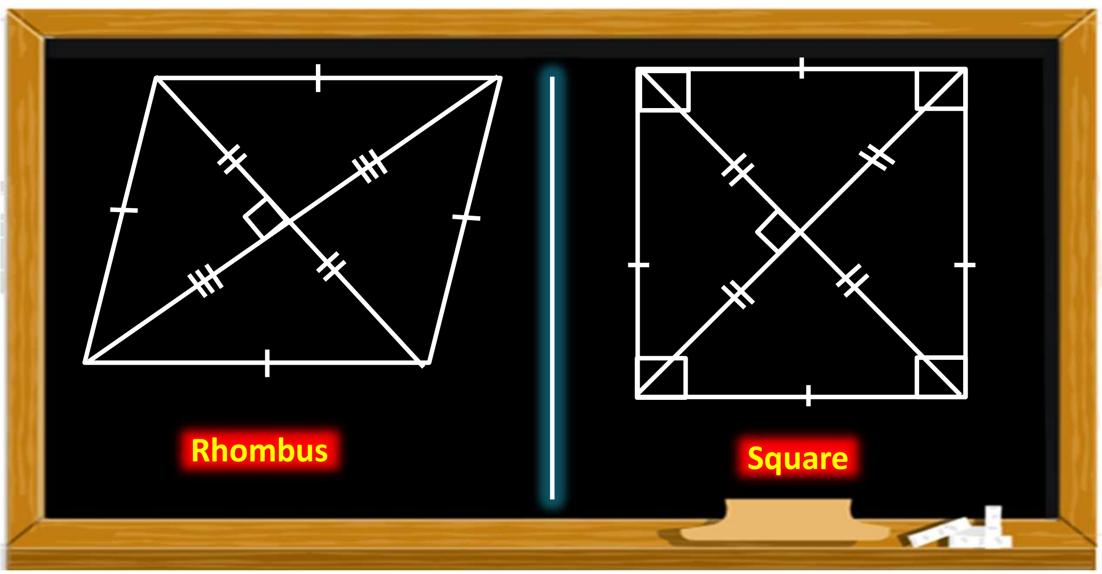
Sol. **Rhombus, Parallelogram, Rectangle and Square are the quadrilaterals whose diagonals bisects each other.**



Q. Name the quadrilateral whose diagonals:

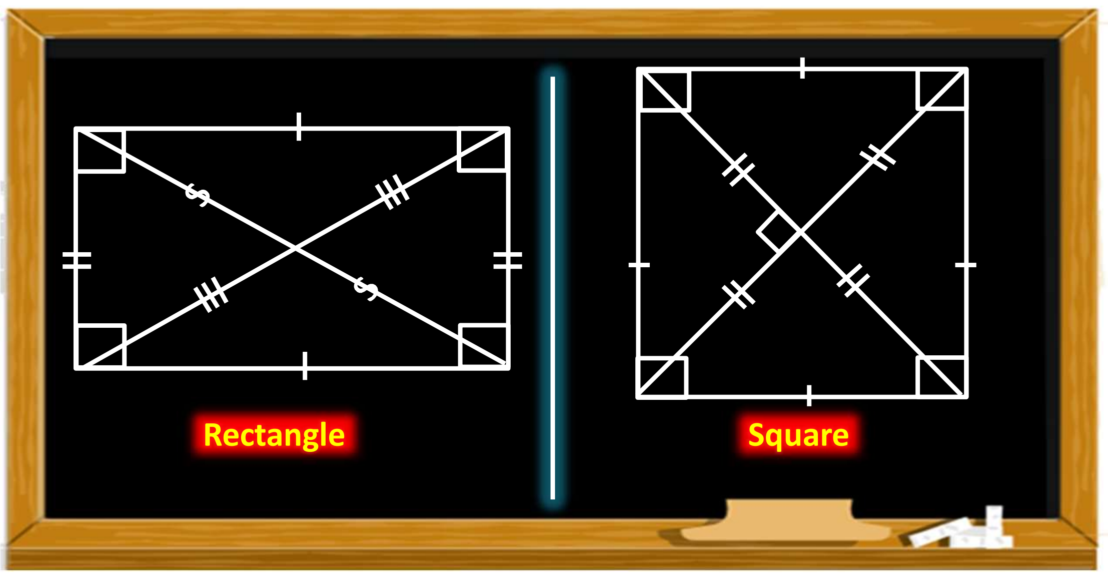
b) are perpendicular bisectors of each other

Sol. **Rhombus and Square are the quadrilaterals whose diagonals are perpendicular bisectors of each other.**



Q. Name the quadrilateral whose diagonals:
c) are equal.

Sol. **Rectangle and Square have diagonals equal.**

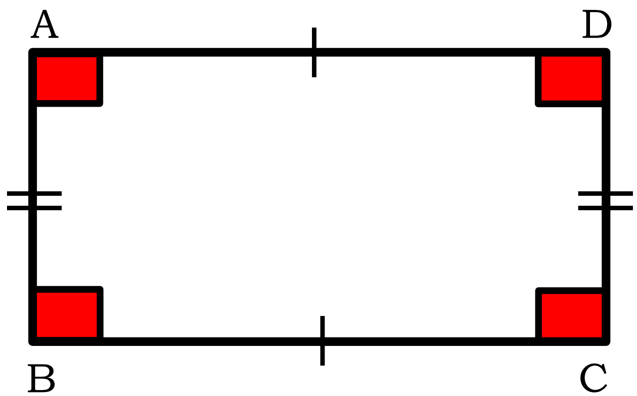


Q. Explain why a rectangle is a convex quadrilateral.

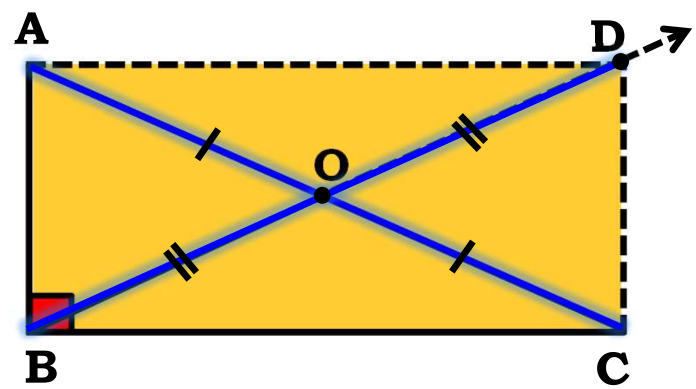
Each angle of a polygon is less than 180°

Sol. In a rectangle, measure of each angle is 90°

$\therefore$ A rectangle is a convex quadrilateral



Q. 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.



To show : OA = OB = OC

Sol. AO = OC

OB = OD

Diagonals of □ABCD bisects each other

∴ □ABCD is a Parallelogram

$\angle B = 90°$

∴ □ABCD is a rectangle

Diagonal of rectangle bisect each other

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

Ex... ...int D

Draw AD and DC

...t,

BO = OD

Al...

∴ AC ... ...(iii)

∴ OA = OC = OB = OD [from (i) (ii) and (iii)]

∴ O is equidistant from A, B and C


Thank You