MATHS

By Priyanshu Shukla Sir For Class 8th

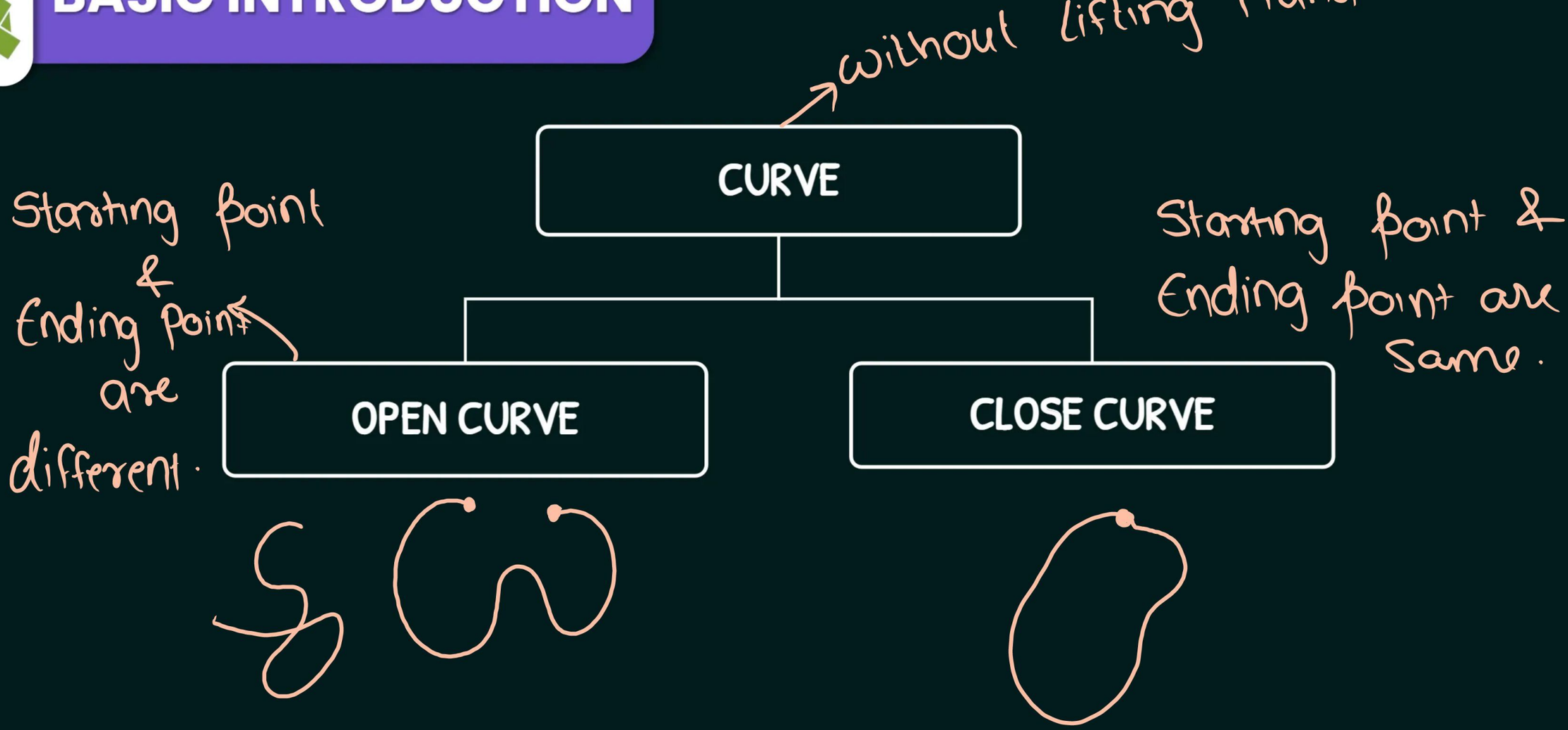
UNDERSTANDING QUADRILATERAL

Lecture No.- 03

Topics To Be Covered

1. All Topics In One Short

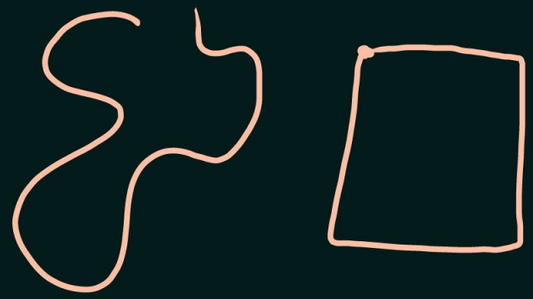
BASIC INTRODUCTION



Simple Curve

↓

Intersect Nhi hota



Complex

⇓

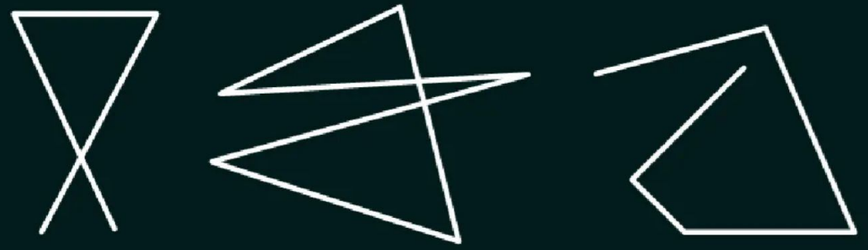
Intersect Each other

POLYGON

A simple closed curve made up of only line segments is called a polygon.

Curves that are polygons

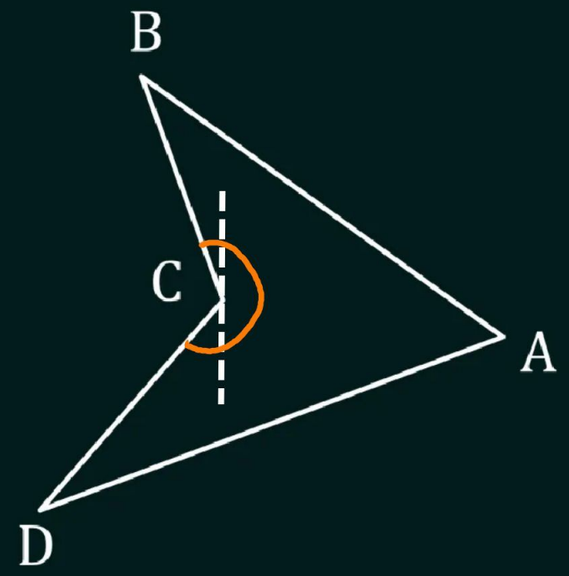
Simple x Simple x Close x



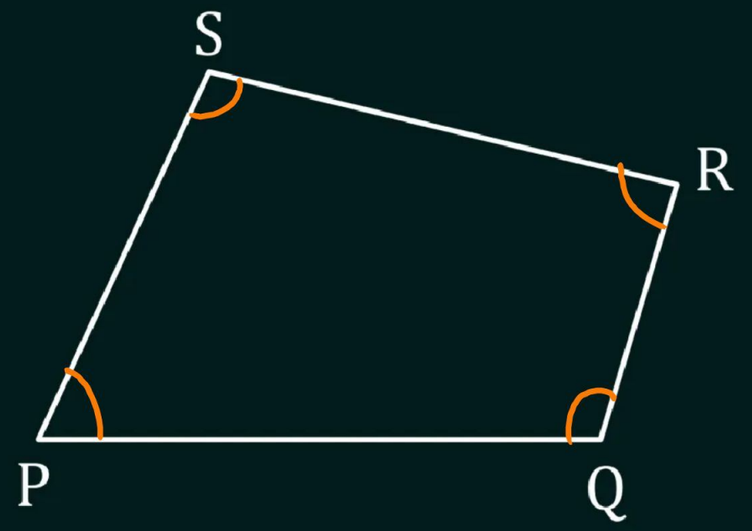
Curves that are not polygons

TYPES OF POLYGON

Concave polygon: A polygon in which at least one interior angle is more than 180° is called a concave polygon.



Convex polygon: A polygon in which each interior angle is less than 180° is called a convex polygon



Question

Classify each of the above figure on the basis of the following:

This is not curve.

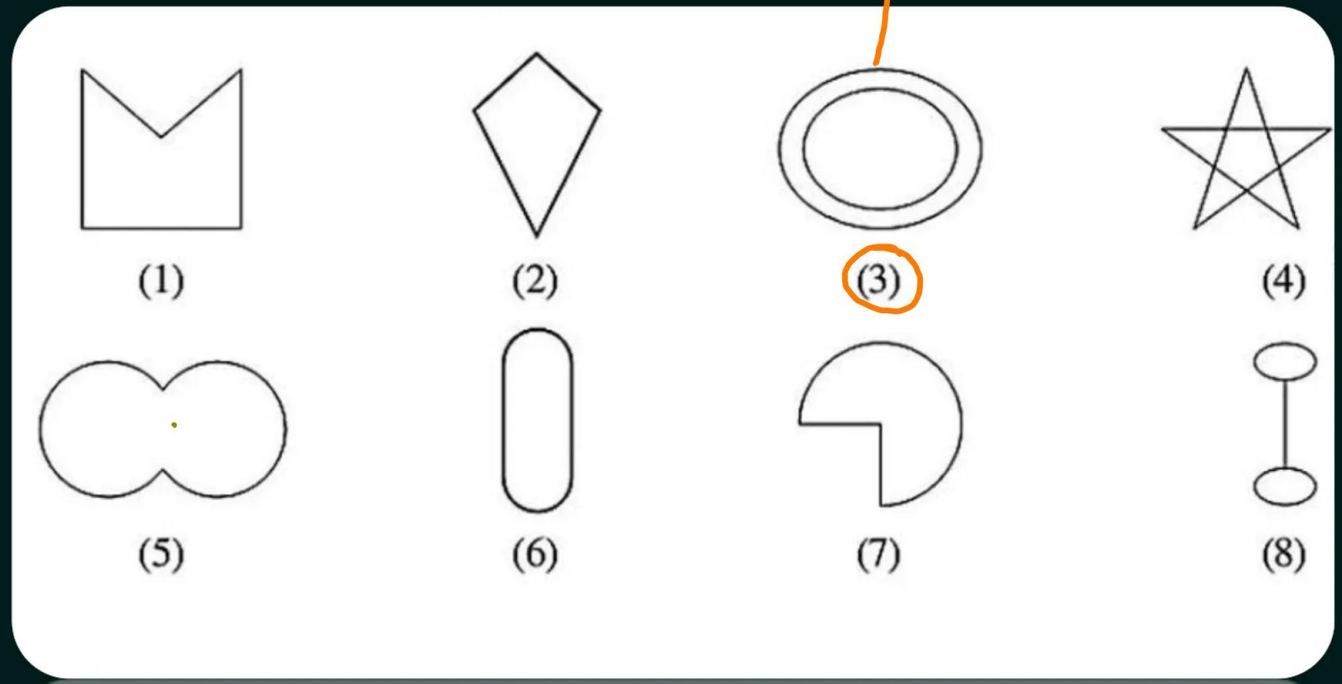
(a) Simple curve 1, 2, 5, 6, 7, 8

(b) Simple closed curve 1, 2, 5, 6, 7, 8

(c) Polygon SC L 1, 2,

(d) Convex polygon 2,

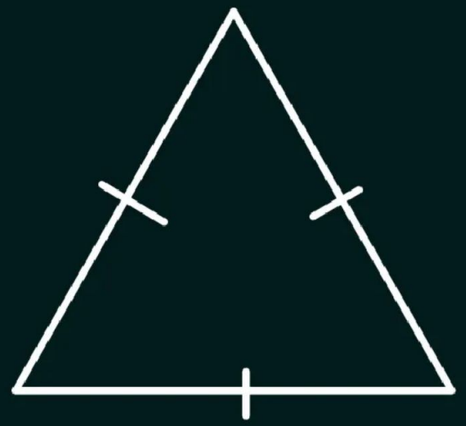
(e) Concave polygon 1

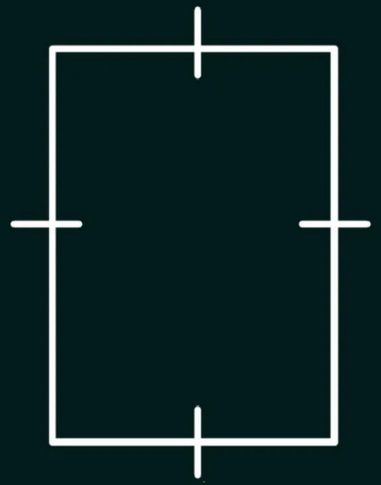


TYPES OF POLYGON

Regular polygon: A polygon having all sides equal and all interior angles equal is called a regular polygon.

Eg Triangle, Square,





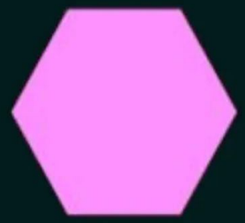
Irregular polygon: An irregular polygon does not have all its sides equal or not all the angles are equal in measure.

CLASSIFICATION OF POLYGON

Triangle

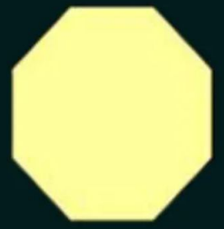
Quadrilateral

Pentagon



Hexagon

Heptagon



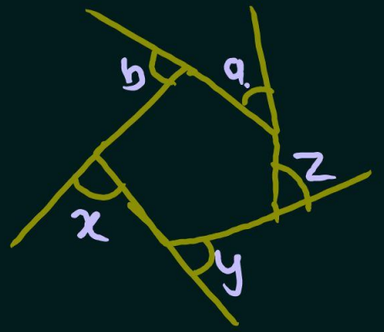
Octagon

Nonagon

Decagon

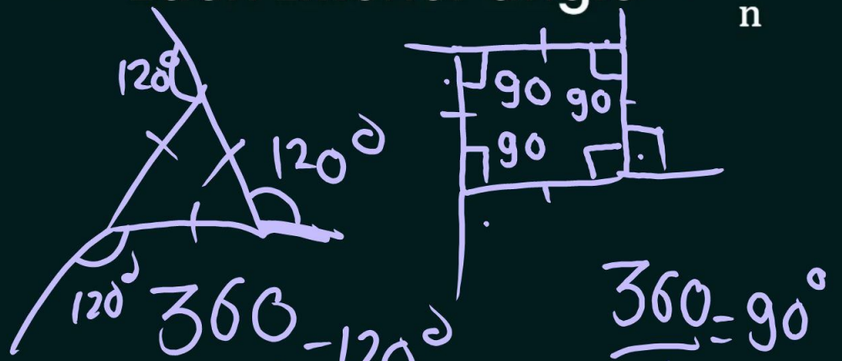
SUM OF EXTERIOR ANGLE OF A POLYGON

- Sum of all exterior angle of a polygon $= 360°$



$a+b+x+y+z=360°$

- Each Exterior angle $= \frac{360°}{n}$



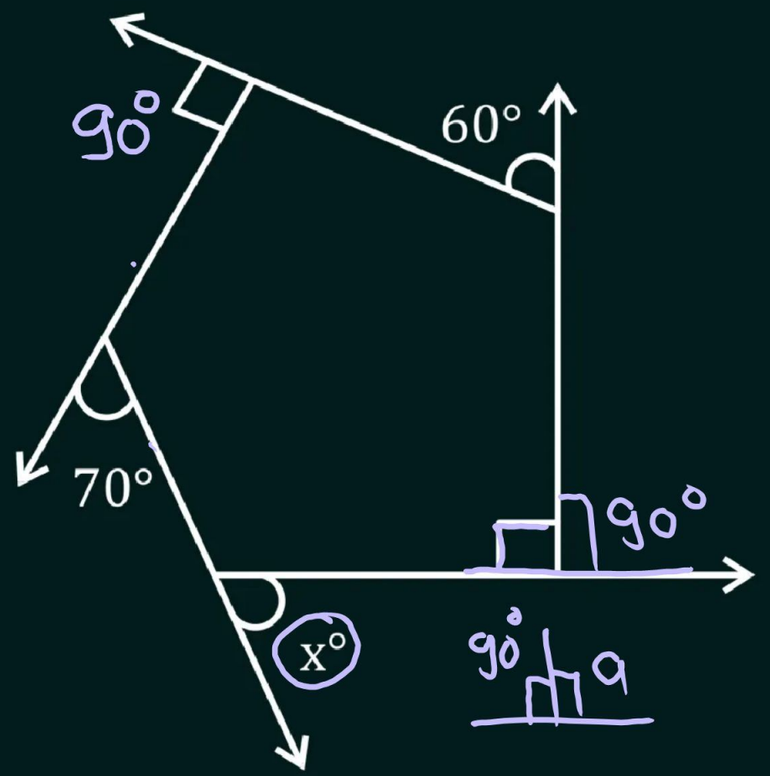
$\frac{360}{3}=120°$

$\frac{360}{4}=90°$

each $= \frac{360}{5} = 72°$

Question

Find x in the following figure:



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

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

$$x = 360 - 310$$

$$= \underline{\underline{50^\circ}}$$

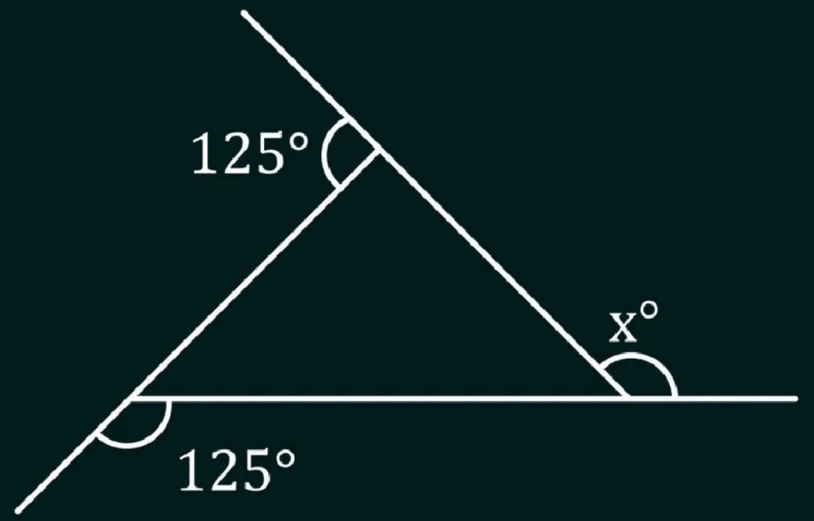
$$90 + a = 180^\circ$$

$$a = 180 - 90$$

$$= 90^\circ$$

Question

Find x in the following figure:



$125 + 125 + x = 360^\circ$

$250 + x = 360^\circ$

$x = 360 - 250$

$x = 110^\circ$

Question

Is it possible to have a regular polygon each of whose exterior angle is

A. 25°

$$\text{Each Ex. Angle} = \frac{360^\circ}{n}$$

$$n = \frac{360}{25} = 14.4 \Rightarrow$$ No. of side can't be in decimal.

B. 45°

$$\text{Each Ex. Angle} = \frac{360}{n}$$

$$45^\circ = \frac{360}{n}$$

$$n = \frac{360}{45} = 8$$

Question

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

(i) 9 sides

$$\Rightarrow \frac{360^\circ}{n} = \frac{360}{9} = \underline{\underline{40^\circ}}$$

(ii)15 sides

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

SUM OF INTERIOR ANGLE OF A POLYGON

- Sum of Interior angle of a Polygon = $\boxed{(n-2)\times 180^\circ}$, where n = Number of Sides

3 Side $(3-2)\times 180$

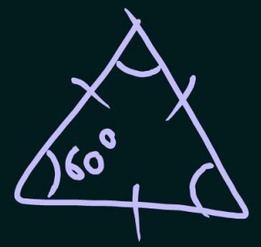
$1 \times 180 = 180^\circ$

- Each interior angle = $\frac{(n-2)\times 180^\circ}{n}$

(Regular polygon)

$\frac{(n-2)\times 180}{n}$

$\Rightarrow \frac{180^\circ}{3} = 60^\circ$



Question

Find the measure of each of interior angle of a regular:

I. Pentagon $= \frac{(5-2)\times 180}{5} = \frac{3\times 180}{5}$

$= 3 \times 36$

$= 108^\circ$

$\frac{(n-2)\times 180}{n}$

II. Hexagon $\Rightarrow \frac{(6-2)\times 180}{6}$

$= \frac{4 \times \overset{30}{\cancel{180}}}{\cancel{6}_1} \Rightarrow 4 \times 30 = 120^\circ$

III. Octagon $\Rightarrow \frac{(8-2)\times 180}{8}$

$= \frac{\overset{3}{\cancel{6}} \times \overset{45}{\cancel{180}}}{\cancel{8}_4}$

$= 135^\circ$

Question

In a regular polygon, each interior angle is thrice the exterior angle. The number of sides of the polygon is.

$I = 3E$

$I + E = 180^\circ$

$3E + E = 180^\circ$

$4E = 180^\circ$

$E = \frac{180}{4}$

$= 45^\circ$

Each Ex. Angle $= \frac{360^\circ}{n}$

$n = \frac{360^\circ}{\text{Each Ex}}$

$= \frac{360}{45}$

$n = 8$

Interior

All Sum $= (n-2) \times 180^\circ$

Each $= \frac{(n-2) \times 180^\circ}{n}$

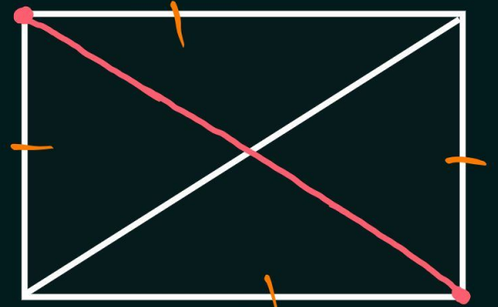
Exterior

All Sum $= 360^\circ$

Each $= \frac{360^\circ}{n}$

DIAGONALS OF POLYGON

Number of diagonals in a polygon of n sides = $\boxed{\frac{n(n-3)}{2}}$



2

$\frac{n(n-3)}{2} = \frac{4\times(4-3)}{2} = \frac{4\times1}{2} = 2$

5

$\Rightarrow \frac{5(5-3)}{2}$

$= \frac{5\times2}{2}$

$= 5$

Question

How many diagonals are there in a

I. Pentagon $= 5$

II. Hexagon $= \frac{6(6-3)}{2} = \frac{{}^{3}\cancel{6} \times 3}{\cancel{2}_{1}} = 9$

III. Octagon $= \frac{8(8-3)}{2}$

$= \frac{{}^{4}\cancel{8} \times 5}{\cancel{2}_{1}}$

$= 20$

$\frac{n(n-3)}{2}$

Heptagon

$= \frac{7 \times (7-3)}{2}$

$= \frac{7 \times 4^{2}}{2}$

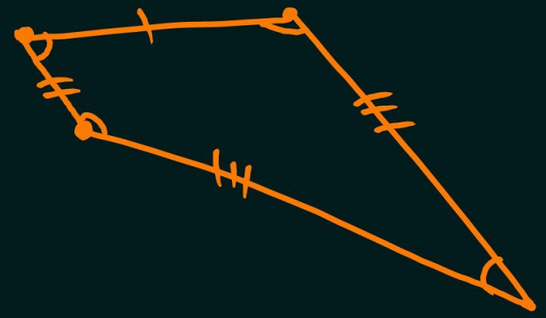
$= 14$

QUADRILATERAL

side

Polygon

- 4 Sides
- 4 Angle
- 4 Vertex



QUADRILATERAL

Adjacent sides of a Quadrilateral:

Two sides of a quadrilateral which have a common end point are called its adjacent sides.

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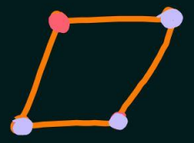
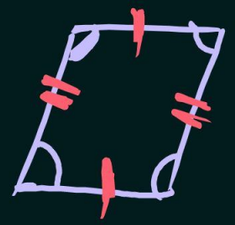


Opposite sides of a Quadrilateral:

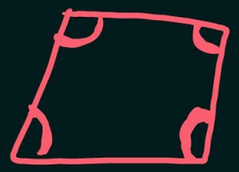
Two sides of a quadrilateral are called its opposite sides if they do not have a common end point.



QUADRILATERAL

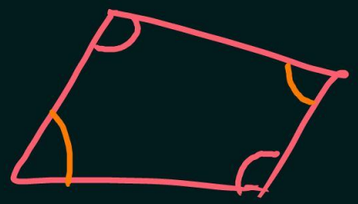
Adjacent Angles of a Quadrilateral:

Two angles of a quadrilateral having common arm are called its adjacent angles.



Opposite Angles of a Quadrilateral:

Two angles of a quadrilateral which are not adjacent angles are known as opposite angles.



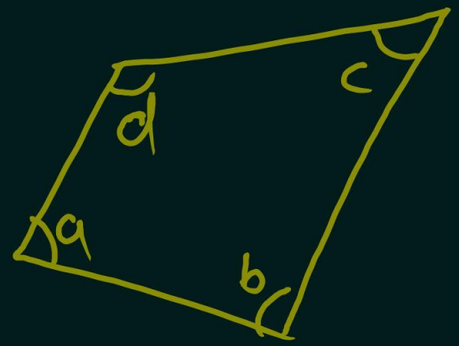
ANGLE SUM PROPERTY OF QUADRILATERAL

$\Rightarrow (n-2)\times 180^\circ$

$= (4-2)\times 180$

$= 2\times 180^\circ$

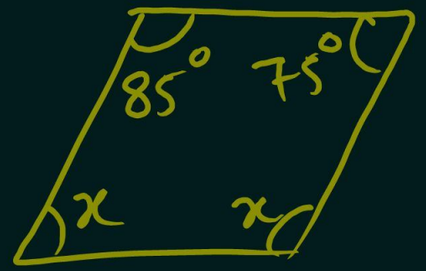
$= \underline{\underline{360^\circ}}$



$a+b+c+d = \underline{\underline{360^\circ}}$

Question

Two angles of a quadrilateral measure 85° and 75° respectively. The other two angles are equal. Find the measure of each of these equal angles.



$$x + x + 75^\circ + 85^\circ = 360^\circ$$

$$2x + 160^\circ = 360^\circ$$

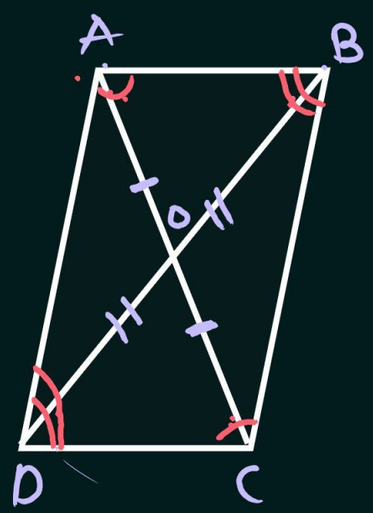
$$2x = 360 - 160$$

$$2x = 200^\circ$$

$$x = \frac{200}{2} = 100^\circ$$

PARALLELOGRAM

A quadrilateral is called a parallelogram if both of its opposite sides are parallel.



i) Opposite Sides are parallel & Equal

$AB = DC$; $BC = AD$

ii) Opposite Angles are equal ($\angle A = \angle C$; $\angle B = \angle D$)

iii) Adjacent Angles are supplementary

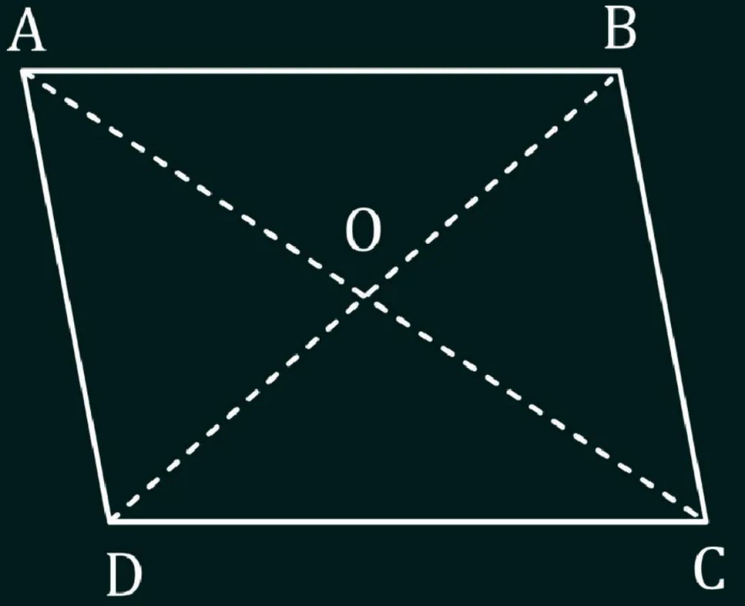
$\angle A + \angle B = 180^\circ$, $\angle B + \angle C = 180^\circ$, $\angle C + \angle D = 180^\circ$, $\angle A + \angle D = 180^\circ$

iv) Diagonal Bisect each other

$AO = CO$; $DO = BO$.

PROPERTIES OF PARALLELOGRAM

In a quadrilateral, if both the pairs of opposite sides are parallel, then it is called a parallelogram.



- Opposite sides are equal i.e., AB = DC and BC = AD.
- Opposite sides are parallel i.e., AB || DC and BC || AD..
- Opposite angles are equal i.e., $\angle A = \angle C$ and $\angle B = \angle D$.
- Sum of any two adjacent angles are supplementary i.e.,

  $\angle A + \angle B = 180° = \angle B + \angle C = \angle C + \angle D = \angle A + \angle D$.
- Diagonals bisect each other i.e., OA = OC and OB = OD

RECTANGLE

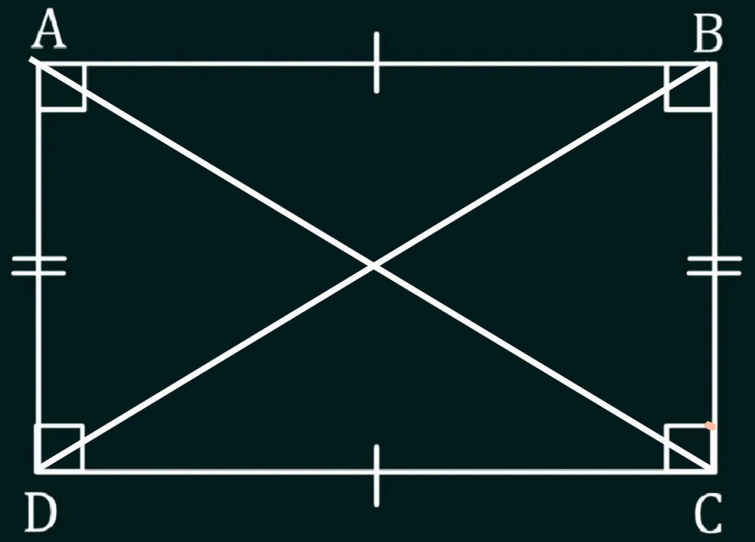
A parallelogram in which each angle is a right angle is known as rectangle.

⇒ All the properties of Parallelogram

⇒ All the Angles are 90°

⇒ Diagonals are equal

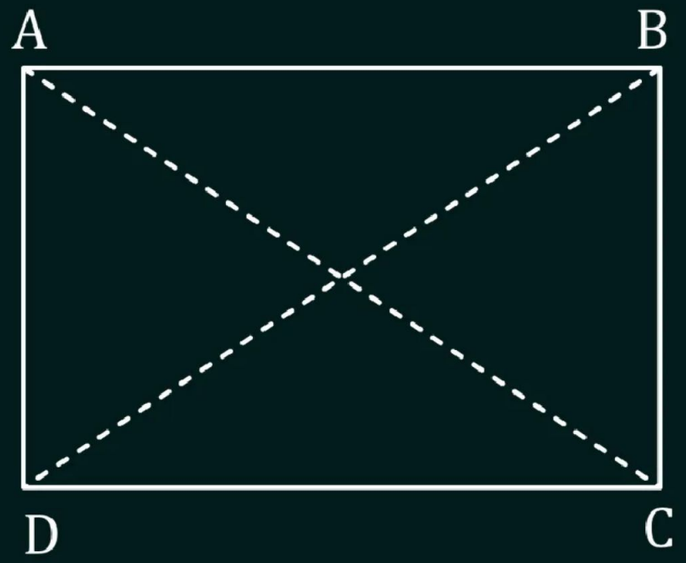
$AC = BD$



PROPERTIES OF RECTANGLE

A rectangle is a parallelogram in which all the four angles at the vertices are right angles, i.e., 90°.

- Opposite sides are equal i.e., AB = DC and BC = AD
- Opposite sides are parallel i.e., AB || DC and BC || AD.
- Each angle is a right angle i.e., ∠A = ∠B = ∠C = ∠D = 90°.
- Both diagonals are equal i.e., AC = BD .
- Diagonals bisect each other i.e., OA = OC and OB = OD
  ∴ OA = OB = OC = OD
- Sum of any two adjacent angles are supplementary i.e., ∠A + ∠B = ∠B + ∠C = ∠C + ∠D = ∠A + ∠D = 180°.



RHOMBUS

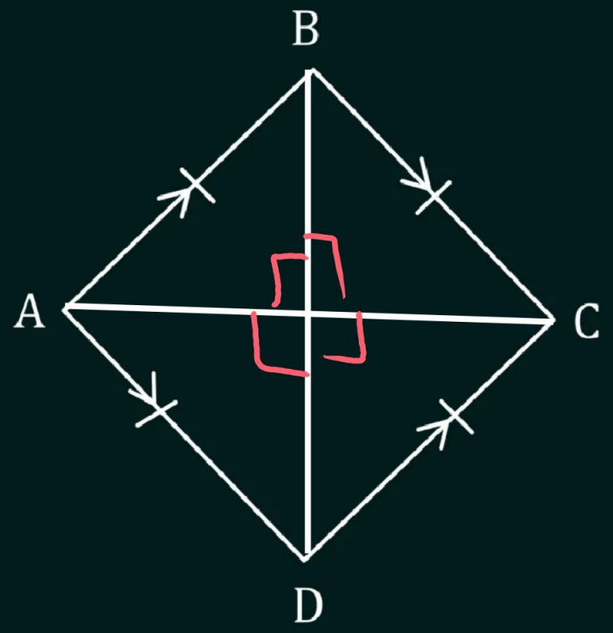
All Angles are NOT 90°

In a parallelogram, if all the sides are equal, then it is called a rhombus.

⇒ All properties of Parallelogram

⇒ All Sides are equal.

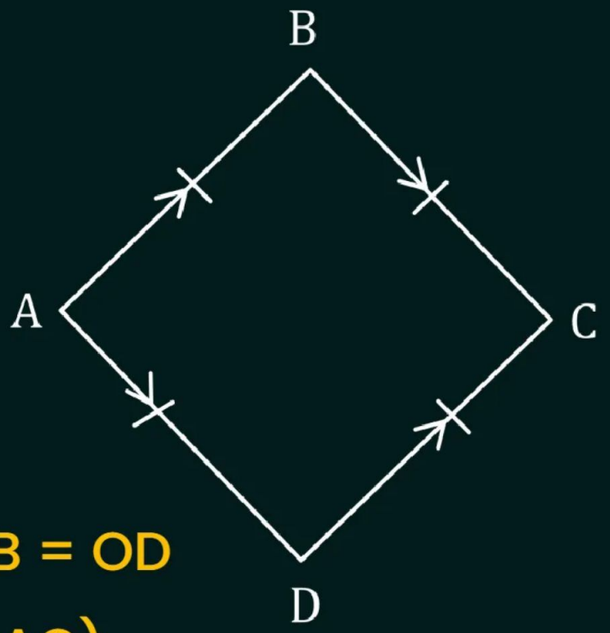
⇒ Diagonal bisect each other at 90°



PROPERTIES OF RHOMBUS

In a parallelogram, if all the sides are equal, then it is called a rhombus.

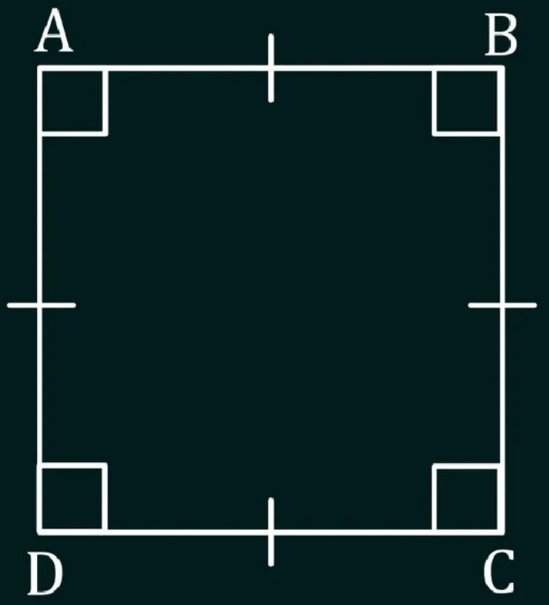
- All four sides are equal i.e., AB = BC = CD = AD.
- Opposite sides are parallel i.e., $AB||DC$ and $BC||AD$.
- Opposite angles are equal i.e., $\angle A = \angle C$ and $\angle B = \angle D$.
- Sum of any two adjacent angles are supplementary i.e.,
  $\angle A + \angle B = \angle B + \angle C = \angle C + \angle D = \angle A + \angle D = 180°$
- Diagonals bisect each other at right angle i.e., OA = OC and OB = OD and $\angle AOB = \angle BOC = \angle COD = \angle AOD = 90°$ (i.e., $AC \perp BD$ or $BD \perp AC$).



SQUARE

A parallelogram in which all sides are equal and each angle measure 90° is called a square.

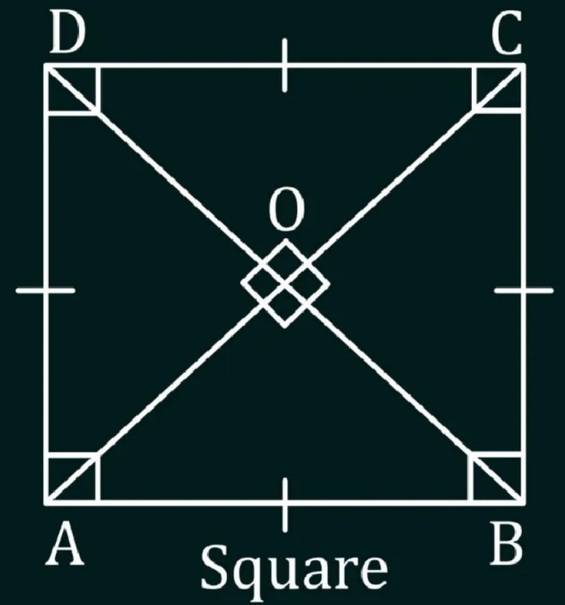
⇒ All properties of parallelogram, Rectangle, Rhombus



PROPERTIES OF SQUARE

In a rectangle, if all the sides are equal, then it is called a square.

- All four sides are equal i.e., AB = DC = CD = AD.
- Opposite sides are parallel i.e., AB || DC and BC || AD.
- Each angle is a right angle i.e., $\angle A = \angle B = \angle C = \angle D = 90°$.
- Both diagonals are equal i.e., AC = BD.
- Diagonals bisect each other at right angle. i.e., OA = OC and OB = OD But diagonals AC = BD $\therefore$ OA = OB = OC = OD and $\angle AOB = \angle BOC = \angle COD = \angle AOD = 90°$. (AC $\perp$ BD or BD $\perp$ AC).
- Sum of any two adjacent angles are supplementary i.e., $\angle A + \angle B = \angle B + \angle C = \angle C + \angle D = \angle A + \angle D = 180°$.



Square

PROPERTIES OF DIAGONALS

Parallelogram	→	Bisect each other
Rectangle	→	Equal and Bisect each other
Square	→	Equal and Bisect each other at right angles
Rhombus	→	Bisect each other at right angles

Question

State true or false

(i) All rectangle are squares. False

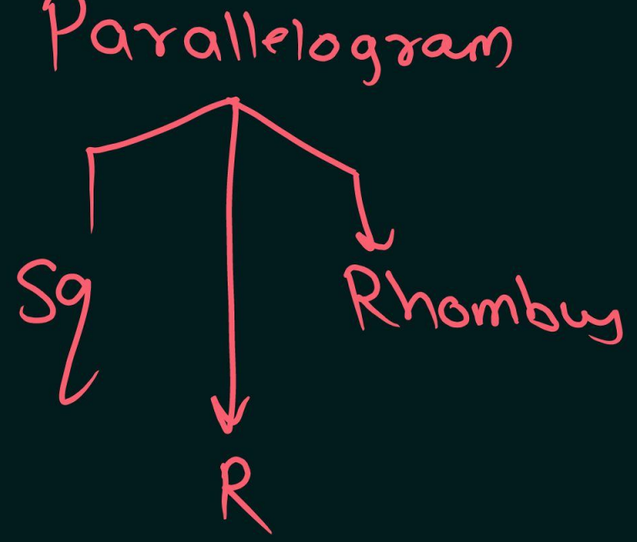
All sides are equal ×

(ii) All rhombus are parallelogram True

(iii) All squares are not parallelogram. false.

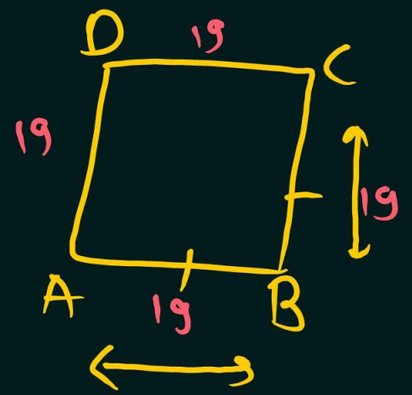
(iv) All square are rectangles.

Angles = 90° ✓
Diagonal equal ✓
} True.



Question

In a square ABCD, AB = (2x + 3) cm and BC = (3x – 5) cm. Then, the value of x is



$2x+3$

$= 2\times8+3$

$= 16+3$

$= 19$

$2x+3 = 3x-5$

$+3+5 = 3x-2x$

$8 = x$

$x = 8$

Question

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

$y = 100^\circ$ [opp. Angles equal]

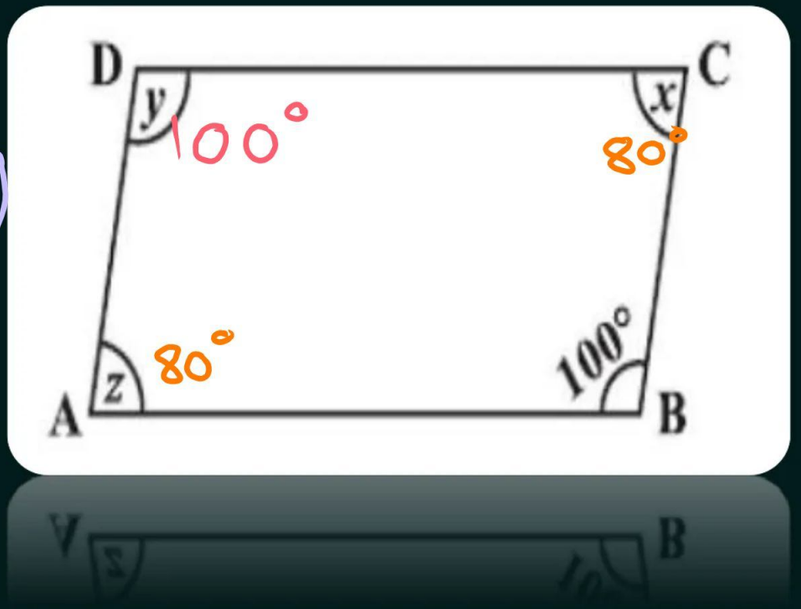
$x + y = 180^\circ$ (Adjacent Angle supplem)

$x + 100 = 180^\circ$

$x = 180 - 100$

$x = 80^\circ$

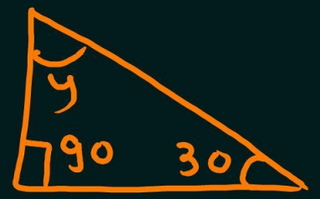
$\angle Z = 80^\circ$ (opp. Angles are equal]



Question

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

$x = 90^\circ$

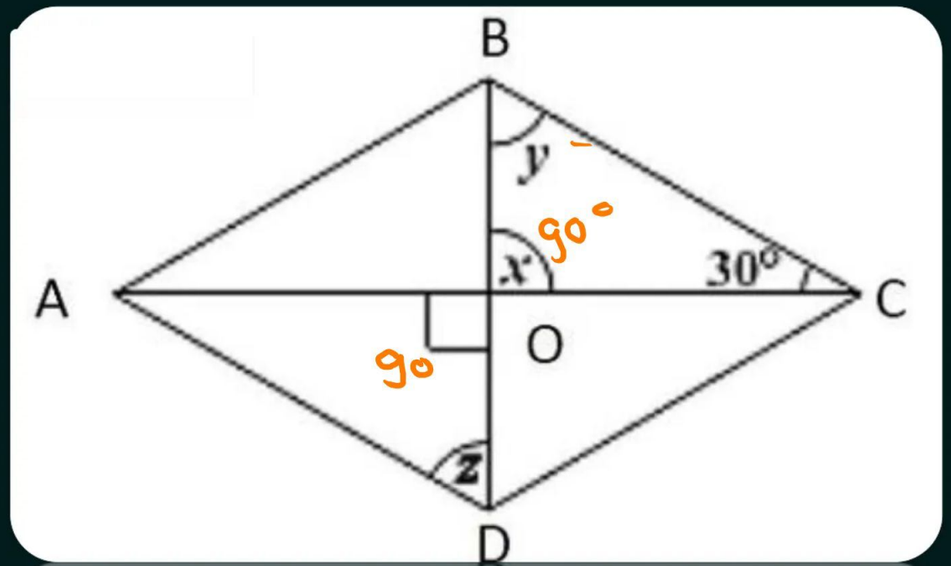


$90 + 30^\circ + y = 180^\circ$

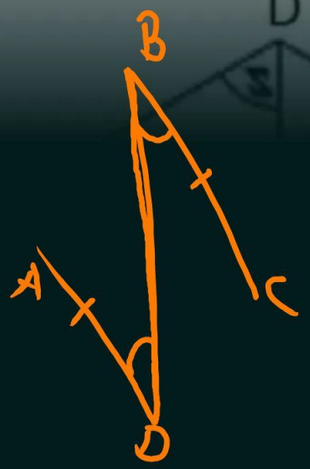
$120^\circ + y = 180^\circ$

$y = 180 - 120$

$= \underline{\underline{60^\circ}}$



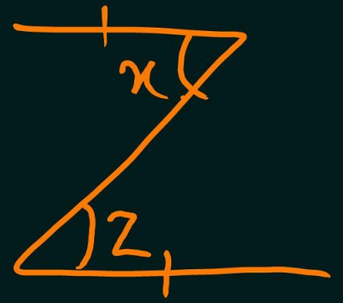
$\angle Z = 60^\circ$ [Alternate interior Angle]

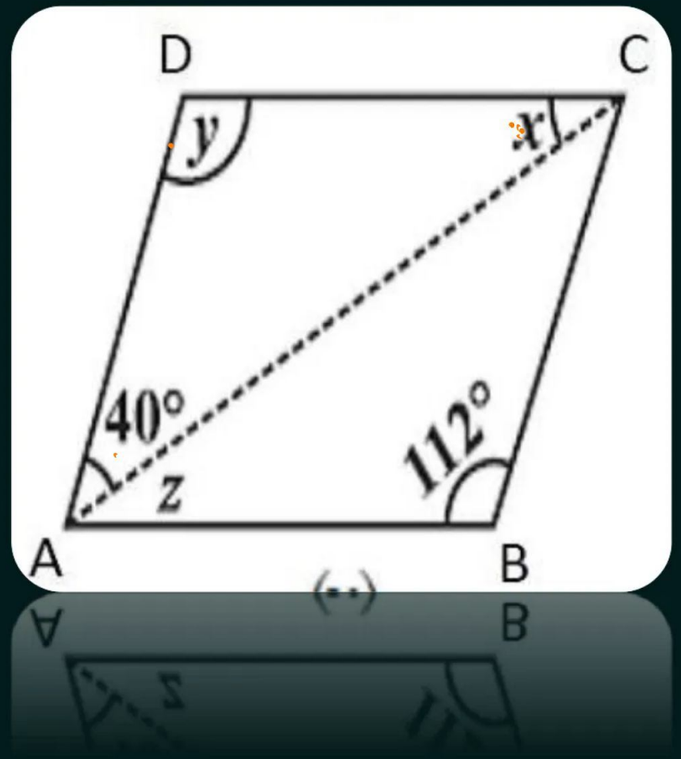


HALWA QUESTION 1

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

HALWA QUE-1

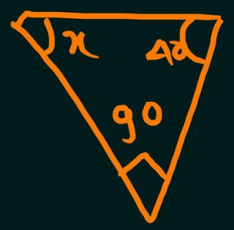




Question

In the given figure, BEST is a rhombus. Then the value of y – x is

$LY = 90^\circ$



$x + 40 + 90 = 180^\circ$

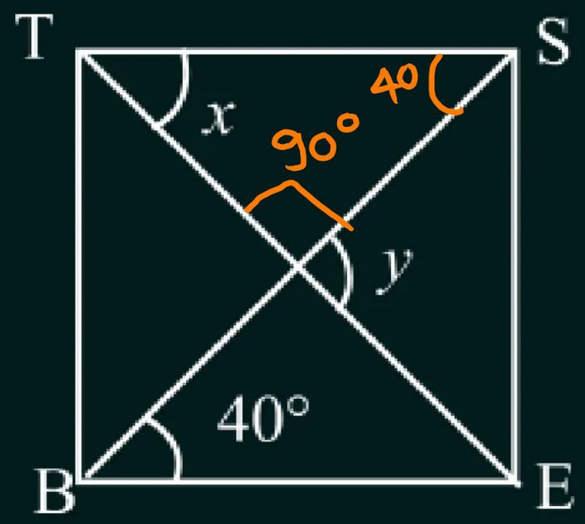
$x + 130 = 180^\circ$

$x = 180 - 130$

$= 50^\circ$

$Y - x = 90 - 50$

$= 40^\circ$



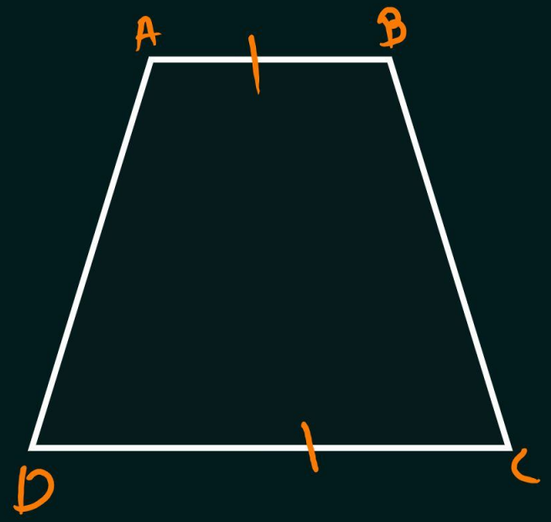
HALWA QUESTION 2

Identify all the quadrilaterals that have.
(a) four sides of equal length

(b) four right angles

TRAPEZIUM

A quadrilateral having exactly one pair of parallel side and another pair of non – parallel sides is called a trapezium



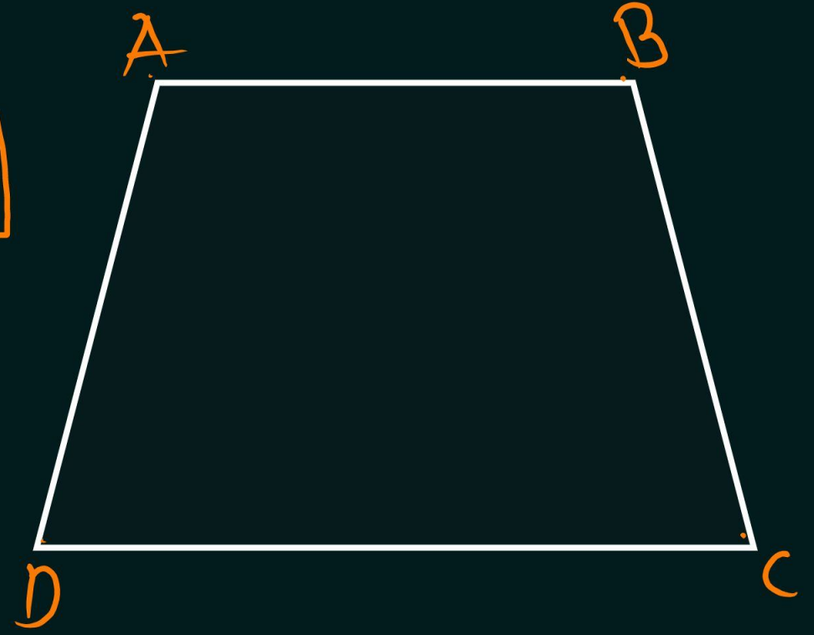
AB || CD

ISOSCELES TRAPEZIUM

A trapezium whose non – parallel sides are equal is called an isosceles trapezium.

$AD = BC$

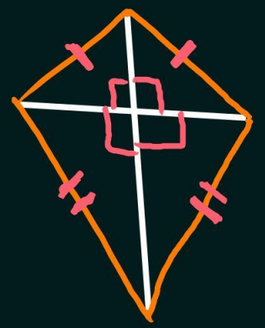
$AB \parallel CD$



KITE

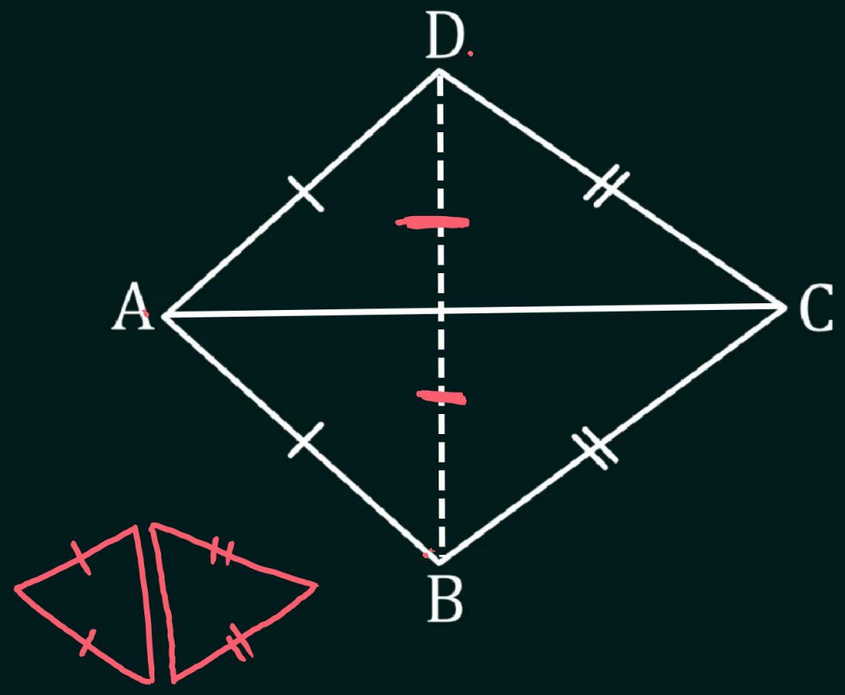
A quadrilateral is called a kite if it has two pairs of equal adjacent sides but unequal opposite sides.

Remember : No pair of parallel side



KITE

1) Two pairs of adjacent sides are equal.
2) Two diagonals intersect each other at right angles.
3) The kite is symmetrical about the longer diagonal.
4) The longer diagonal bisects the shorter diagonal.
5) The kite is split into two isosceles triangles by the shorter diagonal.



Thank You