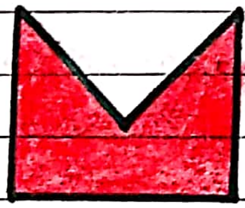
CHAPTER → 3

UNDERSTANDING QUADRILATERALS

1- Given here figure some:



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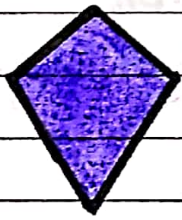

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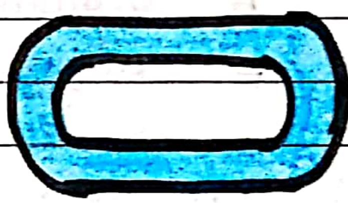

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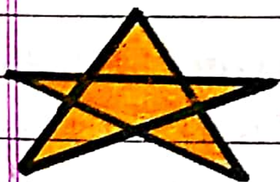

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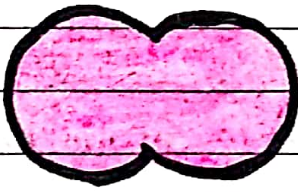

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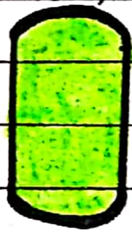

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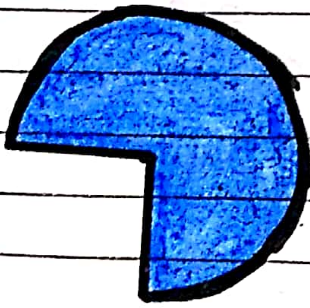

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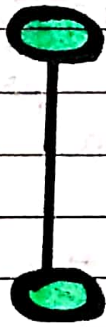


(8)

2. classify each of them on the basis of the following.

(a) simple curve → 1, 2, 5, 6, 7 and 8.
(b) simple closed curve → 1, 2, 5, 6 and 7.
(c) Polygon → 1 and 2.
(d) convex polygon → 2.
(e) concave polygon → 1 and 4.

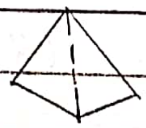
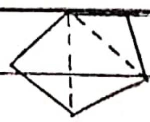
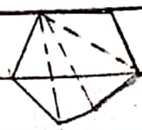
2.) How many diagonals does each of the following have?
(a) A convex quadrilateral
Ans:- A convex quadrilateral has two diagonals.

(b) A regular hexagon.
Ans:- A reguler hexgon has nine diagonals.

(c) A triangle
Ans:- A triangle has 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?
Ans:- The sum of measures of the angles of a convex quadrilateral is 360°.
Yes, this property holds in case of the quadrilateral is not convex.

4. Examine the table:-

figure				
side	3	4	5	6
Angle sum	180°	$2 \times 180°$ $= (4-2) \times 180°$	$3 \times 180°$ $= (5-2) \times 180°$	$4 \times 180°$ $= (6-2) \times 180°$

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

(a) 7

Ans- From the given table, clearly we observe that the sum of angle of a polygon with n sides

$= (n-2) \times 180°$

(i) = Hence $n = 7$

$\therefore$ The sum of the angles of a polygon of 7 sides

$= (7-2) \times 180°$

$= 5 \times 180°$

$= 900°$

(b) 8

Ans/. Here $n = 8$

$\therefore$ The sum of the angles of a polygon of 8 sides.

$= (8-2) \times 180°$

$= 6 \times 180°$

$= 1080°$

(c) 10

Ans/- Here $n = 10$

$\therefore$ The sum of the angles of polygon of 10 sides.

$= (10-2) \times 180°$

$= 8 \times 180°$

$= 1440°$

(d) n

Ans/- clearly from the given table it is observed that the number of triangles is two less than the number of sides in the polygon.

$\therefore$ if the polygon has n sides, the number of triangles formed will be $(n-2)$.

since the sum of angles of a triangle = 180°

$\therefore$ The sum of angles of a polygon of n sides

$(n-2) \times 180°$

5. what is a regular polygon?

State the name of a regular polygon of:

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

Ans- A polygon is said to be a regular polygon, if all its

i) interior angles are equal

ii) sides are equal and

iii) exterior angles are equal

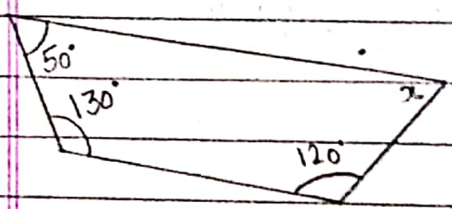
The name of a regular polygon of

i) 3 sides is equilateral triangle

ii) 4 sides is square

iii) 6 sides is regular hexagon.

6. Find the angles measure x in the following figures

(a) 

Ans since the sum of angles of a quadrilateral is 360°

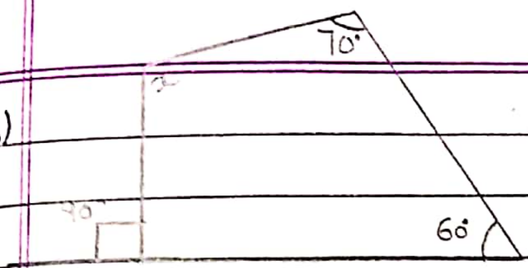
$\Rightarrow \quad x + 120° + 130° + 50° = 360°$

$x + 300° = 360°$

$x = 360° - 300°$

$x = 60°$

(b)



Ans- since the sum of angles of a quadrilateral is 360°

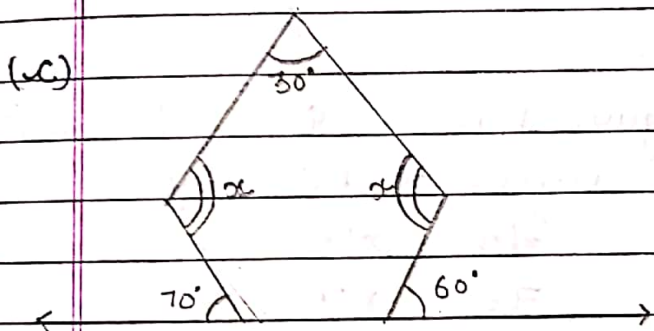
$= \quad x + 70° + 60° + 90° = 360°$

$x + 220° = 360°$

$x = 360° - 220°$

$x = 140°$

(c)



Ans- since the given figure has 5 sides, i.e., n = 5

∴ The sum of the angles of this figure

$= (n-2) \times 180°$

$= (5-2) \times 180°$

$= 3 \times 180°$

$= 540°$

clearly, from the figure

$m\angle 1 + 60° = 180°$ [linear pair]

$m\angle 1 = 180° - 60°$

$m\angle 1 = 120°$

and, $m\angle 2 + 70° = 180°$ [linear pair]

$m\angle 2 = 180° - 70°$

$m\angle 2 = 110°$

$\therefore m\angle 1 + m\angle 2 + x + 30° + x = 540°$

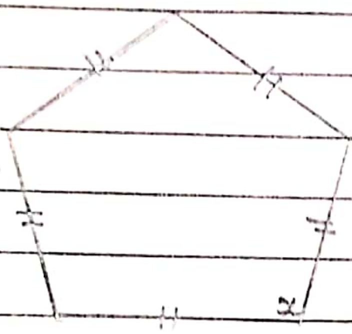
$120° + 110° + 2x + 30° = 540°$

$2x + 260° = 540°$

$2x = 540 - 260°$

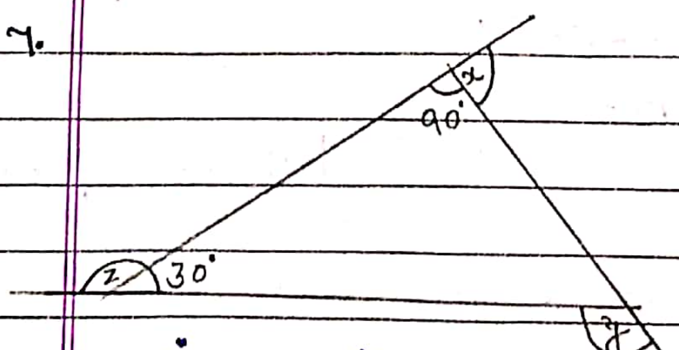
$$2x = 280^\circ$$
$$x = \frac{\cancel{280^\circ}}{\cancel{2}}$$
$$x = 140^\circ$$

(d)



Ans:- Since the given figure has 5 sides, i.e, $n=5$
∴ The sum of the angles of this figure
$$= (n-2)\times 180^\circ$$
$$= (5-2)\times 180^\circ$$
$$= 3\times 180^\circ$$
$$= 540^\circ$$
∴ $$x+x+x+x+x = 540^\circ$$
$$5x = 540^\circ$$
$$x = \frac{\cancel{540^\circ}}{\cancel{5}}$$
$$x = 108^\circ$$

7.



Find $x+y+z$

Ans:- since the sum of angles of a triangle is 180°
∴ $m\angle 1 + 30^\circ + 90^\circ = 180^\circ$
$$m\angle 1 + 120^\circ = 180^\circ$$

$m\angle 1 = 180° - 120°$

$m\angle 1 = 60°$

Also, $x + 90° = 180°$

$x = 180° - 90°$ (linear pair)

$\therefore x = 90°$ --- (1)

$y + m\angle 1 = 180°$ (linear pair)

$y + 60° = 180°$ ($\because m\angle 1 = 60°$)

$y = 180° - 60$

$y = 120°$ --- (2)

and, $z + 30° = 180°$ (linear pair)

$z = 180° - 30°$

$z = 150°$ --- (3)

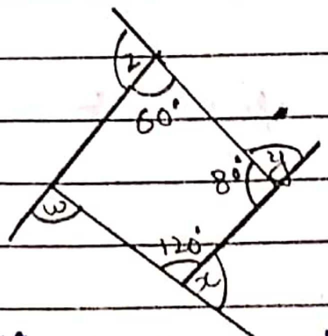
Adding (1), (2) and (3), we get

$x + y + z$

$90° + 120° + 150°$

$= 360°$

(b)



Find $x + y + z + w$

Ans Since sum of angles of a quadrilateral is 360°, therefore,

$m\angle 1 + 120° + 80° + 60° = 360°$

$m\angle 1 + 260° = 360°$

$m\angle 1 = 360° - 260°$

$m\angle 1 = 100°$

Also, $x + 120° = 180°$

$x = 180° - 120°$

$x = 60°$ --- (1)

$y + 80° = 180°$ (linear pair)

$y = 180° - 80°$

$y = 100$ --- (2)

$\Rightarrow$ $z + 60° = 180°$ (linear pair)

$z = 180° - 60°$

$z = 120°$ --- (3)

$\Rightarrow$ $m\angle 1 + w = 180°$

$\therefore w = 180° - m\angle 1$

$w = 180° - 100$

$w \Rightarrow 80°$ --- (4)

Adding (1), (2), (3) and (4), we get

$x + y + z + w$

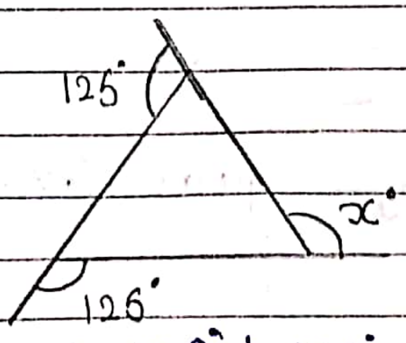
$= 100 + 100 + 120° + 80°$

$= 360°$

Ex 7.2

1. Find x in the following figures :-

(a)



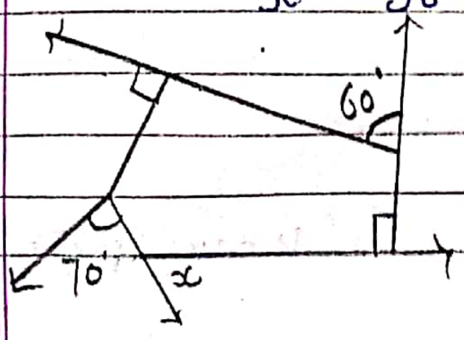
Find x

Ans/- $x + 125° + 125° = 360°$

$x + 250° = 360°$

$x = 360° - 250° = 110°$

(b)



Find the x

Ans 1- $x + 90° + 60° + 90° + 70° = 360°$

$x + 310° = 360°$

$x = 360° - 310 = 50°$

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

(i) 9 sides

Ans Each exterior angle of a regular polygon of 9 sides

$= \frac{360°}{n}$, where $n = 9$

$= \left(\frac{\cancel{360°}^{40°}}{\cancel{9}}\right) = 40$

(ii) 15 sides

Ans each exterior angle of a regular polygon of 15 sides

$= \frac{360°}{n}$, where $n = 15$

$= \left(\frac{\cancel{360°}^{24}}{\cancel{15}}\right) = 24°$

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

Ans 1- Since the number of sides of a regular polygon

$= \frac{~~360°~~\ 36°}{\text{exterior angle}}$

Here, exterior angle $= 24°$

Number of sides of the given polygon

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

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

Ans each interior angle $= \left\{\frac{(n-2)\times 180°}{n}\right\}$

$$\therefore \frac{n-2}{n} \times 180 = 165$$

$$180n - 360 = 165n$$

$$180n - 165n = 360$$

$$15n = 360$$

$$n = \frac{\cancel{360}\ 24}{15} = 24$$

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

Ans/- Since the number of sides of a regular polygon

$$\frac{360}{\text{Exterior angle}}$$

$\therefore$ The number of sides of a regular polygon

$$= \frac{\cancel{360}}{\cancel{22}} \quad (\because \text{Ext. angle} = 22°)$$

$$= \frac{180}{11}$$

Which is not a whole number.

$\therefore$ A regular polygon with measure of each exterior angle as $22°$ is not possible

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

Ans/- If interior angle $= 22°$, then its exterior

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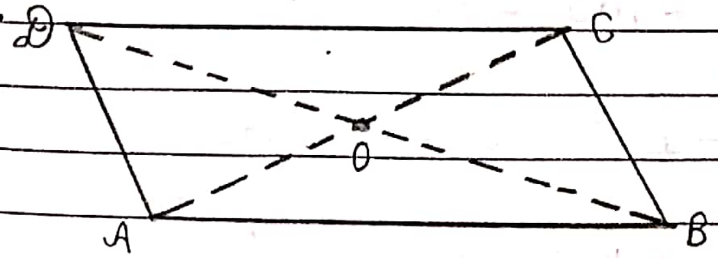
$= 180^\circ - 22^\circ = 158^\circ$.
But 158° does not divide 360 exactly.
Hence, the polygon is not possible.

6.(a) What is the minimum interior angles possible for a regular polygon? Why?
Ans/- The equilateral triangle being a regular polygon of 3 sides has the least measure of an interior angle $= 60^\circ$

(b) What is the maximum exterior angle possible for a regular polygon?
Ans/- Since the minimum interior angle of a regular polygon is equal to 60°, therefore, the maximum exterior angle possible for a regular polygon $= 180^\circ - 60^\circ = 120^\circ$

Ex- 3.3

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



i) AD = ______
Ans/- AD = BC : In a parallelogram, opposite sides are equal.

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ii) $\angle DCB = \text{-----}$

Ans:- $\angle DCB = \angle DAB$: In a parallelogram, opposite angels are equal.

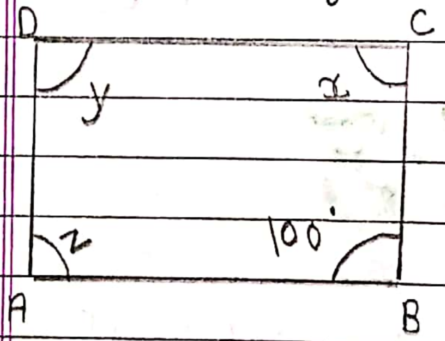
iii) $OC = \text{-----}$

Ans:- $OC = OA$: The diagonals of a parellelogram, opposite bisect each other.

iv) $m\angle DAB + m\angle CDA = \text{------}$

Ans:- $m\angle DAB + m\angle CDA = 180°$: In a parallelogram the sum of any two adjecent angle is 180°.

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



find x, y and z

Ans
$x + 100° = 180°$

$x = 180° - 100° = 80°$

$x + y = 180°$

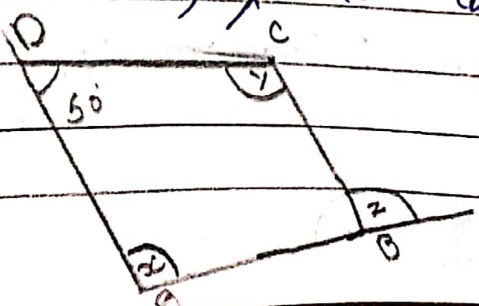
$y = 180° - x = 180° - 80 = 100°$

$y + z = 180°$

$z = 180° - y = 180° - 100° = 80°$

$x = 80°$, $y = 100°$ and $z = 80°$

(ii)



find x, y and z

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Ans:- Since ABCD is a parrallelogram, therefore, $AB \parallel DC$ and $AD \parallel BC$

Now, $AB \parallel DC$ and transversal BC intersect them.

$Z = Y$ [∵ Alternate angles are equal]

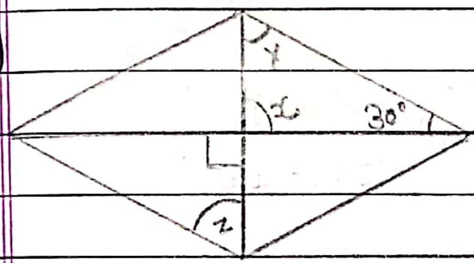
and, $AD \parallel BC$ and transversal AB intersect them.

$z = x$ [∵ Corresponding angles are equal]

$x = y = z$

$y + 50° = 180° \Rightarrow y = 180° - 50° = 130°$

$x = y = z = 130°$

(iii) 

Find x, y and z.

Ans From the figure, clearly,

$x = 90°$

In $\triangle DOC$, we have [∵ Vertically opp $\angle$s are equal]

$\angle DOC + \angle OCD + \angle CDO = 180°$

$x + 30° + y = 180°$ [Angle sum property of triangle]

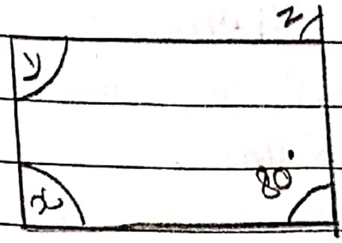
$90 + 30 + y = 180°$

$y = 180° - 120° = 60$

$z = y$ [Alternate angle are equal]

$z = 60°$

$x = 90°$ $y = 60°$ $z = 60°$



Find x, y and z

Ans $\angle A + \angle B = 180°$

$x = 180° - 80 = 100°$

$\angle A + \angle D = 180° \Rightarrow x + y = 180$

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

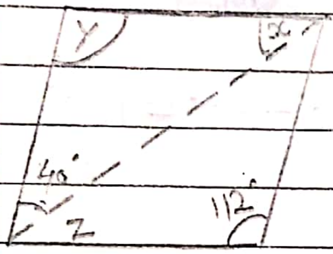
$\angle D + \angle C = 180^\circ$

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

$\angle C = 180^\circ - Y \Rightarrow 180^\circ - 80^\circ - 100^\circ$

$Z = 180^\circ - \angle C = 180^\circ - 100^\circ = 80^\circ$

$x = 100^\circ \quad y = 80^\circ \quad z = 80^\circ$

(v) 

Find x, y and z

Ans/- $Y = 112^\circ$

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

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

$Z = x$

$Z = 28^\circ$

$x = 28 \quad y = 112^\circ \quad z = 28^\circ$

3. Can a quadrilateral ABCD be a parallelogram if

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

Ans If in a quardrilateral ABCD, $\angle D + \angle B = 180^\circ$, then it is not necessary that ABCD is a parrallelogram.

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

Ans Since $AD \neq BC$, i.e, the opposite sides are unequal. So ABCD is not a parallelogram.

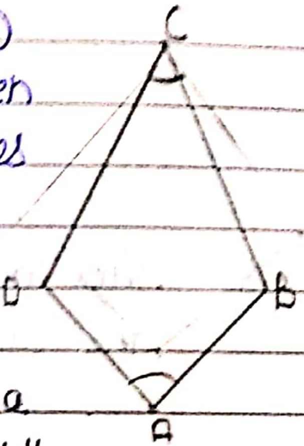
(iii) $\angle A = 70^\circ$ and $\angle C = 65^\circ$?

Ans Since $\angle A \neq \angle C$, i.e, the opposite angles are unequal.

So ABCD is not parallelogram.

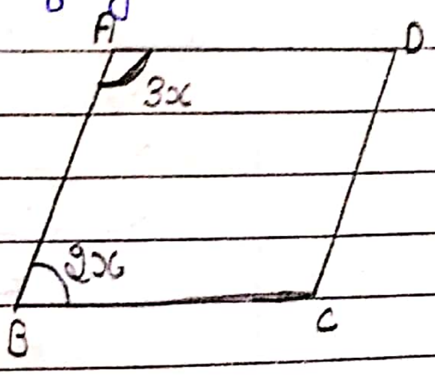
4. Draw a rough figure of a quadrilateral that is not a parallelogram but has exactly two opposite angles of equal measure.

Ans A rough figure of quadrilateral ABCD that is not a parallelogram has been drawn with exactly two opposite angles of equal measure such that $\angle A = \angle C$ which is a kite as a example.



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

Ans Let two adjacent angles A and B of llgm ABCD be $3x$ and $2x$ respectively.



$$\angle A + \angle B = 180^\circ$$
$$3x + 2x = 180^\circ$$
$$5x = 180^\circ$$
$$x = \frac{\cancel{180^\circ}^{36}}{5} = 36^\circ$$

$$\angle A = 3 \times 36^\circ = 108^\circ$$
$$\angle B = 2 \times 36^\circ = 72^\circ$$
$$\angle C = \angle A = 108^\circ \text{ and } \angle D = \angle B = 72^\circ$$
$$\angle A = 108^\circ, \angle B = 72^\circ, \angle C = 108^\circ \text{ and } \angle D = 72^\circ$$

6. Two adjacent angles A and B of parallelogram AB ~~CD~~ be have equal measure. Find the measure of each of the angles of the parallelogram.

Ans:- Let two adjacent angles A and B of parallelogram

ABCD be x each.
Since the adjacent angles of a parallelogram supplemantry.

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

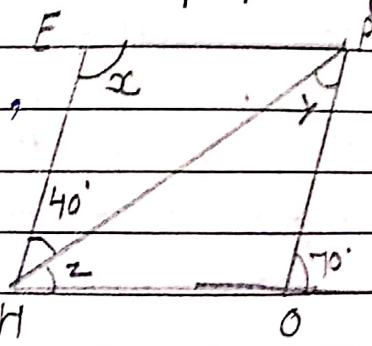
$2x = 180^\circ \Rightarrow x = 90^\circ$

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

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

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

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



Ans :- Since HOPE is a parallelogram, therefore, HE ∥ OP and HO ∥ EP
Now, HE ∥ OP and transversal HO intersect them

$\angle EHO = \angle POX$

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

$z = 70^\circ - 40^\circ = 30^\circ$

$\angle OPH = \angle \cancel{HOP}\, EHP$

$y = 40^\circ$

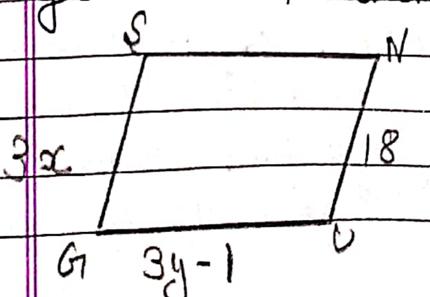
$\angle HEP = \angle HOP$

$x = 180^\circ - \angle POX = 180^\circ - 70^\circ = 110^\circ$

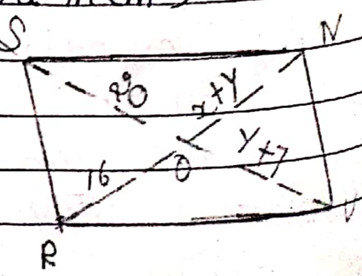
$x = 110^\circ$ $y = 40^\circ$ $z = 30^\circ$

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

(i)



(ii)



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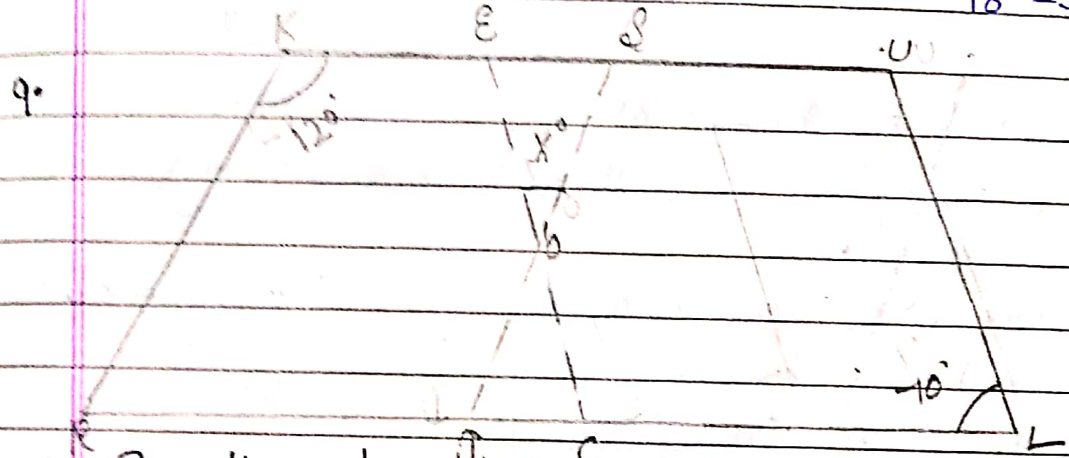
(i) Since GUNS a Parallelogram
GS = UN and GU = SN
$3x = 18$, i.e, $x = 6$
$3y - 1 = 26$
$3y = 26 + 1 = 27 \Rightarrow y = 9$
Hence, $x = 6$ and $y = 9$

(ii) In a parallelogram, diagonal bisect each other, before
$OR = ON$, i.e, $16 = x + y$
$OU = OS$, i.e, $y + 7 = 20$
$y = 20 - 7 = 13$
Putting $y = 13$ in (1), we get
$16 = x + 13 \Rightarrow x = 16 - 13 = 3$

9. 

In the above figures both RISK and CLUE are parallelogram. Find the value x.

Sol. In the llgm RISK, we have
$\angle RIS = \angle RKS = 120°$ [∵ Opp. ∠s are equal]
$\angle OIC = 180° - \angle RIS$ [Linear pair]
$\angle OIC = 180° - 120° = 60°$

In the llgm CLUE, CE ‖ LU and a transversal TCL intersect them.
∴ $\angle ICO = \angle CLU$
$\angle ICO = 70°$ [∵ Corresponding ∠s are equal]

In △OIC, by angle sum property, we have
$\angle IOC + \angle OIC + \angle ICO = 180°$
$\angle IOC + 60° + 70° = 180°$
$\angle IOC = 180° - 60° - 70° = 50°$
$x = \angle IOC = 50°$
[∵ Vertically opp. ∠s are equal]

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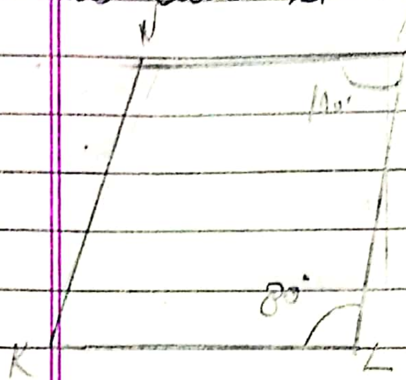
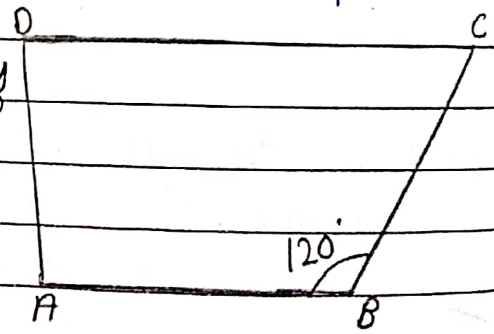
10 Explain how this figures is a traperzium which of its two sides are parallel?



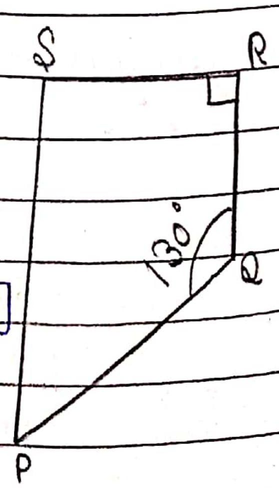
Ans Since ∠KLM + ∠NML = 180°
i.e., the pair of consecutive interior angles are suplementary.
There Fore, KL || NM and so KLMN is a trapezium.

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



Ans/- Since AB||DC and Transversal BC intersect them.
∴ ∠B + ∠C = 180°
120° + ∠C = 180° [∴ Sum of interior angle is 180°]
∠C = 180° - 120° = 60°
m∠C = 60°

12. Find the measure if ∠P and ∠S if $\overline{SP} \parallel \overline{RQ}$. if you find m∠R, is there more than one method to and m∠P ?]



Ans/- ∠P + ∠Q = 180° [∴ Sum interior angle is 180°]
∠P + 130° = 180° = 50°
∠S + ∠R = 180° = ∠S + 90 = 180°
∠S = 180° - 90° = 90°
m∠P + m∠Q + m∠R + m∠S = 360°
m∠P + 130° + 90° + 90° = 360°
m∠P = 360° - 310° = 50°

Ex - 3.4

1. State whether True or False:
(a) All rectangles are squarse. (False)
(b) All rhombuses are parallelograms. (True)
(c) All squares are rhombus and also rectangles. (True)
(d) All square are not parallelograms. (False)
(e) All kites are rhombuses. (False)
(f) All rhombuses are kites. (True)
(g) All parallelogram are trapeziums. (True)
(h) All squares are trapeziums. (True)

2. Indentify all the quardrilateral that have:
(a) four sides of equal length.
Ans/- The quadrilaterals having four sides of equal length is either a square or a rhombus.

(b) four right angles.
Ans/- The quadrilaterals having four right angles is either a square or a rectangle.

3. Explain how a square is
(i) a quadrilateral
Ans A squar is 4 sided, so it is a quadrilateral.

(ii) a parallelogram
Ans A square has a its opposite sides parallel, so it is a parallelogram.

(iii) a rhombus

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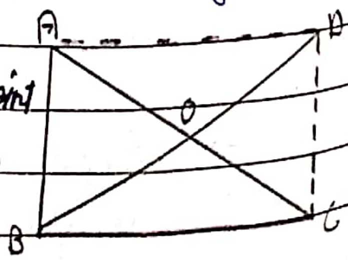
Ans/- A square is a parallelogram with all the four sides equal, So it is a rhombus

(iv) a rectangle
Ans A Square is a parallelogram with each angle a right angle, so its is a rectangle.

4. Name the quadrilateral whose diagonals:
(i) bisect each other
Ans/- The quadrilateral whose diagonals bisect each their can be a parallelogram or a rhombus or a square or rectangle.

(ii) are perpendicular bisectors of each other
Ao The quadrilateral whose diagonals are perpendicular besectors of each other can be a rhombus or square
(iii) are equal ⇒ The quilateral Whose diagonals are equal can square ore rectange
(5) Explain why a rectangle is a convex quadrilateral.
Ans Since the measure of each angle is a less than 180° and also both the digonals of a rectangle lie wholey in its interior, so a rectangle is a convex quadrildoral
(6) ABC is a right-angled triangle and O the mid-point of the side opposite to the right angled. Explain Why O is equidistant from A, B and C.



Ao $BO = OD$
$OA = OC$ and $OB = OD$
$AC = BD$
$OA = OB = OB$
Thus, O is equidistant from A, B and C.

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