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Chapter - 3
Quadrilaterals

Polygons :- A simple closed curve made up of only line segment.

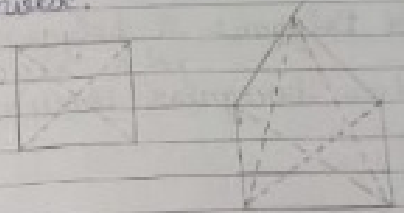
Line Segment :- A line segment is a part of a line that bounded by two distinct end points and contains every point on the line between its end every point on the line between its end points

In a polygon number of sides equal to number of angles and a polygon named according to the number of sides / angle it has.

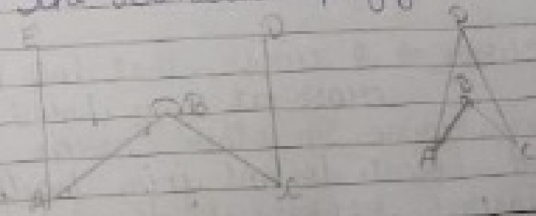
No of Sides / angles	Types of polygon	Sum of all angles $(n-2) \times 180$
3	Triangle	$(3-2) \times 180 = 180°$
4	Quadrilateral	$(4-2) \times 180 = 360°$
5	Pentagon	$(5-2) \times 180 = 540$
6	Hexagon	$(6-2) \times 180 = 720$
7	Heptagon	$(7-2) \times 180 = 900$
8	octagon	$(8-2) \times 180 = 1080$
9	Nonagon	$(9-2) \times 180 = 1260$
10	Decagon	$(10-2) \times 180 = 1440$

Types of Polygon

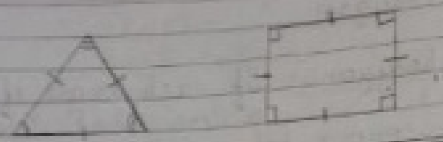
1. **Convex polygons :-** If each angle of a polygon is less than 180, then it is known as convex polygon. The given figures represent the convex.



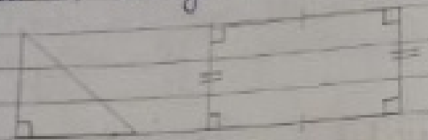
2. **Concave polygon:** If at least one angle of a polygon is more than 180 then it is known as concave polygon. The given figures represent the concave polygon.



3. **Regular polygon :-** A polygon which has all its sides and angles equal is know as regular polygon. There, a regular polygon is both equiangular & equilateral.



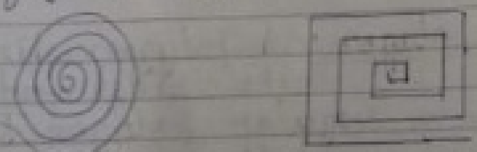
4. <u>Irregular Polygon</u>:- A polygon which is not a regular polygon is called an irregular polyon



* <u>Curve and its ~~T~~ Types</u>

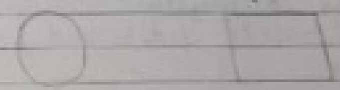
Curve = A set of points which form or other surface

(i) <u>Open curve</u> → A curve that does not cross at any point is known as open curve. In other words, begin and end points do not join together. The given figures represent the open curves



(ii) <u>Closed curve</u> → A continuous plane curve that begins no ends. In otherwords, that begins & ends at the same point. The given figures represent the closed curves.

(iii) <u>Simple closed curve</u> → A closed curve which does not cross itself is called a simple closed curve. The given figures represent the simple closed curve.



⇨ <u>Quadrilateral</u> → A quadrilateral is a polygon with ~~f~~ four edges and ~~a~~ 4 Vertices or corners. or A quadrilateral ~~a~~ can be defined as a ~~st~~ ~~st~~ closed, two dimesional shape which has 4 straight sides. The polygon has 4 vertices & corners

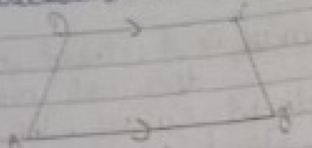
⇨ <u>Properties of a Quadrilateral</u>

(a) Sum of 4 interior angles of a quadrilateral is 360.

(b) A quadrilateral should be closd shape with 4 sides.

Types of Quadrilateral

⇒ Trapezium ⇒ A quadrilateral in which one pair of opposite side is parallel but the other pair of opposite side is not parallel is called a trapezium.



Properties of Trapezium ⇒ (a) only one pair of opposite sides are parallel to each other.

⇒ Kite ⇒ A plane figure with four sides & two pairs of equal adjacent sides is known as a kite

Properties of Kite

Properties of Kite

(1) One pair of opposite angles is equal where other pair must not be equal.

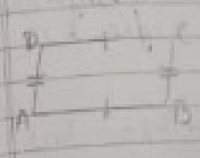
(2) Diagonals of Kite intersect each other at 90°.

(3) If diagonals of Kite are equal, then it is a rhombus.

(4) One diagonal bisects other diagonal.

5 Kite is not a parallelogram.

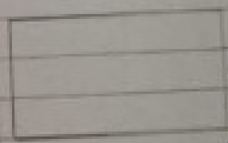
⇒ Parallelgram :- A quadrilateral is a parallelogram if both pairs of opposite sides are equal and parallel.



Properties of a parallelgram

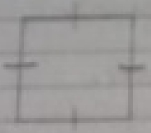
(a) opposite sides are equal
(b) opposite angle are equal
(c) Diagonals must not be equal
(d) Diagonals must not be equal
(e) Any of 4 interior angles must not be right angle.
(f) Adjacent angles are supplementary.

⇒ ~~Rectan~~ Rectangle :- Those parallelograms in which each angle is a right angle is called Rectangle



Properties of Rectangle
(a) opposite sides are equal.
(b) Each angle is of measure 90°
(c) Diagonals are equal and bisect each other.

⇒ **Square:-** A rectangle with all equal sides is called square. Diagonals of a square are equal and perpendicular to each other. Properties of a square



All sides are equal.
Diagonals bisect to each other.
-Diagonals are prependicular to each ~~otho~~ other

⇒ **Rhombus:-** Parallelogram in which ch-4 sides are equal and diagonals bisect each other at right angle. ~~I~~ is called rhombus.

Properties of a Rhombus

(a) Opposite sides are parallel and all sides are equal

(b) opposite angles are equal

(c) Diagonals bisect each other at right angle.

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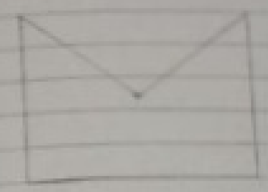
Ex- 3.1

Q.1 Given here some figures.

(1)

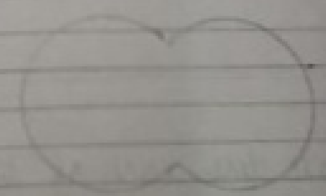


(2)

(3)

(4)

(5)



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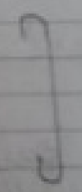

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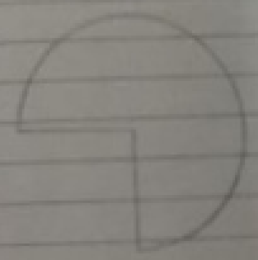

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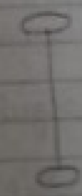


* Classify each of ~~them on~~ them on the basis of the following

(a) Simple curve

Ans 1, 2, 5, 6, 7

(b) Simple closed curve

Ans 1, 2, 5, 6, 7

(c) Polygon

Ans 1, 2

(d) Convex ~~pb~~ polygon

Ans ~~1~~ 2

(e) Concave polygon

Ans 1

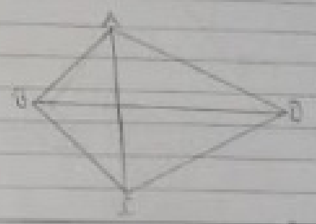
Q:2 How many diagonals does each of the following have?

(a) A convex quadrilateral

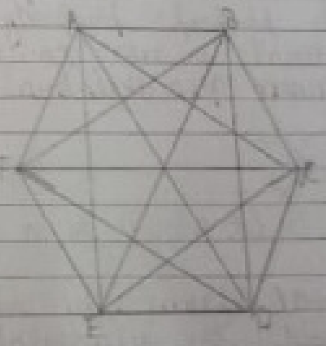
(b) A regular hexagon

(c) A triangle

(a) There are 2 diagonals in a convex quadrilateral.



(b) There are 9 ~~do~~ diagonal in a regular hexagon



(c) A triangle does'nt have any diagonal in it

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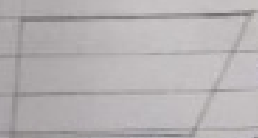
Q.3 What is the sum of the measure of the angles of a convex quadrilateral? Will this ~~propert~~ property hold if the quadrilateral is non-convex? (Make a non-convex quadrilateral and try!)

⇨  Let ABCD be a convex quadrilateral from the figure: we infer that the quadrilateral ABCD is formed by 2 Δ, ~~& Δ~~ i.e Δ ADC Δ ABC.
Since, we know that sum of interior angles of triangle is 180.
the sum of the measure of triangle.
⇒ 180 + 180 ⇒ 360°

Q.2 

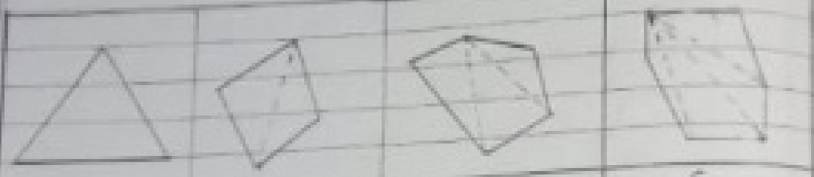
⇨ Let us take another quadrilateral ABCD which is not convex. Join AD, Such that it divides ABCD into two triangles Δ ABC Δ ABC

In Δ ~~ABC~~ ABD
$\angle 1 + \angle 2 + \angle 3 = 180°$ (angle sum pro of Δ)

In Δ ADC
$\angle 4 + \angle 5 + \angle 6 = 180$ (angle sum pro. of Δ)

In Δ ABCD
$\angle 1 + \angle 2 + \angle 3 + \angle 4 + \angle 5 + \angle 6 = 180° + 180°$
$\angle ABD + \angle ADC$
$180 + 180 = 360$
$\angle A + \angle B + \angle C + \angle D = 360°$

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

Figures				
Side	3	4	5	6
Angle Sum	180° $(n-2)\times180$ $(3-2)\times180$ 180	2×180 $=(4-2)180$ $\Rightarrow 360$	3×180 $=(5-2)\times180$ $\Rightarrow 540$	4×180 $=(6-2)\times180$ $=720$

* What can you say about the ~~sq~~ angle sum of ~~o~~ a convex polygon with of sides?

Ans The angle sum of a polygon having side ~~n~~ ~~a~~ $n = (n-2)\times180$

(a) 7 (b) 8 (c) 10 (d) n

$\rightarrow (n-2)\times180$
$(7-2)180$
5×180
900

$\rightarrow (n-2)180$
$(8-2)180$
6×180
1080

$=(n-2)180$
$(10-2)180$
8×180
1440

$\Rightarrow (n-2)\times180$

Q.5 What is a regular polygon? state the name of a regular polygon.

A Regular polygon ⇒ A polygon with equal sides & equal angle

(a) 3 side ⇒ Equilateral triangle

(b) 4 side ⇒ Square

(c) 6 side ⇒ Regular Hexagon

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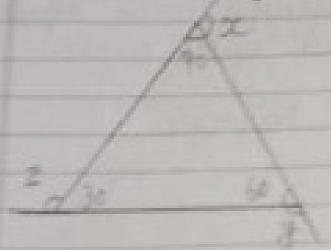
Ex-3.1

Q.7 Find ~~a~~ $x+y+z$



Sum of all interior angles of a Δ = 180

30 + 90 + third angle = 180

third angle = 180 - 120

= 160

~~External angle = 180~~

External angle $x + 90 = 180$ (L.P)

$x = 180 - 90 = 90$

External angle $y + 60 = 180$ (L.P)

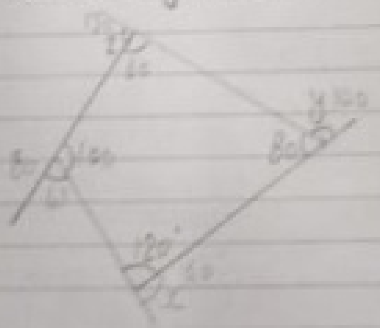
$y = 180 - 60 = 18$

120

External angle $z + 30 = 180$ (L.P)

$z = 180 - 30 = 150$

(b) Find ~~x~~ $x+y+z+w$



Sum of 4 interior angles of a quadrilateral are = 360 ~~a+~~

$a + 60 + 80 + 120 = 360$

$a + 260 = 360°$

$a = 360 - 360°$

$a = 360 - 260 = 360$

$a = 360 - 260 = 100°$

External angle $x + 120 = 180$ (L.P)

$x = 180 - 120 = 60$

$y + 80 = 180$ (L.P)

$y = 180 - 180 = 100$

$z + 60 = 180$ (L.P)

~~z + 60 = 180 (L.P) 180~~

$z = 180 - 60 = 120°$

$w + 100 = 180$ (L.P)

$w = 180 - 100 = 80$

$x + y + z + w$

$60 + 100 + 120 + 80 \Rightarrow 360°$ Ans

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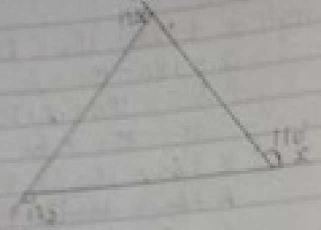
Ex 3.2

Q1 Find x in the following figures:

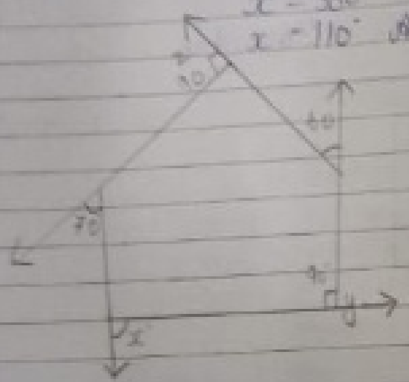
a



Ans We know that the sum of all the exterior angles of a polygon = 360°

$125° + 125 + x = 360°$
$x = 360 - 250$
$x = 110°$ Ans

b



We know that the sum of all the exterior angles of a polygon ⇒ 360°

$90° + 60° + 90° + x + 70 = 360°$
$x + 310 = 360$
$x = 360 - 310$
$x = 50$ Ans

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Q2 Find the measure of each exterior angle of a regular polygon of?

(a) 9 sides (b) 15 sides

Ans No of side = 9
Sum of all exterior angles of a polygon = 360°
each exterior angle ⇒ $\frac{360}{n}$

⇒ $\frac{360}{9} = 40°$ Ans.

(b) No of side = 15

Sum of all exterior angles of a polygon = 360
each ~~of all~~ exterior ~~as~~ angles of ~~a p~~ = $\frac{360}{x}$

⇒ $\frac{360}{15} = 24$ Ans

Q3 How many sides does a regular polygon have ~~if~~ if the measure of an exterior angle is 24?

A No of sides ⇒ a
Sum of all exterior angles of a polygon = 360°
each exterior angle = 24°
each exterior angle = $\frac{360°}{x}$

$24 = \frac{360}{a}$ $a = \frac{360°}{24} = 15°$ Ans

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Ex. 3.2

Q4 How many sides does a regular polygon have if each of its interior is 165?

Ans Let the number of sides been n

measure of each interior angles of n sided regular polygon = $\frac{(n-2) \times 180}{n}$

$165n = 180n - 360°$

$165n - 180n = -360°$

$-15n = -360°$

$n = \frac{360}{15} = 24°$

No. of side = 24 Ans

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

Ans Let the number of sides be n.

each exterior polygon angle = $\frac{360}{n}$

$\frac{22}{1} = \frac{360}{n}$

$22n = 360°$

$n = \frac{360}{22} = 16.363$

no it is not possible to have a regular polygon with measure of each exterior polygon angle as 22

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

Ans Let the no of sides be

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

$22 = \frac{(n-2) \times 180}{n}$

$22n = 180n - 360$

$22n - 180n = -360$

$-158n = -360$

$n = \frac{360}{158} = \frac{180}{79}$

not a whole no. So number of sides cannot be in fractions. it is not possible for a regular polygon to have its interior angle = 22

Q.6 What is the minimum interior angle possible for a regular polygon? Why?

Ans The eq equilateral triangle being a regular polygon of 3 sides has the least measure of an interior angle = $\frac{180}{3} = 60$

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

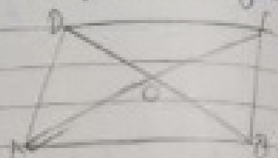
We can see the greatest / maximum exterior angle is = 180 − 60 (l.P)

= 120

Ex - 7.3

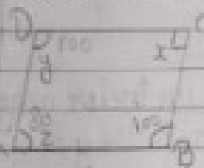
Q.1 Given a parallelogram ABCD. Complete each statement along with the definition or property used.

(i) AD = <u>BC</u> (Opposite sides are equal)
(ii) $\angle DCB$ = <u>$\angle DAB$</u> (opposite angles are equal)
(iii) OC = <u>OA</u> (Diagonals bisect each other)
(iv) $m\angle DAB + m\angle CDA = 180$ (interior opposite angles)



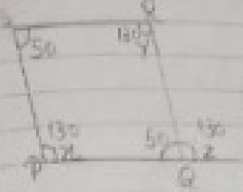
Q.2 Consider the following parallelograms. Find the value of the unknowns x, y, z

(a)



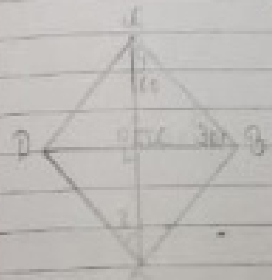
Ans $\angle B$ = ~~$\angle P$~~ $\angle D$ (opposite angle of a parallelogram are equal)
$\angle D = y = 100°$
$\angle A + \angle B = 180°$ (Adjacent angles of a parallelogram are supplementary)
$z + 100 = 180°$, $z = 180 - 100 \rightarrow 80°$
$\angle A = \angle C$ (opposite ~~as~~ angles are equal)
$\angle C = x = 80°$ [x = 80, y = 100, z = 80]

(b)



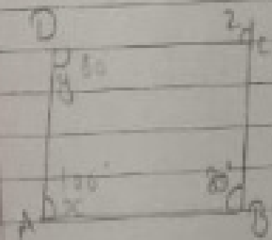
Ans $\angle P + \angle S = 180°$ (Adjacent angles of a parallelogram are supplementary)
$x + 50 = 180°$, $x = 180 - 50 = 130°$
$\angle P = \angle R$ (opposite angles are equal)
$\angle R = y = 130°$
$\angle R + \angle Q = 180°$ (Adjacent angles of a ||gram are supplementary)
$\angle Q = 180 - 130 = 50°$
$z + 50 = 180°$ (L.P)
$z = 180 - 50 = 130$
or
Also $y = z$ (Alternate angles)
$130 = z$
$x = 130$; $y = 130$ $z = 130$

(c)



Ans $x = 90°$
Now in $\triangle OCB$
$x + y + 30 = 180$ (Angle sum property)
$90 + y + 30 = 180°$
$y = 180 - 120°$
$y = 60$
$y = z$ (Alternate angles)
$z = 60°$
$x = 90$, $y = 60$, $z = 60°$

(d)



$\angle B = \angle D$ (opposite angles are equal of a ||gram)
$\angle D = y = 80°$
$\angle A + \angle B = 180°$ (Adjacent angles of a ||gram are supplementary)

$x + 80 = 180°$

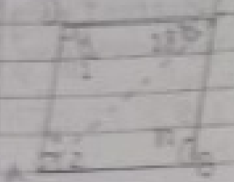
$x = 180 - 80 = 100$

Also $z = \angle B$ (alternate angles)

$z = 80°$

$\therefore x = 100,\ y = 80°,\ z = 80$

(e)



Sol $\angle B = \angle D$ (opposite angles are equal)

$\angle D = y = 112$

Now in $\triangle ADC$

$x + 112 + 40 = 180$

$x + 152 = 180$

$x = 180 - 152 = 28$

$z = x = 28$ (alternate angles)

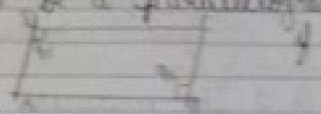
$x = 28,\ y = 112,\ z = 28$

Monday

Ex - 3.3

Q.3 Can a quadrilateral ABCD be a parallelogram if

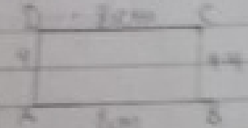
(i) $\angle D + \angle B = 180°$?



Sol Yes, a quadrilateral ABCD be a parallelogram if $\angle D + \angle B = 180°$ but it should also fulfilled some condition which are

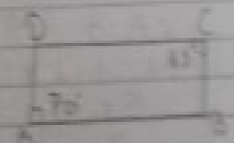
The sum of the adjacent angles should be 180, opposite angles must be equal.

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



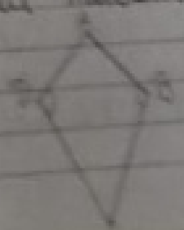
Sol No, opposite

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



Sol No, opposite angle should be of same measure Here, $\angle A \neq \angle C$

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



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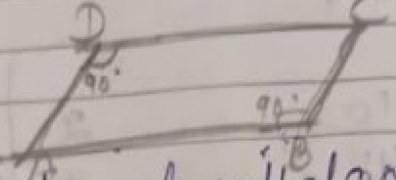
Exercise 3.3

Q3. Can a quadrilateral ABCD be a parallelogram, if:-

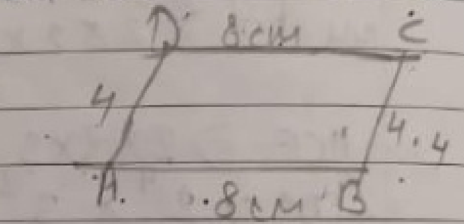
(i) $\angle D + \angle B = 180^\circ$?



Sol. yes, a quadrilateral ABCD be a parallelogram if $\angle D + \angle B = 180^\circ$ but it should also fulfilled some conditions which are.

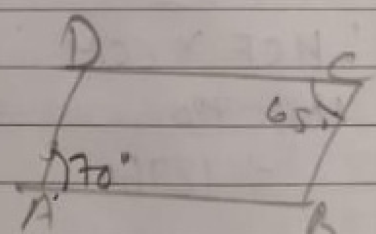
The sum of the adjacent angles should be 180, opposite angles must be equal.

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



Sol. No, opposite side should be of same length. Here AD ≠ BC

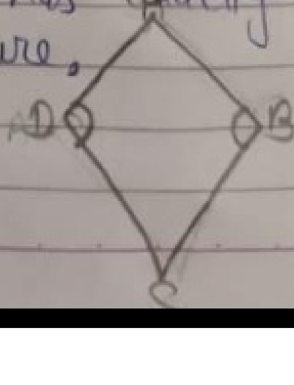
(iii) $\angle A = 70^\circ$ and $\angle C = 65^\circ$?



Sol. No, opposite angles should be of same measure
Here, $\angle A \neq \angle C$

Q4. Draw a rough figure of a quadrilateral that is not a parallelogram but has exactly two opposite angles of equal measure.

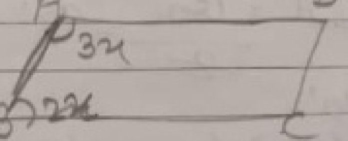
Sol.



Sol. ABCD is a figure of quadrilateral that is not a parallelogram but has ~~exact~~ exactly two opposite angles that is $\angle B = \angle D$ of equal measure. It is not a parallelogram because $\angle A \neq \angle C$.

Q5. 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.

Sol. Given, ratio of two adjacent angles of a parallelogram is 3 : 2.
Let these angles be $3x$ and $2x$.
$\because$ Sum of two adjacent angles of a parallelogram $\Rightarrow 180^\circ$



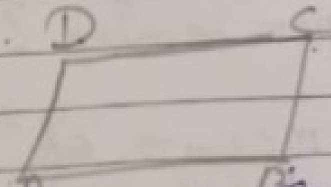
$\angle A + \angle B = 180^\circ$
$3x + 2x = 180$
$5x = 180^\circ$
$x = \frac{180^\circ}{5} = 36^\circ$

$\angle A = 3x = 3 \times 36 = 108^\circ$
$\angle B \Rightarrow 2x = 2 \times 36 = 72^\circ$
$\angle A = \angle C$
$\angle C = 108^\circ$ (Opposite angles of a parallelogram are equal.)

$\angle D = \angle B$
$\angle D = 72^\circ$ (Opposite angles of a parallelogram are equal.)

$\angle A = 108^\circ$, $\angle B = 72$, $\angle C = 108$ and $\angle D = 72^\circ$.

Q6. Two adjacent angles of a parallelogram have equal measure. Find the measure of each of the angles of the parallelogram.



Sol. Let ABCD is a parallelogram.

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

(opposite angles of parallelogram are equal.)

But sum of two adjacent angles $= 180°$

$\angle A + \angle B = 180°$

But. $\angle A = \angle B$ (Given)

$\angle A + \angle A = 180°$

$2\angle A = 180°$

$\angle A = \frac{180°}{2} = 90°$

$\angle A = 90°$

$\angle A = \angle B = \angle C = \angle D \Rightarrow 90°$

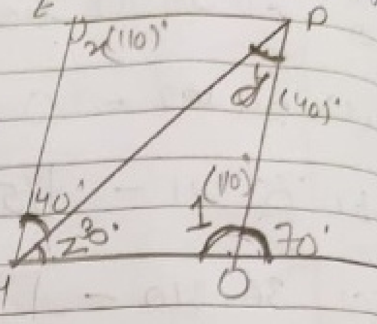
Each angle $= 90°$

There fore, we can say such quadrilateral is either a rectangle or a square.

Tuesday 28 July 2020

Exercise 3.3

Q7. The adjacent fig. HOPE is a parallelogram. Find the angles measure x, y and z. State the properties you use to find them.



Sol. Let HOPE is a parallelogram.

$\angle 1 + 70 = 180°$ (Linear pair)

$\angle 1 = 180 - 70°$

$\angle 1 = 110°$

$\angle 1 = \angle x$

$\angle x = 110°$ (opposite angles of parallelogram are equal)

$\angle y = 40°$ (alternate interior angles)

$40° + z = 70°$ (corresponding angles)

$z = 70 - 40°$

$z = 30°$

$\angle x = 110°, \angle y = 40°, \angle z = 30°$ Ans

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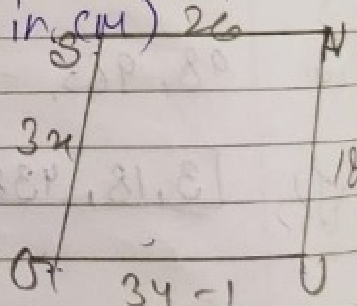
Q8. The following fig. GUNS and RUNS are parallelogram. Find x and y (Length are in cm)



Sol. GUNS is a parallelogram. Opposite sides of a parallelogram are equal.

GU = NS and SG = NU

When: GU = NS

$3y - 1 = 26$

$3y = 26 + 1 = 27$

$y = \frac{27}{3} = 9$

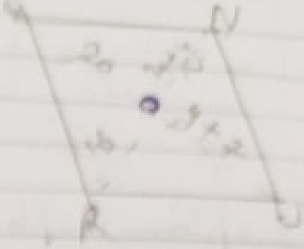
When SG = NU

$3x = 18$

$x = \frac{18}{3} = 6$

$x = 6$ cm, $y = 9$ cm.

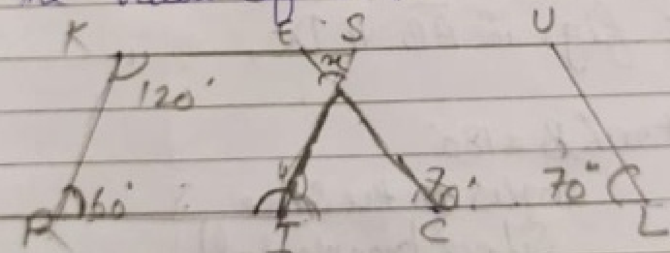
(ii)
Sol. RUNS is a parallelogram.
Diagonals of a parallelogram bisect each other.



SO = OU and RO = ON
When = SO = OU
OU = SO
$y + 7 = 20$
$y = 20 - 7 = 13$

When ON = OR
$x + y = 16$
$x + 13 = 16$
$x = 16 - 13 = 3$
($x = 3$ cm and $y = 13$ cm)

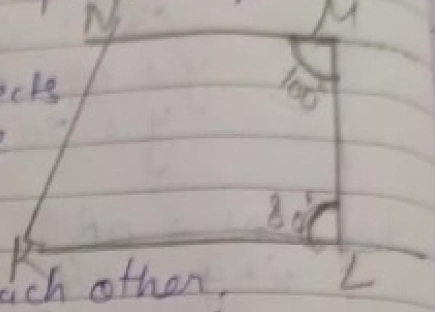
Q2. In the figure, both RISK and CLUE are parallelogram. Find the Value of x.



Sol. $\angle K + \angle R = 180°$ (adjacent angles of parallelogram are supplementary).
$120 + \angle R = 180°$
$\angle R = 180 - 120 = 60°$
$\angle I = \angle R$ (corresponding angles)
$\angle I = 60°$
$\angle C = \angle L$ (corresponding angles)
$\angle C = 70°$
In ΔxIC
$\angle x + 60 + 70 = 180°$ (angle sum of a triangle)

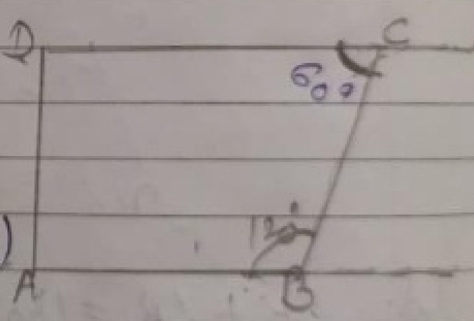
$x + 130 = 180^\circ$
$x = 180 - 130^\circ$
$x = \underline{50^\circ}$

Q10. ~~Explain~~ Explain how this figure is a trapezium. Which of its two sides are parallel?



Sol. When a transversal line intersects two lines in such a way that the Sum of adjacent angles on the Same Side of transversal is 180. then the lines are parallel to each other.
Here $\angle M + \angle L = 100^\circ + 80^\circ = 180^\circ$
Thus, $MN \parallel LK$
As the quadrilateral KLMN has one pair of parallel line therefore it is a trapezium. MN and LK are parallel lines.

Q11. Find $m\angle C$ fig. if $\overline{AB} \parallel \overline{DC}$.

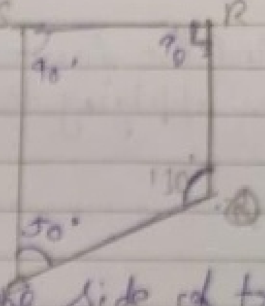


Sol. $m\angle C + m\angle B = 180^\circ$
(angles on the Same Side of transversal)
$m\angle C + 120 = 180$
$m\angle C = 180 - 120^\circ$
$m\angle C = \underline{60^\circ}$ Ans

Q12.

Sol.

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



sol (If you find $m\angle R$, is there more than one method to find $m\angle P$?)

$\angle P + \angle Q = 180°$ (angles on the same side of transversal)

$\angle P + 130 = 180°$

$\angle P = 180 - 130°$

$\angle P = 50°$

also $\angle R + \angle S = 180°$ (angles on the same side of transversal)

$90 + \angle S = 180$

$\angle S = 180 - 90°$

$\angle S = 90°$

Thus $\angle P = 50$ and $\angle S = 90$.

Yes, there are more than one method to find $m\angle P$.
PQRS is a quadrilateral. Sum of measures of all angles is 360,
We know the measurement of $\angle Q$, $\angle R$ and $\angle S$,

$\angle P + \angle Q + \angle R + \angle S = 360°$

$\angle P + 130 + 90 + 90° = 360°$

$\angle P + 310 = 360°$

$\angle P = 360 - 310°$

$\angle P = 50°$ Ans

(If you find m∠X, is there ...

Exercise 3.4

1 State whether True or False :

(a) All rectangles are squares. False

(b) All rhombuses are parallelograms. True

(c) All squares are rhombuses and also rectangles. True

(d) All squares are not parallelograms. False

(e) All kites are rhombuses. False

(f) All rhombuses are kites. True

(g) All parallelograms are trapeziums. True

(h) All squares are trapeziums. True

2 Identify all the quadrilaterals that have :

(a) four sides of equal lengths. Square, Rhombus

(b) four right angles. Square and Rectangle

3 Explain how a square is :

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Q3. Explain how a Square is:-
(a) Square (b) Parallelogram (c) Rhombus (d) Rectangle

(a) Square → Square is a quadrilateral it has four sides.
(b) Square is a parallelogram it's opposite sides are parallel and opposite angles are equal.
(c) Square is a rhombus because all the four sides are of equal length and diagonals bisect at right angle.
(d) Square is a rectangle because each interior angle of the square is 90°.

Q4. Name the quadrilaterals whose diagonals:-

(i) bisect each other → Square, Rectangle Rhombus and Parallelogram.

(ii) are perpendicular bisectors of each other → Square and Rhombus.

(iii) are equal → Square and Rectangle.

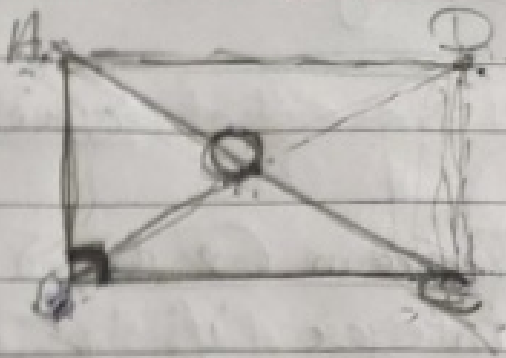
Q5. Explain why a rectangle is a Convex quadrilateral.

Ans Because Both of its diagonals lie in its interior.

Q6. ABC is a right-angled triangle and O is the mid point of the side opposite to the right angle. Explain why O is equidistant from A, B and C. (The dotted lines are drawn additionally to help you)

Date / /

ABCD is formed a rectangle.



a diagnals of a rectangle are equal in length.

$BD = AC$

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

$BO = OD = AO = OC$

O is equidistant from A, B and C.