Chapter - 11
Understanding Quadrilaterals

* Polygon - A simple closed curve made up of only line segments is called polygon.

* Regular Polygon - A polygon having all sides and all angles equal is called regular Polygon

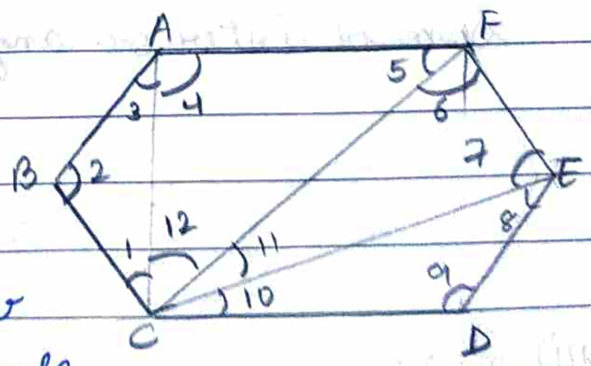
* Sum of exterior angle of any polygon is 360°

* Sum of interior angles of a polygon of n sides is $(n-2) \times 180^\circ$

* Each angle of a regular polygon n sides = $\frac{(n-2) \times 180^\circ}{n}$

WS-1

Q1:



ABCDEF is a hexagon
join CA, CF, CE

We get 4 triangles we know sum of 3 angles of a triangle is 180°

$\angle 1 + \angle 2 + \angle 3 = 180^\circ$ — (1)
$\angle 4 + \angle 5 + \angle 12 = 180^\circ$ — (2)

$\angle 6 + \angle 7 + \angle 11 = 180°$ — (3)
$\angle 8 + \angle 9 + \angle 10 = 180°$ — (4)

According eq. 1, 2, 3, 4

$\angle 1 + \angle 2 + \angle 3 + \angle 4 + \angle 5 + \angle 12 + \angle 6 + \angle 7 + \angle 11 + \angle 8 + \angle 9 + \angle 10$
$= 180° + 180° + 180° + 180°$

$(\angle 1 + \angle 10 + \angle 11 + \angle 12) + (\angle 2 + \angle 3 + \angle 4) + (\angle 5 + \angle 6 + \angle 7 + \angle 8) + \angle 9 = 720°$

So sum of all angles is 720°

Q2: (i) $n = 12$

Sum of interior angles of polygon $= (n-2)180°$
$= (12-2)180°$
$= 10 \times 180°$
$= 1800°$

(ii) 9 sides
$n = 9$

Sum of interior angles $= (n-2)180°$
$= (9-2)180°$
$= 7 \times 180°$
$= 1260°$

(iii) $n = 22$

Sum of interior angles $= (n-2)180°$
$= (22-2)180°$
$= 20 \times 180°$
$= 3600°$

Q3: In regular octagon
$n = 8$

Measure of each angle $= \frac{(n-2)180^\circ}{n}$

$= \frac{(8-2)180^\circ}{8}$

$= \frac{\cancel{6}^{3} \times \cancel{180}^{45}}{\cancel{8}_{2}}$

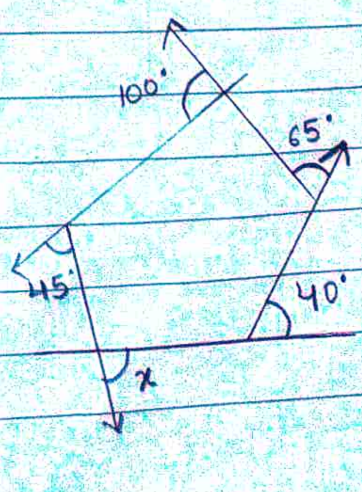
$= 135^\circ$

Q4: 4 angles of pentagon -
$100^\circ, 175^\circ, 85^\circ, 75^\circ$

Sum of 5 angles of pentagon
$= (n-2)180^\circ$
$= (5-2)180^\circ$
$= 3 \times 180^\circ$
$= 540^\circ$

Sum of 4 angles $= 100 + 175 + 85 + 75$
$= 435^\circ$

Fifth angle = Sum of 5 angles - Sum of 4 angles
$= 540 - 435$
$= 105^\circ$



Q5: We know sum of all external angles of any polygon is 360°

$\therefore 45 + x + 40 + 65 + 100 = 360^\circ$

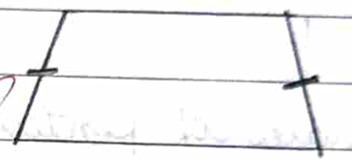
$250 + x = 360^\circ$

$x = 360 - 250$

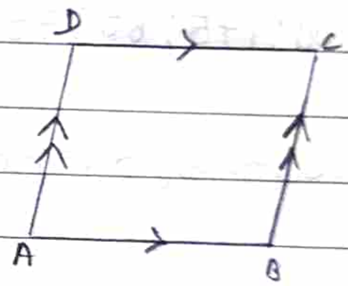
$x = 110^\circ$

✩ Trapezium - A quadrilateral in which at least one pair of opposite sides is parallel.

✩ Isosceles trapezium - A trapezium in which non parallel sides are equal.



✩ Parallelogram - A quadrilateral in which both pairs of opposite sides are parallel is called ||gm



Properties - (i) Opposite sides are equal
(ii) Opposite angles are equal
(iii) Diagonals of ||gm bisect each other.

|| GM

Rectangle   Rhombus   Square

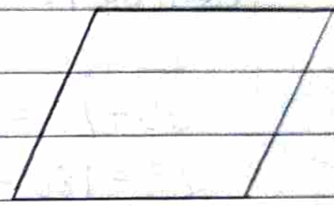
☆ Rectangle- Rectangle is a ||gm in which one angle is 90°

Properties- (i) All properties of ||gm
(ii) Diagonals are equal

Rectangle

☆ Rhombus- Rhombus is a || gm in which pair of adjecent sides is equal.

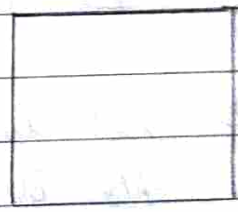
Properties- (i) All properties of ||gm
(ii) Diagonals bisect at 90°



Rhombus

☆ Square- Square is a ||gm in which one angle is 90° and one pair of adjecent sides is equal

Properties- (i) All properties of ||gm
(ii) Diagonals are equal
(iii) Diagonals bisect at 90°



Square

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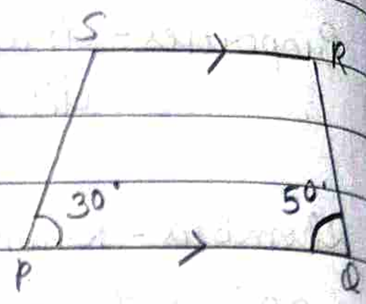
Excellent!

WS-2

Q1: Let in fig. PQRS is a trapezium
PQ || SR



$\angle P = 30°$, $\angle Q = 50°$

PQ // RS, PS & RQ are transversal

$\angle P + \angle S = 180°$ | co-Interior

$30 + \angle S = 180°$

$\angle S = 180° - 30°$

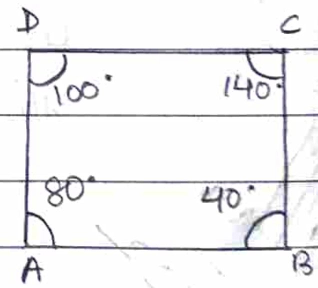
$\angle S = 150°$

$\angle Q + \angle R = 180°$ | co-Interior

$50 + \angle R = 180°$

$\angle R = 130°$

Q2: Let in fig ABCD is a Quadrilateral



$\angle A = 80°$, $\angle B = 40°$, $\angle C = 140°$, $\angle D = 100°$

$\angle A + \angle D = 100° + 80°$

$= 180°$

But these are co-interior angles so AB//CD

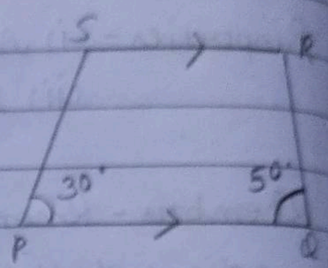
$\angle A + \angle B = 80° + 40°$

$= 120° \neq 180°$

hence, AD is not parallel to BC
Since in quad ABCD one pair of opposite sides is parallel.

WS-2

Q1: Let in fig. PQRS is a trapezium
PQ||SR



$\angle P = 30°$, $\angle Q = 50°$

PQ||RS, PS & RQ are transversal

$\angle P + \angle S = 180°$ | co-Interior

$30 + \angle S = 180°$

$\angle S = 180° - 30°$

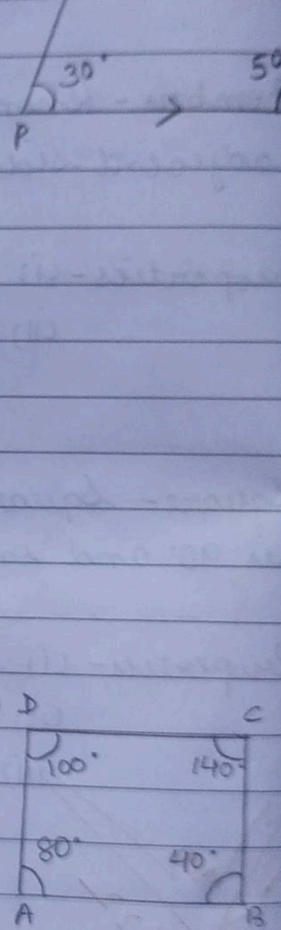
$\angle S = 150°$

$\angle Q + \angle R = 180°$ | co-Interior

$50 + \angle R = 180°$

$\angle R = 130°$

Q2: Let in fig ABCD is a Quadrilateral



$\angle A = 80°$, $\angle B = 40°$, $\angle C = 140°$, $\angle D = 100°$

$\angle A + \angle D = 100° + 80°$

$= 180°$

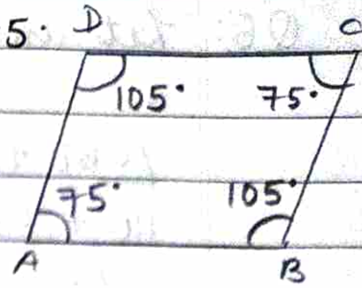
But these are co-interior angles
so AB||CD

$\angle A + \angle B = 80° + 40°$

$= 120° \neq 180°$

hence, AD is not parallel to BC
Since, in quad ABCD one pair of opposite sides is parallel.

Q3: Let in fig ABCD is a ||gm in which $\angle A = 75°$



AB||CD and AD is transversal

$\angle A + \angle D = 180°$ | Co-Interior

$75° + \angle D = 180°$

$\angle D = 180° - 75°$

$\angle D = 105°$

We know opposite sides of a ||gm are equal

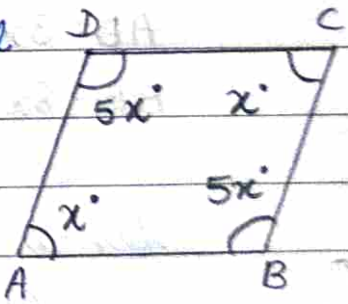
So $\angle A = \angle C = 75°$

$\angle D = \angle B = 105°$

hence other angles are 75°, 105°, 105°

Q4: Let in fig ABCD is a ||gm

$\angle A = x°$, $\angle D = 5x°$



Since opposite angles of a ||gm are equal

$\angle A = \angle C = x°$

$\angle B = \angle D = 5x°$

Using A.S.P in ||gm ABCD

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

$x + 5x + x + 5x = 360°$

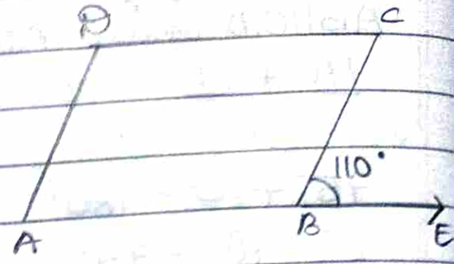
$12x = 360°$

$x = 30°$

So $\angle A = \angle C = 30°$

$\angle B = \angle D = 150°$

Q5: Let in fig. ABCD is a ||gm in which $\angle CBE = 110^\circ$



$\angle CBE + \angle CBA = 180^\circ$ | Linear Pair

$110^\circ + \angle CBA = 180^\circ$

$\angle CBA = 180^\circ - 110^\circ$

$\angle CBA = 70^\circ$

$\angle C = \angle CBE = 110^\circ$ | Alternate interior angles

$\angle C = 110^\circ$

Since opposite sides of a ||gm are equal

so $\angle CBA = \angle D = 70^\circ$

$\angle C = \angle A = 110^\circ$

Since angles of ||gm are) $70^\circ, 110^\circ, 70^\circ, 110^\circ$

Q6: Let in a fig. ABCD is a ||gm in which

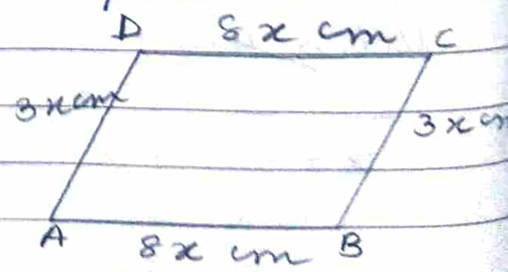
AB = $3x$ cm

AB = $8x$ cm

Since opposite sides of ||gm are equal

AB = CD = $8x$ cm

AB = BC = $3x$ cm



Perimeter of ||gm = 110 cm

$8x + 8x + 3x + 3x$

$\Rightarrow 22x = 110^\circ$

$\Rightarrow x = \frac{\cancel{110}\ 5}{\cancel{22}}$

So $AB = CD = 8x = 8 \times 5$
$= 40$ cm

$AD = BC = 3x = 3 \times 5$
$= 15$ cm

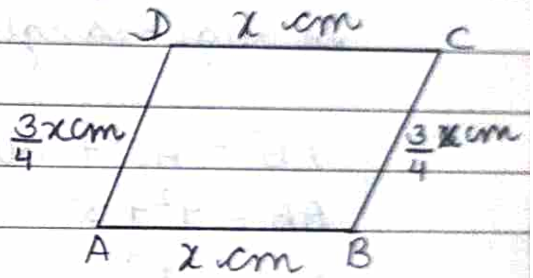
So sides are 40 cm, 15 cm, 40 cm, 15 cm

Q7: Let in fig. ABCD is a given ∥gm in which $AB = x$ cm, $AD = \frac{3}{4}x$ cm

Since opposite sides of ∥gm are equal

$AB = CD = x$ cm

$AD = BC = \frac{3}{4}x$ cm



Perimeter = 70 cm

$x + x + \frac{3}{4}x + \frac{3}{4}x = 70$

$2x + \frac{3}{4}x + \frac{3}{4}x = 70$

$\frac{8x + 3x + 3x}{4} = 70$

$\frac{\cancel{14}^{7}x}{\cancel{4}_{2}} = 70$

$x = \frac{\cancel{70}^{10} \times 2}{\cancel{7}_{1}}$

$x = 20$

So sides are $AB = CD = 20$ cm, $AD = BC = \frac{3}{\cancel{4}} \times \cancel{20}^{5} = 15$ cm

So 20 cm, 15 cm, 20 cm, 15 cm all are req. sides

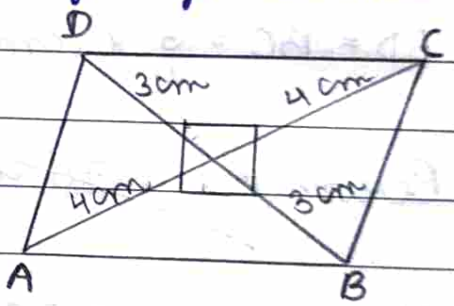
Q8: Let in fig. ABCD is a || gm in which
AC = 8 cm
BD = 6 cm

$\angle AOB = \angle BOC = \angle COD = \angle DOA = 90^\circ$ (Given)
We know diagonal of || gm bisect each other

$\therefore AO = OC = \frac{\cancel{8}}{\cancel{2}} 4$ cm

$BO = OD = \frac{\cancel{6}}{\cancel{2}} 3$ cm

In right angled triangle AOB by Pythagoras Theorem



$AB^2 = AO^2 + BO^2$
$AB^2 = 4^2 + 3^2$
$AB^2 = 16 + 9$
$AB^2 = 25$
$AB = 5$ cm

Similarly ~~b~~ we can find BC = CD = DA = 5 cm by pythagoras theoram

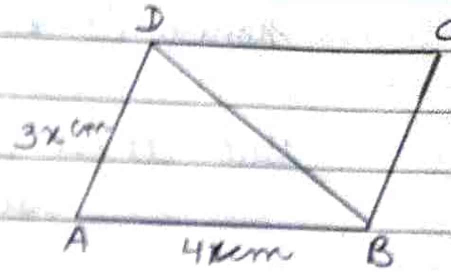
So all sides of || gm are 5 cm each

Q9: In fig ABCD is a || gm AD : AB = 3 : 4

So AB = 4x cm
AD = 3x cm

BD = 10 cm
$\angle A = 90^\circ$

Using Pythagoras Theoram



$AB^2 + AD^2 = BD^2$

$(4x)^2 + (3x)^2 = 10^2$

$16x^2 + 9x^2 = 100$

$\Rightarrow 25x^2 = 100$

$\Rightarrow x^2 = \frac{\cancel{100}\ 4}{\cancel{25}}$

$\Rightarrow x = 2$

Since $AB = 4 \times 2 = 8$ cm

$AD = 3 \times 2 = 6$ cm

Since opposite sides of ∥gm are equal so

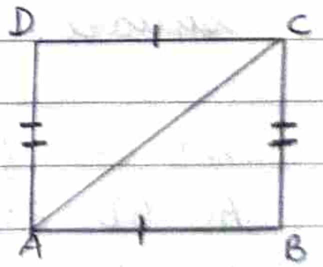
$AB = CD = 8$ cm

$AD = BC = 6$ cm

So perimeter of ABCD is $(8+8+6+6)$ cm

$= 28$ cm

Q10: Given - Let in fig. ABCD is a given quadrilateral in which $AB = CD$ and $AD = BC$



To prove - ABCD is a ∥gm

construction - Join AC

Proof - In $\triangle ABC$ & $\triangle CDA$

$AB = CD$] Given
$BC = DA$]

$AC = CA$ | common

By SSS $\triangle ABC \cong CDA$

hence $\angle 1 = \angle 2$ | CPCT

But these are Alternate interior angles
So $AB \parallel CD$

Now $\angle 3 = \angle 4$ | CPCT

But these are alternate interior angles
So $AD \parallel BC$

Since in quad. ABCD both pairs of opposite sides are parallel
So it is a $\parallel$ gm

WS-3

Q1: Ans In quad. ABCD diagonals are equal and bisect each other at right angles so it is square.

Q2: Let in fig ABCD is a given rhombus
$AC : BD = 5:12$
Let AC be $5x$ cm
BD be $12x$ cm

Perimeter of rhombus = 104 cm
Since all sides of rhombus are equal
So each side = $\frac{104}{4}$ = 26 cm

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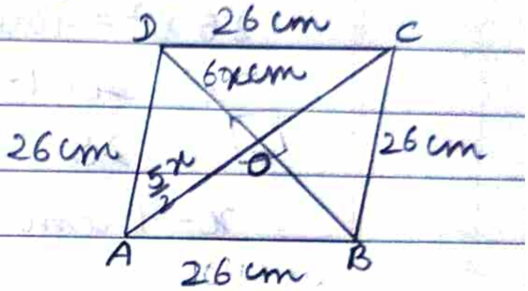
We know diagonals of rhombus bisect at 90° so
$AO = CO = \frac{5x}{2}$ cm

$BO = DO = \frac{12x}{2}$ cm $= 6x$ cm

In right angled triangle AOB by pythagoras Theoram



$AO^2 + BO^2 = AB^2$

$\left(\frac{5x}{2}\right)^2 + (6x)^2 = 26^2$

$\frac{25x^2}{4} + 36x^2 = 676$

$\Rightarrow \frac{25x^2 + 144x^2}{4} = 676$

$\Rightarrow \frac{169x^2}{4} = 676 \quad \Rightarrow 169x^2 = 676 \times 4$

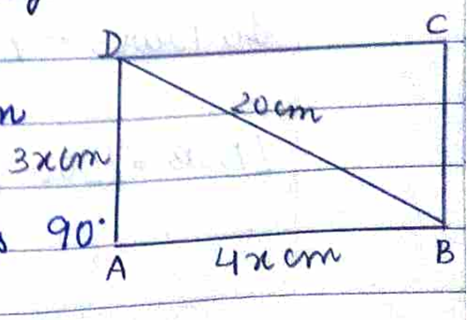
$\Rightarrow x^2 = \frac{\cancel{676}^{4} \times 4}{\cancel{169}}$

$\Rightarrow x^2 = 16 \qquad x = 4$ cm

So diagonals are $5x = 5 \times 4 = 20$ cm
$12x = 12 \times 4 = 48$ cm

So each side $= 26$ cm
Diagonals are $= 48$ cm & 20 cm

Q3: Let in fig ABCD is a given rectangle



Let $AD = 3x$ cm, $AB = 4x$ cm, $BD = 20$ cm

Since each angle of a rectangle is 90°

So in right angled triangle $\triangle ABD$
By Pythagoras Theoram

$$AB^2 + AD^2 = BD^2$$
$$(4x)^2 + (3x)^2 = 20^2$$
$$16x^2 + 9x^2 = 400$$
$$25x^2 = 400$$
$$x^2 = \frac{\cancel{400}\ 16}{\cancel{25}}$$
$$x = 4 \text{ cm}$$

So ~~diagonals~~ sides are -
$AB = 4x = 4 \times 4 = 16$ cm
$AD = 3x = 3 \times 4 = 12$ cm

Since opposite sides are equal in a rectangle
$AB = CD = 16$ cm
$AD = BC = 12$ cm

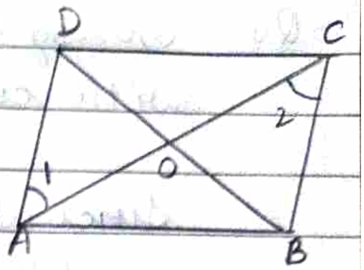
$$\text{Perimeter} = 2(16 + 12)$$
$$= 2 \times 28$$
$$= 56 \text{ cm}$$

Q4: Given - Let in fig. ABCD is a given rhombus in which angles bisect at O

To Prove - $\triangle AOB \cong \triangle COD$

$\angle AOB = \angle COD$ | Vertically opposite angles

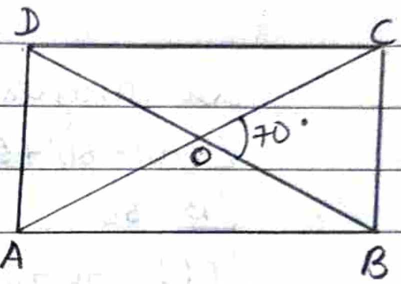
$\angle 1 = \angle 2$ | Alternate interior angles



$AB = CD$ | side of rhombus

$\therefore$ by AAS, $\Delta AOB \cong \Delta COD$

Q5: Let in fig ABCD is a given rectangle



Diagonals AC & BD bisect at O

$\angle BOC = 70°$

We know diagonals of rectangle are equal and bisect each-other

So $AC = BD$

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

$AO = OD$

hence $\angle 1 = \angle 2$ — ① | $\angle$s opposite to equal sides

$\angle BOC = \angle AOD = 70°$ — ② | vertically opposite angles

In ΔAOD by angle sum property

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

$\angle 2 + \angle 2 + 70° = 180°$ | By using ① & ②

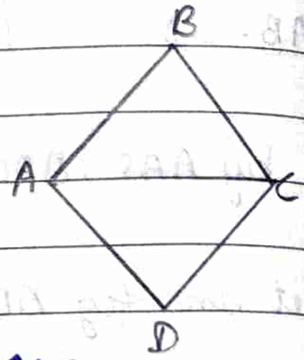
$2\angle 2 = 180° - 70°$

$2\angle 2 = 110°$

$\angle 2 = \frac{\cancel{110°}}{\cancel{2}}\ 55°$

So $\angle ODA = 55°$

Q6: In fig ABC & ADC are equilateral triangles with common base AC



Since ΔABC & ΔADC are equilaterals

So $\angle BAC = \angle B = \angle BCA = 60^\circ$

$\angle DAC = \angle D = \angle ACD = 60^\circ$

So angles of quadrilateral ABCD are

$\angle BAD = 60^\circ + 60^\circ = 120^\circ$

$\angle B = 60^\circ$

$\angle BCD = 60^\circ + 60^\circ = 120^\circ$

$\angle D = 60^\circ$

$AB = BC = AC$ | Sides of equilateral triangles

But $AC = AD = CD$

hence $AB = BC = CD = AD$

So all sides of quad. ABCD are equal so it is a rhombus

Q7: Given - In fig ABCD is a rectangle

$DP \perp AC$, $BQ \perp AC$

To Prove :- (i) $\Delta ADP \cong \Delta CBQ$

(ii) $\angle ADP = \angle CBQ$

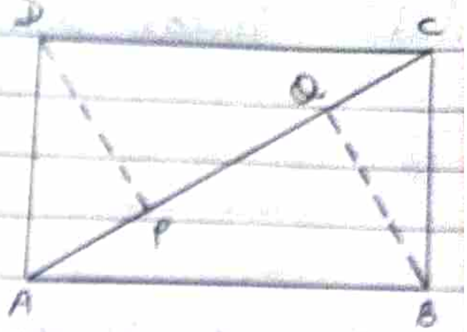
(iii) $\overline{DP} = \overline{BQ}$

Proof :- (i) In ΔADP & ΔCBQ

$\angle DPA = \angle BQC$ | 90° each

$\angle PAD = \angle QCB$ | Alternate Interior angles

$AD = BC$ | Opposite sides of ∥gm



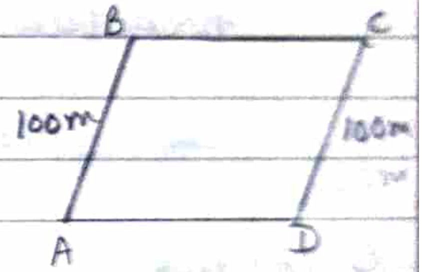
∴ By AAS congruency

$\triangle ADP \cong \triangle CBQ$

(ii) $\angle ADP = \angle CBQ$ | By CPCT

(iii) $\overline{DP} = \overline{BQ}$ | By CPCT

Value Based Questions



Q1: ABCD is a ∥gm. Since opposite sides of ∥gm are equal

$AB = CD = 100m$

$AD = BC = x$ (Say)

Perimeter of ∥gm $ABCD = 320m$

$AB + CD + AD + BC = 320$

$100 + 100 + x + x = 320$

$200 + 2x = 320$

$2x = 320 - 200$

$2x = 120$

$x = \frac{120}{2}$

$\cancel{x = 60m}$

So $BC = AD = 60m$

Since AD is gate

Total length to be fenced

$= AB + BC + CD$

$= 100 + 60 + 100$

$= 260m$

(a) Cost of fencing 1 m = ₹26

cost of fencing 260m = ₹26 × 260

= ₹6760

(b) Yes, Parks give us fresh air, Place to exercise

(c) Growing plants, by making health club, hospitals etc.

Brain Teasers

Q1:(A) Tick

(a) (IV) 5

(b) (ii) Rhombus

(c) (IV) Heptagon

(d) (iii) Equiangular and equilateral

(e) (i) Square

(B)

(a) Square & Rhombus

b. Let in fig ABCD is a ∥gm

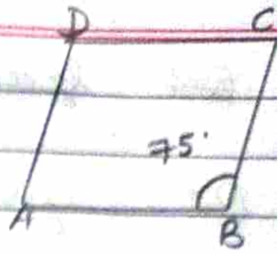
$\angle B = 75°$

$\angle B + \angle C = 180°$ | co-interior

$75° + \angle C = 180°$

$\angle C = 180° - 75$

$\angle C = 105°$



c) For Octagon

$n = 8$

Sum of all exterior angles of a regular octagon = $360°$

So each exterior angle = $\frac{360°}{8}$ $45°$

$= 45°$

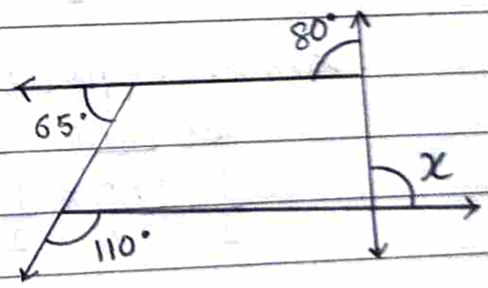
d) Sum of all exterior angles of any polygon is $360°$

$65° + 110° + 80° + x = 360°$

$255° + x = 360°$

$x = 360° - 255$

$x = 105°$



e) $n = 5$

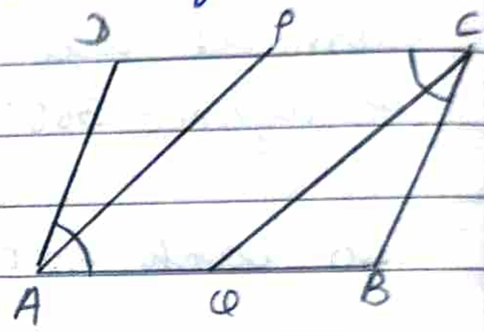
Each angle = $\frac{(n-2)180}{n}$ $= \frac{(5-2)180°}{5}$

$\frac{3 \times \cancel{180}^{36}}{\cancel{5}}$ $= 108°$

~~Q4: Given~~

Q2: Given - Let in fig ABCD is a given ||gm in which AP is bisector of $\angle A$ and CQ bisects $\angle C$

To prove :- (i) $AP \parallel CQ$ (ii) AQCP is a ||gm



Proof - Since AP bisects $\angle DAB$

So $\angle 1 = \frac{1}{2} \angle DAB$ — ①

CQ bisects $\angle BCD$

So $\angle 2 = \frac{1}{2} \angle BCD$ — ②

Since opposite angles of a ||gm are equal

So $\angle DAB = \angle BCD$

$\frac{1}{2} \angle DAB = \frac{1}{2} \angle BCD$

$\angle 1 = \angle 2$ | using ① & ②

But $\angle 2 = \angle 3$ | Alternate interior angles

therefore -

$\angle 1 = \angle 3$

But these are corresponding angles

So $AP \parallel CQ$

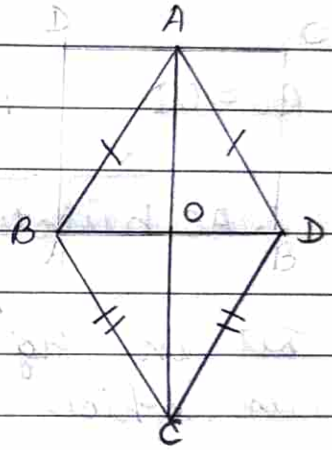
(ii) In quad. AQCP

AP ∥ CQ | Proved Above

AQ ∥ CP | Parts of parallel sides

Becomes in quad. AQCP
both pairs of opposite sides are parallel
So it is ∥gm.

Q3: Given :- In fig. ABCD is a quadrilateral
in which $\overline{AB} = \overline{AD}$, $\overline{BC} = \overline{DC}$



To prove :- (i) $\Delta ABC \cong \Delta ADC$
(ii) $\Delta AOB \cong \Delta AOD$
(iii) $\overline{AC} \perp \overline{BD}$
(IV) AC bisects BD

Proof :- (i) In ΔABC & ΔADC
$\overline{AB} = \overline{AD}$ | ∵ Given
$\overline{BC} = \overline{DC}$ | ∵ Given
$AC = AC$ | common

∴ By SSS , $\Delta ABC \cong \Delta ADC$

∴ $\angle 1 = \angle 2$ | CPCT

(ii) In ΔAOB & ΔAOD
$AB = AD$ | Given

$\angle 1 = \angle 2$ | Proved Above
$AO = AO$ | common

∴ By SAS congruency $\triangle AOB \cong \triangle AOD$

(iii) $\angle AOB = \angle AOD$ | CPCT

But $\angle AOB + \angle AOD = 180°$ | Linear Pair

$\angle AOB + \angle AOB = 180°$

$2\angle AOB = 180°$

$\angle AOB = 90°$

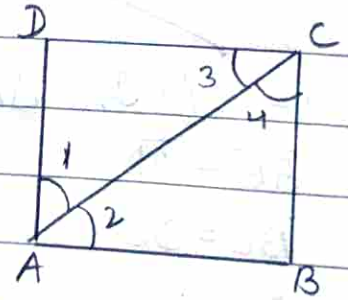
hence $AC \perp BD$

(IV) $BO = OD$ | CPCT

∴ AC bisects BD

Q4: Let in fig ABCD is a given quadrilateral in which

$AB = BC = CD = DA$



To prove :- $AB \parallel CD$

$AD \parallel BC$

Construction:- Join AC

Proof- In $\triangle ABC$ & $\triangle CDA$

$AB = CD$ | Given

$AC = AC$ | common

$BC = DA$ | Given

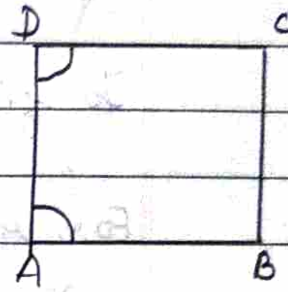
by SSS congruency $\triangle ABC \cong \triangle CDA$

$\angle 1 = \angle 4$ | CPCT

But these are alternate interior angles so $AD \parallel BC$

(ii) $\angle 2 = \angle 3$ | CPCT

But these are alternate interior angles so $AB \parallel CD$



Q5: Let in fig. ABCD is a given quad.

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

But these are co-interior angles so $AB \parallel CD$

Since one pair of opposite side is parallel so it is a trapezium.

HOTS

Q1: For regular pentagon

$n = 5$

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

$\frac{(5-2)\cancel{180}^{36}}{\cancel{5}} = 3 \times 36$

$= 108^\circ$

For regular decagon

$n = 10$

Sum of all exterior angle $= 360^\circ$

Each exterior angle $= \frac{360^\circ}{10}$

$= 36$

Since $108 = 3 \times 36$

$\because$ Each interior angle of a regular pentagon is three times the exterior angle of a regular decagon.

Q2: In fig. ABCDE is a regular pentagon.

$\angle EBD = 36^\circ$

To find $\angle 1, \angle 2, \angle 3$

For regular pentagon

$n = 5$

each angle $= \frac{(n-2)180^\circ}{n}$

$= \frac{(5-2)\cancel{180}^{36}}{\cancel{5}}$

$= 3 \times 36$

$= 108^\circ$

So $\angle 1 = 108^\circ$

Since $AB = AE$ | sides of regular pentagon

$\therefore \angle 2 = \angle 4 = x^\circ$ (say)

In ΔAEB by ASP

$\angle 1 + \angle 2 + \angle 4 = 180^\circ$

$108^\circ + x + x = 180^\circ$

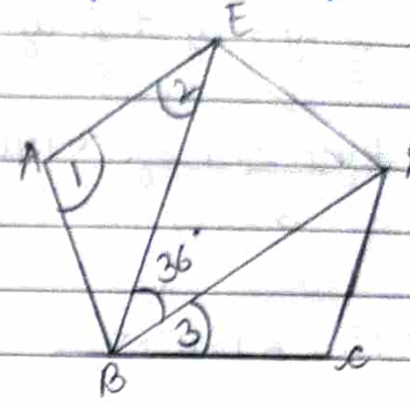
$2x = 180^\circ - 108^\circ$

$2x = 72$

$x = 36$

So $\angle 2 = \angle 4 = 36^\circ$

$\angle 4 + 36 + \angle 3 = \cancel{180}\ 108$ | Each angle of a regular pentagon is 108°



$36 + 36 + \angle 3 = 108$

$\angle 3 = 108^\circ - 72$

$\angle 3 = 36^\circ$

$\angle 1 = 108^\circ, \angle 2 = 36^\circ, \angle 3 = 36^\circ$

Enrichment Questions

Q1: Each Side $= \dfrac{(n-2)180^\circ}{n}$

$156 = \dfrac{(n-2)180}{n}$

$156n = 180n - 360$

$156n - 180n = -360$

$\cancel{-}24n = \cancel{-}360$

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

So there are 15 sides

b) Each side $= \dfrac{(n-2)180^\circ}{n}$

$108 = \dfrac{(n-2)180^\circ}{n}$

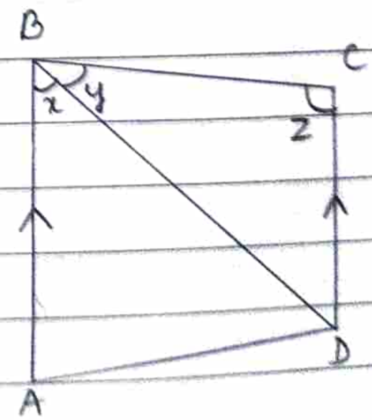
$108n = 180n - 360$

$108n - 180n = -360$

$\cancel{-}72n = \cancel{-}360$

$n = \dfrac{360}{72}$

So there are 5 sides



Q2: In fig. ABCD is a trapezium

$x = \dfrac{4}{3}y$ — (1)

and $y = \dfrac{3}{8}z$

or $z = \dfrac{8}{3}y$ — (2)

Since AB || CD & BC is transversal

$\angle ABC + \angle C = 180^\circ$ | co- interior angle

$x + y + z = 180^\circ$

$\frac{4}{3}y + y + \frac{8}{3}y = 180^\circ$ | using 1 & 2

$\frac{4y + 3y + 8y}{3} = 180^\circ$

$\frac{15}{3}y = 180^\circ$

$y = \frac{\cancel{180}^{12} \times 3}{\cancel{15}}$

$y = 36$

put y 36 in eq-1

$x = \frac{4}{\cancel{3}} \times \cancel{36}\,12$

$x = 48$