Understanding Quadrilaterals

1. Excercise: 13.1

a) Simple Curves:- (i), (ii), (iii), (iv), (vi).

b) Simple closed curves:- (iii), (v), (vi)

c) Polygon:- (iii), (vi)

d) Convex polygon:- (iii),

e) Concave polygon:- vi

2.

a) A convex quadrilateral has two diagonals

b) A regular hexagon has 9 diagonals

3.

i. 8

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

given no. of sides of polygon (n) = 8

Sum of all interior angles = $(2\times 8-4)\times 90$

$= (16-4)\times 90$

$= 12\times 90$

$= 1080°$

ii given

no. of sides of polygon (n) = 12

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

$= (2\times 12-4)\times 90$

$= 1800°$

4. given ~~exterio~~

(i)

exterior angle of polygon = 24°

Sum of all exterior angles of polygon = 360°

$\therefore \quad n \times 24 = 360$

$\boxed{n = 15}$

(ii)

given

exterior angle of polygon = 60°

Sum of all exterior angles of polygon = 360°

$\therefore \quad n \times 60 = 360$

$\boxed{n = 6}$

$\therefore$ no. of sides of given polygon is 6

(iii)

given

exterior angle of polygon = 72°

Sum of all exterior angles of polygon = 360°

$\therefore \quad n \times 72^\circ = 360$

$\boxed{n = 5}$

$\therefore$ no. of sides of given polygon is 5.

5.

(i) For polygon with 'n' sides,

The each interior angle of polygon is given by

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

given interior angle of polygon = 90°

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

$$(2n-4) = n$$

$$2n - n = 4$$

$$\boxed{n = 4}$$

$\therefore$ no. of sides of polygon = 4

(ii) For a Polygon with 'n' sides

The each interior angle of polygon is given by

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

given interior angle = 108°

$$\frac{(2n-4)\times 90}{n} = 108^\circ$$

$$2n-4 = \frac{6}{5}\cdot n \Rightarrow 5(2n-4) = 6n$$

$$10n - 20 = 6n$$

$$10n - 6n = 20$$

$$4n = 20$$

$$n = \frac{20}{4}$$

$$\boxed{n = 5}$$

$\therefore$ no. of sides of polygon = 5.

(ii) For a polygon with 'n' sides,

The each interior angle of polygon is given by

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

given interior angle = $165°$

$$\therefore \frac{(2n-4) \times 90}{n} = 165$$

$$\frac{(2n-4)}{n} = \frac{11}{6}$$

$$6(2n-4) = 11 \times n$$

$$12n - 24 = 11n$$

$$\cancel{12-n}$$

$$12n - 11n = 24$$

$$\boxed{n = 24}$$

$\therefore$ no. of sides of polygon = 24.

6. Given Sum of interior angles of a polygon = 1260°

$\therefore \quad (2n-4)\times 90 = 1260°$

where n - no. of sides of polygon

$$(2n-4) = \frac{1260}{90}$$

$$2n-4 = 14$$

$$2n = 14+4$$

$$2n = 18$$

$$n = 18/2$$

$$\boxed{n=9}$$

$\therefore$ Given polygon has nine sides

7. Given

Ratio of angles of pentagon = 7 : 8 : 11 : 13 : 15

Let Angles of pentagon = $7x, 8x, 11x, 13x, 15x$

Sum of angles of Polygon = $(2n-4)\times 90$

$$7x+8x+11x+13x+15x = (2\times 5-4)\times 90$$

$$54x = 6\times 90$$

$$x = \frac{540}{54}$$

$$\boxed{x = 10°}$$

$\therefore$ Angles of pentagon = 70°, 80°, 110°, 130°, 150°

8. Given angles of pentagon = $x^\circ, (x-10)^\circ, (x+20)^\circ, (2x-44)^\circ$ and $(2x-70)^\circ$

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

$$x+(x+10)+(x+20)+(2x-44)+(2x-70) = (2\times 5-4)\times 90$$

$$7x-104 = 6\times 90$$

$$7x = 540+104$$

$$7x = 644$$

$$x = \frac{644}{7}$$

$$\boxed{x = 92}$$

$\therefore$ Angles of pentagon = $92^\circ, (92-10)^\circ, (92+20)^\circ, (2\times 92-44), (2\times 92-70)$

= 92, 82, 112, 140, 114

9. Given

Exterior angles Ratio = 1:2:3:4:5

Let Exterior angles = $x, 2x, 3x, 4x, 5x$

Sum of the exterior angles = 360°

$$x+2x+3x+4x+5x = 360$$

$$15x = 360$$

$$x = \frac{360}{15}$$

$$x = 24$$

External angles of pentagon

$24°, 48°, 72°, 96°, 120°$

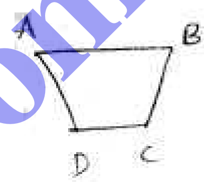
Internal angle = 180 − External angle

Internal angles of pentagon -

$= 180-24,\ 180-48,\ 180-72,\ 180-96,\ 180-120$

Interior angles of pentgon. $= 156°, 132°, 108°, 84°, 60°$

10. Given



$\angle A : \angle D = 2:3$

$\angle B : \angle C = 7:8$

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

Let $\angle B = 7y,\ \angle C = 8y$

$\angle B + \angle C = 180$ ($\because AB \parallel DC$)

$7y + 8y = 180°$

$15y = 180$

$\boxed{y = 12}$

$\therefore \angle B = 7y = 7 \times 12 = 84°$

$\therefore \angle C = 8y = 8 \times 12 = 96°$

lly

$\angle A + \angle D = 180°$

$2x + 3x = 180$

$$5x = 180$$

$$x = 36$$

$$\angle A = 2x = 2 \times 36 = 72^\circ$$

$$\angle D = 3x = 3 \times 36 = 108^\circ$$

$$\therefore \angle A = 72^\circ, \ \angle B = 84^\circ, \ \angle C = 96^\circ, \ \angle D = 108^\circ$$

11.

From $\triangle DBC$

$$\angle DBC + \angle C + \angle CDB = 180^\circ$$

$$x + 5x + 8 + \angle CDB = 180^\circ$$

$$6x + 8 + \angle CDB = 180^\circ$$

$$\angle CDB = 180 - 6x - 8$$

$$\angle CDB = 172 - 6x$$

$$\angle CDB + \angle ADB = 3x + 10^\circ$$

$$172 - 6x + \angle ADB = 3x + 10$$

$$\angle ADB = 3x + 10 + 6x - 172$$

$$\angle ADB = 9x - 162$$

In $\triangle ADB$

$$\angle ADB + \angle DAB + \angle ABD = 180^\circ$$

$$9x - 162 + 3x + 4 + 50 = 180$$

$$12x - 108 = 180$$

$$12x = 180 + 108 = 288$$

$$x = \frac{288}{12}$$

$$\boxed{x = 24^\circ}$$

(ii) $\angle DAB = 3x+4$

$= 3\times24+4$

$= 72+4$

$\angle DAB = 76°$

(iii) $\angle ADB = 9x-162$

$= 9\times24-162$

$\angle ADB = 216-162$

$\angle ADB = 54°$

12.

(i) Sum of angles in quadrilater = 360°

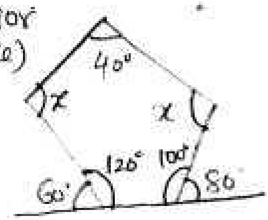
$\therefore\ 40+140+100+x = 360$

$280+x = 360$

$x = 360-280$

$\boxed{x = 80}$

(ii) Interior angle = 180 − (exterior angle)



Sum of interior angles in a pentagone = $(2\times5-4)\times90$

$40+x+x+120+100 = 6\times90$

$2x+260 = 540$

$2x = 540-260$

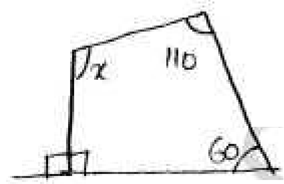
$2x = 280$

$$x = \frac{280}{2}$$

$$\boxed{x = 140}$$

10. (iii)

Sum of interior angles of a quadrilateral = 360°



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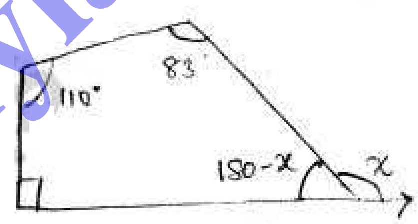
$$\therefore \; x + 110 + 60 + 90 = 360$$

$$x + 260 = 360$$

$$x = 360 - 260$$

$$\boxed{x = 100}$$

10. (iv)



Sum of interior angles of a quadrilater = 360°

$$110 + 83 + 180 - x + 90 = 360$$

$$463 - x = 360$$

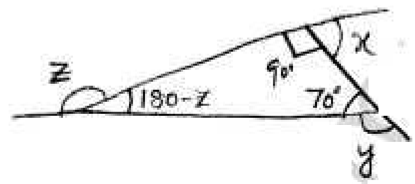
$$x = 463 - 360$$

$$\boxed{x = 103}$$

13.

(i)

Sum of angles in a triangle $= 180°$



$$90+70+\cancel{180}-z=\cancel{180}$$

$$z = 90+70$$

$$z = 160$$

$$90+x = 180 \quad (\because \text{Forms Straight line})$$

$$x = 180-90$$

$$\boxed{x=90}$$

$$70+y = 180 \quad (\because \text{Forms Straight line})$$

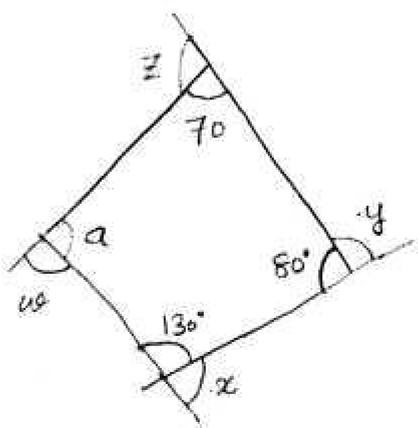
$$y = 180-70$$

$$\boxed{y=110}$$

$$\therefore x+y+z = 90+110+160$$

$$\therefore x+y+z = 360°$$

(ii) Sum of interior angles in a quadrilater $= 360°$



$$70+80+130+a = 360°$$

$$280+a = 360$$

$$a = 360-280$$

$$\boxed{a = 80°}$$

$a + w = 180$ ($\because$ Forms straight line)

$80 + w = 180$

$w = 180 - 80$

$\boxed{w = 100}$

$z + 70 = 180$ ($\because$ Forms straight line)

$z = 180 - 70$

$\boxed{z = 110}$

$80 + y = 180$ ($\because$ Forms straight line)

$y = 180 - 80$

$\boxed{y = 100}$

$130 + x = 180$ ($\because$ Forms straight line)

$x = 180 - 130$

$\boxed{x = 50}$

$\therefore x + y + z + w = 50 + 100 + 110 + 100 = 360^\circ$

14. Given

Heptagon has three equal angles $= 120^\circ, 120^\circ, 120^\circ$

Let Remaining four equal angles $= x, x, x, x$

Sum of interior angles of heptagon $= (2 \times 7 - 4) \times 90$

$= 10 \times 90$

$\therefore 120 + 120 + 120 + x + x + x + x = 900$

$$360 + 4x = 900$$

$$4x = 900 - 360$$

$$4x = 540$$

$$x = \frac{540}{4}$$

$$\boxed{x = 135°}$$

The other equal angle of heptagon = 135°

15. Ratio between exterior and interior angles

$= 1:5$

(i) Let exterior angle $= x$

Interior angle $= 5x$

exterior angle + Interior angle = 180

$$x + 5x = 180$$

$$6x = 180$$

$$x = \frac{180}{6}$$

$$\boxed{x = 30}$$

Each exterior angle $= x = 30°$

ii) Each Interior angle $= 5x = 5 \times 30 = 150°$

iii) no. of sides of polygon $= \frac{360}{\text{Exterior angle}}$

$$= \frac{360}{30} = \underline{\underline{12}}$$

$\therefore$ no. of sides of polygon = 12.

16. Given

Each interior angle of polygon = 2 × Exterior angle

Interior angle + Exterior angle = 180

2 × Exterior angle + Exterior angle = 180

3 × Exterior angle = 180

Exterior angle = $\frac{180}{3}$

Exterior angle = 60°

no. of sides of polygon = $\frac{360}{\text{Exterior angle}}$

$= \frac{360}{60}$

no. of sides of polygon = 6.

Excercise 13.2

1.

i. 6cm ($\because$ opposite sides are equal)

ii. 9cm ($\because$ opposite sides are equal)

iii. $\angle DCB = 60°$ ($\because$ $\angle DCB$, $\angle CBA$ are Sumpplementary)

iv. $\angle ADC = 120°$ ($\because$ opposite angles are equal)

v. $\angle DAB = 60°$ ($\because$ Adjacent angles are Supplementary)

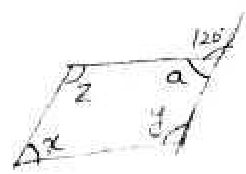
vi. $OC = 7$ cm ($\because$ 'O' bisects ~~the~~ AC)

vii. $OB = 5$cm ($\because$ 'O' bisects DB)

viii. $m\angle DAB + m\angle CDA = 180°$

2.

(i.) Given parallelogram



Let the unknown angle = a

$\therefore$ $a + 120 = 180°$ ($\because$ Adjacent angles are Supplementry)

$a = 180 - 120°$

$\boxed{a = 60°}$

$\therefore$ $a + y = 180°$ ($\because$ Adjacent angles are supplementry)

$60 + y = 180°$

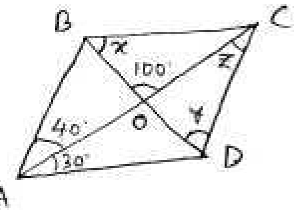
$y = 180 - 60$

$\boxed{y = 120°}$

$x = 60$

$z = 120$ ($\because$ opposite angles are equal in parallogram)

(ii) ABCD is a parallogram



$z = 40°$ ($\because$ AB || CD)

At 'O'

$100 + \angle COD = 180°$ ($\because$ forms straight line)

$\angle COD = 180 - 100°$

$\angle COD = 80°$

In Δ COD

$z + \angle COD + y = 180°$

$40 + 80 + y = 180°$

$y + 120 = 180°$

$y = 180 - 120$

$\boxed{y = 60°}$

In Δ BOC

$\angle ACB = 30°$ ($\because$ BC || AD)

$\therefore$ $x + \angle ACB + \angle BOC = 180°$

$x + 30 + 100 = 180$

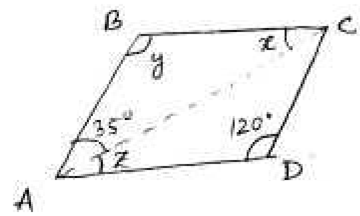
$x + 130 = 180$

$x = 180 - 130$

$\boxed{x = 50°}$

$x = 50°$, $y = 60°$, $z = 40°$

(iii) ABCD is a parallogram



$y = 120^\circ$ ($\because$ opposite angles are equal in parallogram)

$z + 35^\circ + 120 = 180$ ($\because$ Adjacent angles are supplementry)

$z + 155 = 180$

$z = 180 - 155$

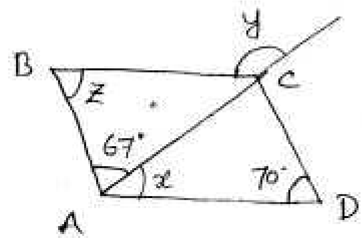
$\boxed{z = 25^\circ}$

~~$z = y$~~ $z = x$ ($\because$ AB || CD)

$x = 25^\circ$

$\therefore$ $x = 25^\circ$, $y = 120^\circ$, $z = 25^\circ$

(iv) ABCD is a parallogram



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

($\because$ Adjacent angles are supplementry)

$67 + x + 70 = 180$

$x + 137 = 180$

$x = 180 - 137$

$x = 43^\circ$

$z = 70^\circ$ ($\because$ opposite angles are equal in parallogram)

$\angle BCA = \angle CAD$ ($\because AD \parallel BC$)

$\angle BCA = x$

$\angle BCA = 43^\circ$

At 'C'

$\angle BCA + y = 180^\circ$ ($\because$ Forms a straight line)

$43 + y = 180$

$y = 180 - 43$

$\boxed{y = 1\cancel{9}7^\circ}$ $\boxed{y = 137^\circ}$

$\therefore x = 43^\circ, y = 137^\circ, z = 70^\circ$

3. Let x, y are length of adjacent sides of parallogram

& Given

Perimeter = 72 cm

$x : y = 5 : 7 \Rightarrow \frac{x}{y} = \frac{5}{7} \Rightarrow x = \frac{5}{7} \cdot y$

$x + y + x + y = 72$ ($\because$ opposite sides are equal in length)

$2(x+y) = 72$

$2\left(\frac{5}{7} \cdot y + y\right) = 72$

$\frac{12}{7} \cdot y = 36$

$y = \frac{36 \times 7}{12}$

$y = 21$ cm

$$x = \frac{5}{7} \cdot y$$

$$x = \frac{5}{7} \times 21$$

$$x = 15\,cm$$

$\therefore$ $x = 15\,cm$, $y = 21\,cm$.

$\therefore$ 15cm, 21cm are lengths of sides of parallogram

4. Given

Angles of parallogram are in the ratio of 4:5

Let the Angle be $4x, 5x$

$4x + 5x = 180$ ($\because$ Adjacent angles are supplementary)

$9x = 180$

$x = 20$

Angles $4x = 4 \times 20 = 80^\circ$

$5x = 5 \times 20 = 100^\circ$

$\therefore$ Four Angles of parallogram $= 80^\circ, 100^\circ, 80^\circ, 100^\circ$

($\because$ opposite are equal in a pallogram)

5.

(i) $\angle A + \angle C = 180°$?

may (or) may not be

($\because \angle A = \angle C = 90°$)

(ii) $AD = BC = 6cm$, $AB = 5cm$, $DC = 4.5cm$!

No ($\because AD \neq BC$)

(iii) $\angle B = 80°$, $\angle D = 70°$?

No, opposite angles must be equal in parallogram.

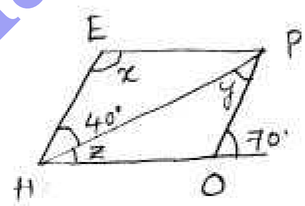
(iv) $\angle B + \angle C = 180°$?

yes. ($\because$ com. Adjacent angles are supplementry)

6.

$y = 40°$

($\because HE \parallel OP$)



At 'O'

$\angle HOP + 70° = 180°$ ($\because$ forms straight line)

$\angle HOP = 180° - 70°$

$\angle HOP = 110°$

$\therefore x = \angle HOP = 110°$ ($\because$ opposite angles are equal)

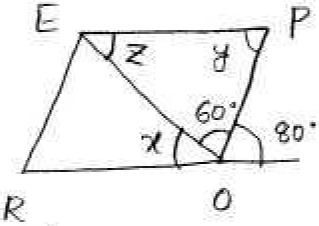
$40 + z + 110° = 180°$ ($\because$ Adjacent angles are supplementry)

$z + 150 = 180$

$z = 180 - 150$

$\boxed{z = 30°}$

(ii)



At 'O'

$x + 60 + 80 = 180°$

($\because$ forms straight line)

$x + 140 = 180°$

$x = 180 - 140$

$\boxed{x = 40°}$

$z = x = 40°$ ($\because$ $RO \parallel EP$)

$\angle O + \angle P = 180°$ ($\because$ Adjacent angles are supplementary)

$x + 60 + y = 180°$

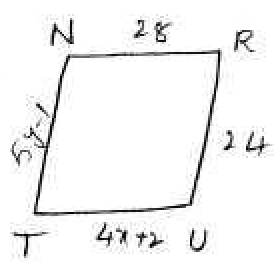
$40 + 60 + y = 180$

$y + 100 = 180$

$y = 180 - 100$

$\boxed{y = 80°}$

7.



Opposite sides are equal

$5y - 1 = 24$

$5y = 24 + 1$

$5y = 25$

$\boxed{y = 5}$

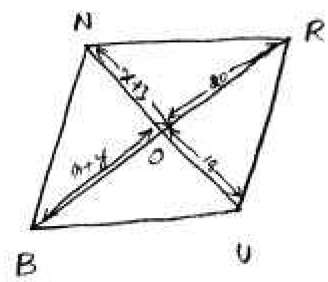
$4x + 2 = 28$

$4x = 28 - 2$

$4x = 26$

$x = \frac{26}{4} = \frac{13}{2}$

$\therefore \quad x = 6.5 \,, \; y = 5$



'O' Bisects the $\overline{BR}$

$\overline{BO} = \overline{OR}$

$x + y = 20 \longrightarrow ①$

'O' Bisects the $\overline{NU}$

$\overline{NO} = \overline{OU}$

$x + 3 = 18 \longrightarrow ②$

$x = 18 - 3$

$\boxed{x = 15}$

Substitute x value in ①

$15 + y = 20$

$y = 20 - 15$

$\boxed{y = 5}$

8.

In ABCD parallogram.

$\angle A + \angle B = 180$ ($\because$ Adjacent angles are supplementry)

$120 + \angle B = 180$

$\angle B = 180 - 120$

$\angle B = 60^\circ$

In PQRS parallelogram

$\angle P = \angle R$ ($\because$ opposite angles are equal)

$\angle P = 50^\circ$

In $\triangle PBX$

$\angle P + \angle B + x = 180^\circ$ ($\because$ sum of angles in triangle)

$50 + 60 + x = 180$

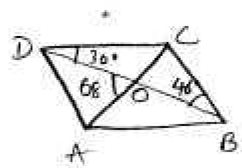
$110 + x = 180$

$x = 180 - 110$

$\boxed{x = 70^\circ}$

9. (i)

$\angle CAD = ?$



$\angle CBD = \angle ADB$ ($\because$ AD ∥ BC)

$\angle ADB = 46^\circ$

In $\triangle ADO$

$\angle CAD + \angle ADB + 68 = 180$

$\angle CAD + 46 + 68 = 180$

$\angle CAD + 114 = 180$

$\boxed{\angle CAD = 66^\circ}$

ii) $\angle ACD = ?$

$\angle DOA + \angle DOC = 180°$ ($\because$ Straight line)

$68 + \angle DOC = 180°$

$\angle DOC = 180 - 68$

$\angle DOC = 112°$

In $\triangle DOC$

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

$112 + 30 + \angle ACD = 180$

$\angle ACD + 142 = 180$

$\angle ACD = 38°$

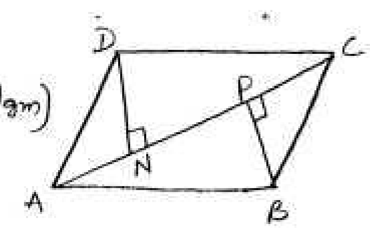
iii) $\angle ADC = \angle ADO + \angle BDC$

$= 46 + 30$

$\angle ADC = 76°$

10.

(i)



$\overline{AD} = \overline{BC}$ ($\because$ Sides of $\parallel$gm)

$\angle AND = \angle CPB = 90°$

$\angle DAN = \angle BCP$ ($\because$ $BC \parallel AD$)

From ~~A~~ SAA Congruence

~~AAI~~ $\triangle AND \cong \triangle BPC$

(ii) As $\triangle DCN \cong \triangle BAP$

$\therefore \overline{AN} = \overline{CP}$

11. In parallelogram ABCR

$\overline{AB} = \overline{RC}$ ($\because$ opposite ~~angle~~ sides) $\rightarrow$ (1)

In parallelogram ABPC

$\overline{AB} = \overline{CP} \rightarrow$ (2) ($\because$ opposite sides)

(1) + (2)

$\overline{AB} + \overline{AB} = \overline{RC} + \overline{CP}$

$2\overline{AB} = \overline{RP} \rightarrow$ (3)

lly

$2\overline{AC} = \overline{PQ} \rightarrow$ (4)

$2\overline{BC} = \overline{QR} \rightarrow$ (5)

(3) + (4) + (5)

$2(\overline{AB} + \overline{AC} + \overline{BC}) = \overline{PQ} + \overline{QR} + \overline{RP}$

Exercise 13.3

1.

i. Square, Rhombus

ii. Square, Rectangle

2.

i) I. Opposite sides are equal and opposite sides are parallel

II. Adjacent angles are ~~com~~ supplementry

ii) I. It has four sides

II. Sum of all interior angles is 360°

iii) I. All the sides are equal

II. All interior angles are 90°

III. Diagnals cut perpendicularly.

iv) I. opposite sides are equal

II. All the interior angles are 90°

3.

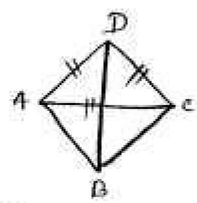
i) Parallelogram, square, rectangle, rhombus

ii) square, ~~recta~~, rhombus

iii) Square, rectangle

4. Given

Side of Rhombus = One diagnal of Rhombs



$AD = DC = AC$

$\therefore$ ~~It is~~ $\triangle ADC$ is a equilateral triangle.

$\therefore \angle ADC = \angle DAC = \angle DCA = 60°$

lly

Δ^{le} ACB is also a equilateral triangle

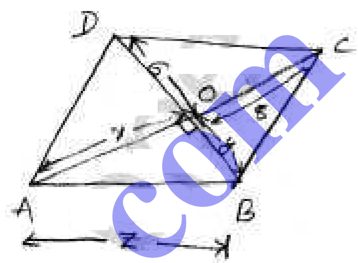
$\therefore \angle CAB = \angle ABC = \angle BCA = 60°$

$\angle ADB = \angle DAC + \angle CAB = 60° + 60° = 120°$

$\angle DCB = \angle DCA + \angle ACB = 60 + 60 = 120°$

$\therefore$ Angles of rhombus $60°, 120°, 60°, 120°$

5. ABCD is a rhombus



diagnals of rhombus bisects each other

$\therefore x = 8$

$y = 6.$

Diagnals of rhombus cuts orthogonally

$\therefore$ In Δ^{le} AOB

$\overline{OA}^2 + \overline{OB}^2 = \overline{AB}^2$ ($\because$ Pythagorus Theorem)

$x^2 + y^2 = z^2$

$8^2 + 6^2 = z^2$

$z^2 = 64 + 36$

$z^2 = 100$

$\boxed{z = 10}$

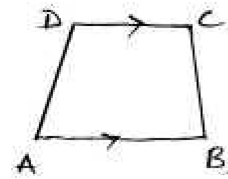
6. Given

ABCD is a trapezium

$\angle A : \angle D = 5:7$

$\angle B = (3x+11)^\circ$

$\angle C = (5x-31)^\circ$



From the property of trapezium

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

Let $\angle A, \angle D = 5y, 7y$

$\therefore \quad 5y + 7y = 180^\circ$

$12y = 180^\circ$

$y = 15^\circ$

$\angle A = 5y = 5\times15 = 75^\circ$

$\angle D = 7y = 7\times15 = 105^\circ$

$3x+11+5x-31 = 180^\circ$

$8x - 20 = 180$

$8x = 180+20$

$8x = 200$

$x = \frac{200}{8}$

$\cancel{x = 12.5^\circ}$

$x = 25^\circ$

$\angle B = 3x+11.$

$= 3\times25+11$

$= 75+11$

$\angle B = 86^\circ$

$\angle C = 5x-31$

$= 5\times25-31$

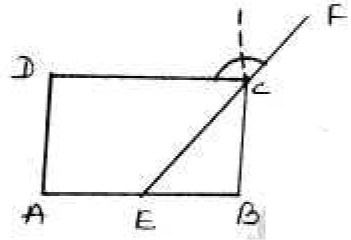
$= 125-31$

$\angle C = 94^\circ$

$\therefore \quad \angle A = 75^\circ, \ \angle B = 86^\circ, \ \angle C = 94^\circ, \ \angle D = 105^\circ$

7.

$\angle CEB : \angle ECB = 3:2$



$\angle CBE = 90°$ ($\because$ Angle in rectangle)

$\therefore$ In Δ^{le} ECB

Let $\angle CEB = 3x$, $\angle ECB = 2x$.

$$\angle CEB + \angle ECB + \angle CBE = 180°$$

$$3x + 2x + 90 = 180$$

$$5x + 90 = 180$$

$$5x = 180 - 90$$

$$5x = 90$$

$$x = \frac{90}{5}$$

$$\boxed{x = 18°}$$

i) $\angle CEB = 3x = 3 \times 18 = 54°$

ii) At 'C'

$$\angle CEB + \angle DCE = \angle DCB$$

$$54° + \angle DCE = 90° \quad (\because \text{Angle in rectangle})$$

$$\angle DCE = 90 - 54$$

$$\angle DCE = 36°$$

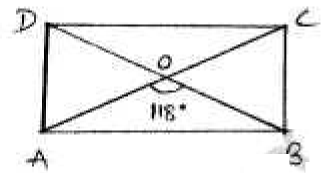
$$\angle DCE + \angle DCF = 180° \quad (\because \text{Forms Straight line})$$

$$36° + \angle DCF = 180°$$

$$\angle DCF = 180 - 36°$$

$$\angle DCF = 144°$$

8. given ABCD is a rectangle



$\overline{AO} = \overline{OB}$ ($\because$ intersect at 'o'.)

$\therefore \angle OAB = \angle OBA = x$.

i) In $\triangle^{le}$ AOB

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

$118 + x + x = 180°$

$2x = 180 - 118$

$2x = 62$

$x = \frac{62}{2}$

$x = 31°$

$\therefore \angle ABO = 31°$

ii) $\angle AOB + \angle AOD = 180°$ ($\because$ forms straight line)

$118 + \angle AOD = 180°$

$\angle AOD = 180 - 118$

$\angle AOD = 62°$

$\overline{OD} = \overline{OA}$ ($\because$ diagonals bisect each other)

$\angle DAO = \angle ADO = y$

In $\triangle^{le}$ AOD

$\angle DAO + \angle ADO + \angle AOD = 180°$

$y + y + 62 = 180$

$2y + 62 = 180$

$2y = 180 - 62$

$2y = 118$

$y = \frac{118}{2}$

$y = 59°$

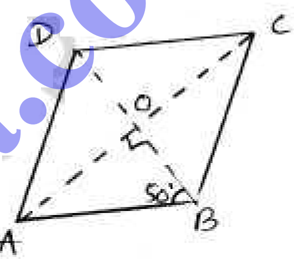
$\therefore \angle ADO = 59°$

iii) Simillary by taking $\triangle^{le}$ BOC

we can prove $\angle OCB = 59°$

9. Give ABCD is a ~~so~~ rhombus

$\angle ABD = 50°$



In $\triangle^{le}$ AOB

$\angle AOB = 90°$ ($\because$ In rhombus, diognals ~~is~~ cut perpendicularly)

$\therefore \angle AOB + \angle OAB + \angle OBA = 180°$

$90 + \angle OAB + 50° = 180$

$\angle OAB + 140° = 180$

$\angle OAB = 180 - 140$

$\boxed{\angle OAB = 40°}$

~~or~~ / $\angle OAB = \angle CAB = 40°$

ii) $\angle BCD = ?$

$AB \parallel DC$

$\therefore \angle CAB = \angle ACD = 40^\circ$

$\angle BCD = 2 \times \angle ACD$ ($\because$ diagnal in rhombus, bisects the angle)

$\angle BCD = 2 \times 40^\circ$

$\angle BCD = 80^\circ$

iii) $\angle ADC$

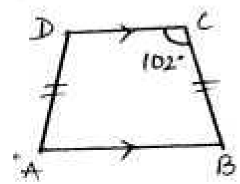
$\angle ADC = \angle ABC$ ($\because$ opposite angles are equal in rhombus)

$\angle ADC = 2 \times \angle ABD$

$\angle ADC = 2 \times 50^\circ$

$\angle ADC = 100^\circ$

10. In a trapezium



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

$112^\circ + \angle B = 180$

$\angle B = 180 - 102$

$\angle B = 78^\circ$

Given $\overline{AD} = \overline{CB}$

$\therefore \angle C = \angle D = 102^\circ$

$\therefore \angle A = \angle B = 78^\circ$

$\therefore$ Angles in trapezium $78^\circ, 78^\circ, 102^\circ, 102^\circ$

11. Given PQRS is a kite

$\therefore \angle Q = \angle S = 120^\circ$

$\boxed{x = 120^\circ}$

In a quadrilateral

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

$y + 120 + 50 + 120 = 360$

$y + 290 = 360$

$y = 360 - 290$

$\boxed{y = 70^\circ}$