



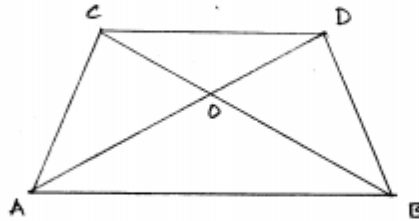
understanding shapes-III special types of quadrilaterals Ex-17.1

17. UNDERSTANDING SHAPES - III

Page ①

Exercise - 17.1

①



(i) $AD = BC$
using the property of equal length
in Isosceles Trapezium

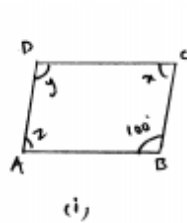
(ii) $\angle DCB = \angle ABC$ (using the property of
 $= \angle BAD$ alternative angles)

(iii) $OC = OB$ [Here, Diagonals are equidistant and get bisected at the point of intersection of two diagonals]

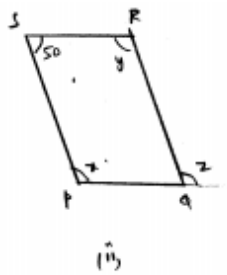
(iv) $\angle DAB + \angle CDA = 180^\circ$
[Sum of two adjacent angles is 180°].



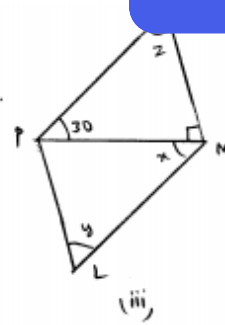
②



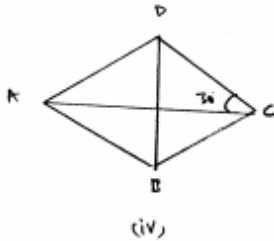
(i)



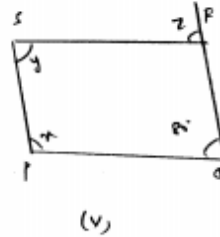
(ii)



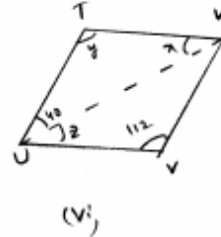
(iii)



(iv)



(v)



(vi)

Main properties used here are :-

- ① Sum of opposite angles is double of original one. That is, opposite angles are equal.
- ② Sum of two adjacent angle is 180° .

(i)

Given opposite angles are equal

$$\Rightarrow \angle ADC = \angle ABC$$

$$\Rightarrow y = 100^\circ$$

Sum of adjacent angles = 180°

$$z + 100 = 180$$

$$z = 80^\circ$$



Opposite angles are equal

$$\angle DAB = \angle DCB$$

$$\Rightarrow x = z$$

$$\Rightarrow \boxed{x = 80^\circ}$$

(ii)

Sum of adjacent angles = 180°

$$50 + y = 180^\circ \quad (\angle PSR + \angle SRQ = 180^\circ)$$

$$\Rightarrow y = 180 - 50$$

$$\Rightarrow \boxed{y = 130^\circ}$$

Opposite angles are equal

$$\Rightarrow \angle SRQ = \angle SPQ$$

$$\Rightarrow y = x$$

$$\Rightarrow \boxed{x = 130^\circ}$$

Opposite angles are equal

$$\Rightarrow \angle PSR = \angle RQP$$

$$50 = 180 - z \quad [\text{since } z \text{ is an exterior angle}]$$

$$\boxed{z = 130^\circ}$$

(iii)

In parallelogram PLMN

Opposite angles are equal;

$$z = y \quad \text{--- (1)}$$

$$x = 30^\circ \quad [\text{because, they are alternate angles}]$$

$$\angle LMN = 30 + 90 \quad (\text{from figure})$$



$$\Rightarrow \boxed{\angle LMN = 120^\circ}$$

Sum of adjacent angles = 180°

$$\angle LMN + \angle MNP = 180^\circ$$

$$z = 180 - 120$$

$$\boxed{z = 60^\circ}$$

$$\boxed{y = 60^\circ} \text{ --- From (1)}$$

(iv) $x = 90^\circ$ [lines joining the angle are perpendicular each other]

In $\triangle ODC$,

$$x + y + 30^\circ = 180^\circ \text{ (sum of angles)}$$

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

$$\Rightarrow \boxed{y = 120^\circ}$$

$$\angle ADC = 2y$$

$$(\because \angle ADO = \angle ODC = y)$$

$$\angle ABC = 2z$$

$$(\because \angle ABO = \angle OBC = z)$$

Here, opposite angles are equal

$$\Rightarrow 2y = 2z$$

$$\Rightarrow y = z$$

$$\Rightarrow \boxed{z = 120^\circ}$$



(v) In parallelogram PQRS
opposite angles are equal
 $\Rightarrow \angle PSR = \angle PQR$
 $\Rightarrow \boxed{y = 80^\circ}$

Sum of adjacent angles is 180°

$$\Rightarrow \angle RSP + \angle SPQ = 180^\circ$$

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

$$\Rightarrow 80 + x = 180^\circ$$

$$\boxed{x = 100^\circ}$$

Sum of adjacent angles is 180°

$$\Rightarrow \angle PQR + \angle QRS = 180^\circ$$

$$80 + 180 - z = 180 \quad (\because z \text{ is an exterior angle})$$

$$\Rightarrow \boxed{z = 80^\circ}$$

(vi) In parallelogram TUVW
opposite angles are equal
 $\angle UVW = \angle WTV$
 $\Rightarrow \boxed{y = 112^\circ}$

The Diagonal bisect the angle at a point

$$\angle TVW = \angle WUV = 40^\circ = z$$

$$\Rightarrow \boxed{z = 40^\circ}$$



$$\text{Q } \angle TWU = \angle WUV = x = x$$

$$\Rightarrow \angle TUV = \angle TUW + \angle WUV$$
$$\angle TUV = 80^\circ$$

$$\text{Q } \angle TWV = \angle TWU + \angle WUV$$
$$\angle TWV = 2x$$

Opposite angles are equal

$$\Rightarrow \angle TWV = \angle TUV$$

$$\Rightarrow 2x = 80^\circ$$

$$\Rightarrow \boxed{x = 40^\circ}$$

③

(i) Here, the opposite angles $\angle PHE$ and $\angle PLE$ are not equal. This violates the rule of parallelogram. Therefore, the given figure cannot be parallelogram.

(ii) Here, the opposite sides RI & GN are equal, and the other pair of opposite sides GR and NI are equal. The law of equal opposite sides supports parallelogram. This figure can be parallelogram.



(iii)

Here $5 \neq 6$ &
 $4 \neq 3$.implies the diagonals aren't bisecting
at the point of intersection of diagonals. $\Rightarrow$ They cannot form parallelogram.

(4)

In given parallelogram EPHO,
Sum of adjacent angles $= 180^\circ$

$$\angle EHO + \angle HOP = 180^\circ$$

$$\angle EHP + \angle PHO + \angle HOP = 180^\circ$$

$$40 + Z + 180 - 70 = 180 \quad \left(\begin{array}{l} \text{because exterior} \\ \text{angle is} \\ 70^\circ \text{ at} \\ O \end{array} \right)$$

$$\Rightarrow \boxed{Z = 30^\circ}$$

Here $\boxed{y = 40^\circ}$, because they are alternative
anglesSum of adjacent angles $= 180^\circ$

$$\angle HEP + \angle OHE = 180^\circ$$

$$x + 40 + Z = 180$$

$$\boxed{x = 110^\circ}$$



⑤

In parallelogram, length of opposite sides are

(i) equal

$$\Rightarrow 26 = 3y - 1$$

$$26 + 1 = 3y$$

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

$$\boxed{y = 9}$$

ii

$$3x = 18$$

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

$$\Rightarrow \boxed{x = 6}$$

(ii) In parallelogram

We know diagonals bisect at the point
of intersection of diagonals

$$\Rightarrow 20 = y - 7$$

$$\text{ii } 16 = x - y \quad \text{--- (1)}$$

$$y = 20 + 7$$

$$\text{ii } \boxed{y = 27}$$

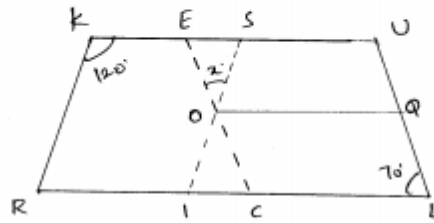
(1) $\Rightarrow$

$$16 = x - y$$

$$16 = x - 27$$

$$\Rightarrow \boxed{x = 43}$$

(6)



Let OQ be the horizontal line passing through O and parallel to KL .

Here $KRIS$ & $CLUE$ are parallelograms

Opposite angles are equal.

$$\angle RKE = \angle RIE = 120^\circ$$

$$\angle OSC = 180^\circ - \angle RIE \quad \left(\begin{array}{l} \text{because they lie on} \\ \text{same line} \end{array} \right)$$

$$\boxed{\angle OIC = 60^\circ}$$

adjacent sides/angles is equal to 180°

$$\angle ULC + \angle LCO = 180^\circ$$

$$70^\circ + \angle LCO = 180^\circ$$

$$\boxed{\angle LCO = 110^\circ}$$



Now,

$$\angle OCI = 180^\circ - \angle LCO$$

, because they lie on
same line

$$\boxed{\angle OCI = 70^\circ}$$

In ΔOCI

$$\angle OIC + \angle ICO + \angle COI = 180^\circ$$

$$60 + 70 + \angle COI = 180$$

$$\Rightarrow \boxed{\angle COI = 50^\circ}$$

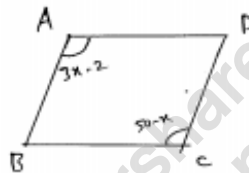
$$\angle ESO = \angle COI \text{ (vertically opposite angles)}$$

$$\Rightarrow \boxed{x = 50^\circ}$$

⑦

Let us consider
parallelogram ABCD,

opposite angles are
equal



$$\Rightarrow \angle A = \angle C$$

$$\Rightarrow (3x-2) = (50-x)$$

$$\Rightarrow 4x = 52$$

$$\boxed{x = 13}$$

$$\angle A = 3(13)-2 = 37 = \angle C$$



$$\angle B = \angle D \text{ (opposite angles)}$$

$$\angle B = 180^\circ - \angle A \text{ (adjacent angles)}$$

$$\Rightarrow \angle B = 180^\circ - 33^\circ$$

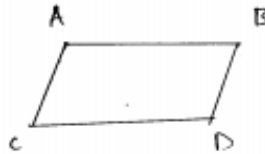
$$\Rightarrow \angle B = 150^\circ$$

$$\boxed{\angle B = 142^\circ = \angle D}$$

Therefore, the angles are $33^\circ, 142^\circ, 33^\circ, 142^\circ$

⑧

Let us consider
a parallelogram
ABCD



Given

$$\angle A = \frac{2}{3} \angle B$$

$$\angle C = \frac{2}{3} \angle D$$

Sum of adjacent sides = 180°

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

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

$$\frac{5}{3} \angle B = 180^\circ$$

$$\boxed{\angle B = 108^\circ}$$



$$\Rightarrow \angle A = \frac{2}{3} \angle B$$
$$= \frac{2}{3} \times 108^\circ$$
$$\boxed{\angle A = 72^\circ}$$

Opposite angles are equal

$$\angle A = \angle D = 72^\circ$$

$$\angle C = \angle B = 180^\circ - 72^\circ = 108^\circ$$

Therefore the angles are $72^\circ, 108^\circ, 72^\circ, 108^\circ$

⑨

Let the parallelogram be ABCD

Given $\angle A = 70^\circ$

Sum of adjacent angles = 180°

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

$$70^\circ + \angle D = 180^\circ$$

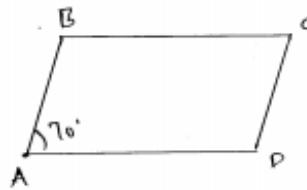
$$\boxed{\angle D = 110^\circ}$$

Opposite angles are equal

$$\angle A = \angle C = 70^\circ$$

$$\angle B = \angle D = 110^\circ$$

Therefore angles are $70^\circ, 110^\circ, 70^\circ, 110^\circ$





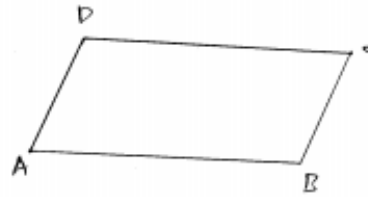
(10)

Let us consider a parallelogram ABCD

Given

$$\angle A : \angle B = 1 : 2$$

$$\Rightarrow \angle A = x \text{ \& } \angle B = 2x$$

Sum of adjacent angles = 180°

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

$$x + 2x = 180$$

$$\boxed{x = 60^\circ}$$

$$\Rightarrow \angle A = 60^\circ, \angle B = 120^\circ$$

Opposite angles are equal

$$\angle A = \angle C = 60^\circ$$

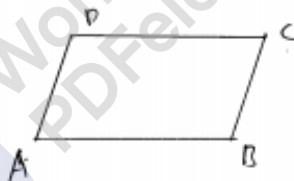
$$\angle B = \angle D = 120^\circ$$

Therefore, the angles are $60^\circ, 120^\circ, 60^\circ, 120^\circ$

(11)

Given parallelogram ABCD

$$\text{Given } \angle A = 70^\circ$$

Sum of adjacent angles = 180°



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

$$70^\circ + \angle B = 180^\circ$$

$$\boxed{\angle B = 110^\circ}$$

Opposite angles are equal

$$\angle A = \angle C = 70^\circ$$

$$\angle B = \angle D = 110^\circ$$

Therefore angles are $70^\circ, 110^\circ, 70^\circ, 110^\circ$

⑬

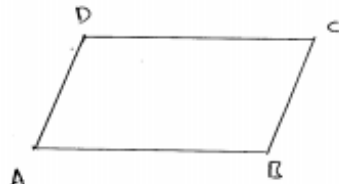
Given parallelogram is 120° ABCD

Given

$$\angle D + \angle B = 130^\circ$$

But

$$\angle D = \angle B \quad (\text{opposite angles})$$



$$\Rightarrow 2\angle D = 130^\circ$$

$$\Rightarrow \boxed{\angle D = \angle B = 65^\circ}$$

Sum of adjacent angles = 180°

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

$$\angle A = 180 - 65$$

$$\boxed{\angle A = 115^\circ}$$



Opposite angles are equal

$$\Rightarrow \boxed{\angle A = \angle C = 115^\circ}$$

(14)

Given quadrilateral is ABCD

Given, all angles are equal.

$$\text{Let } \angle A = \angle B = \angle C = \angle D = x$$

(say)

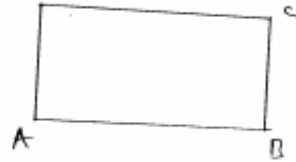
$$x + x + x + x = 360^\circ$$

($\because$ Sum of angles in quadrilateral is 360°)

$$\Rightarrow 4x = 360^\circ$$

$$\Rightarrow x = \frac{360}{4}$$

$$\Rightarrow \boxed{x = 90^\circ}$$



Yes, this quadrilateral can be parallelogram, because, opposite angles are equal and sum of adjacent sides is equal to 180° .

The special type of parallelogram here is Rectangle, because all its angles are equal to 90° .



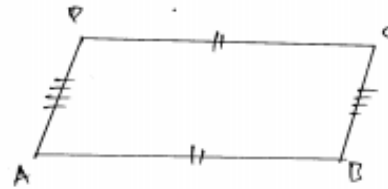
(15)

Given parallelogram is ABCD

Given

$$AB = 4 \text{ cm}$$

$$BC = 3 \text{ cm}$$



We know,

$$AB = DC = 4 \text{ cm} \quad (\text{Opposite sides})$$

$$BC = AD = 3 \text{ cm} \quad (\text{Opposite sides})$$

$$\text{Perimeter} = AB + BC + CD + DA$$

$$= 4 + 3 + 4 + 3$$

$$P = 14 \text{ cm}$$

(16)

Given parallelogram is ABCD

Let the small
side be x

$$AD = BC = x \text{ cm}$$

The greater side
length = $(x + 25) \text{ cm}$

$$\Rightarrow AB = CD = (x + 25) \text{ cm}$$

$$\begin{aligned} \text{Perimeter} &= AB + BC + CD + DA \\ &= x + x + 25 + x + x + 25 \\ &= 4x + 50 \end{aligned}$$





But,

given that Perimeter = 150 cm

$$\Rightarrow 4x + 50 = 150$$

$$\Rightarrow \boxed{x = 25 \text{ cm}}$$

$$\therefore AB = CD = 25 \text{ cm}$$

$$\& AD = BC = 50 \text{ cm}$$

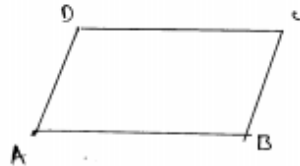
(17)

Given parallelogram is ABCD

length of shorter side
= 4.8 cm

$$\boxed{AD = BC = 4.8 \text{ cm}}$$

(opposite sides)

length of longer side = Short side length + $\frac{1}{2}$ short side length

$$= (1.5) \text{ short side length}$$

$$= (1.5) (4.8)$$

$$\text{length of longer side} = 7.2 \text{ cm}$$

$$\Rightarrow \boxed{AB = CD = 7.2 \text{ cm}}$$
 [opposite sides]

$$\begin{aligned} \text{Perimeter} &= AB + BC + CD + DA \\ &= 4.8 + 7.2 + 4.8 + 7.2 \end{aligned}$$

$$\boxed{P = 26 \text{ cm}}$$



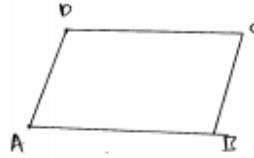
(18)

Given parallelogram is ABCD,

Given

$$\angle A = (3x - 4)^\circ$$

$$\angle B = (3x + 10)^\circ$$

Sum of adjacent angles = 180°

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

$$3x - 4 + 3x + 10 = 180$$

$$6x = 180 - 6$$

$$x = 29^\circ$$

$$\Rightarrow \angle A = 3(29) - 4 \quad \& \quad \angle B = 3(29) + 10$$

$$\Rightarrow \angle A = 83^\circ \quad \& \quad \angle B = 117^\circ$$

Opposite angles are equal

$$\angle A = \angle C = 83^\circ \quad \& \quad \angle B = \angle D = 117^\circ$$

(19)

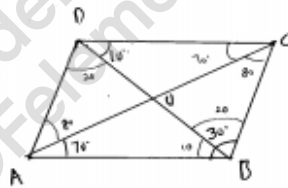
Given parallelogram is ABCD,

Diagonals bisect at 'O',

$$\text{Given } \angle ABC = 30^\circ$$

$$\angle BDC = 10^\circ$$

$$\angle CAB = 70^\circ$$





Sum of adjacent angles = 180°

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

$$\angle CBA + \angle BAC + \angle CAD = 180^\circ$$

$$30 + 70 + \angle CAD = 180^\circ$$

$$\boxed{\angle CAD = 80^\circ}$$

Given

$$\angle BDC = 10^\circ$$

$$\angle BDC = \angle DBA = 10^\circ \text{ (alternative angles)}$$

$$\angle DBA + \angle CBD = \angle CBA = \text{(from figure)}$$

$$10 + \angle CBD = 30^\circ$$

$$\boxed{\angle CBD = 20^\circ}$$

$$\angle CBD = \angle BDA = 20^\circ \text{ (alternative angles)}$$

$$\angle AEB = \angle CAD = 80^\circ \text{ (alternative angles)}$$

$$\angle DCA = \angle CAB = 70^\circ \text{ (alternative angles)}$$

From $\triangle OBC$,

$$\angle OBC + \angle BOC + \angle BCO = 180^\circ$$

$$20 + \angle BOC + 80 = 180^\circ$$

$$\Rightarrow \boxed{\angle BOC = 80^\circ}$$

$$\angle BOC = \angle BDC = \angle DOA = 80^\circ \text{ [opposite angles]}$$



From ΔODC ,

$$\angle ODC + \angle DCO + \angle COD = 180^\circ$$

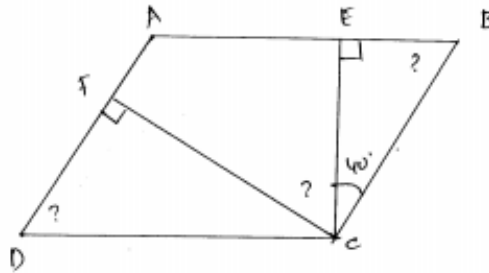
$$20^\circ + 70^\circ + \angle COD = 180^\circ$$

$$\boxed{\angle COD = 100^\circ}$$

$$\boxed{\angle COD = \angle AOB = 100^\circ} \quad (\text{Opposite angles})$$

20)

Given Figure :-



From ΔEBC ,

$$\angle EBC + \angle BCE + \angle CEB = 180^\circ$$

$$\angle EBC + 60 + 90 = 180$$

$$\boxed{\angle EBC = 50^\circ}$$

$$\angle ABC = \angle ADC$$

$$\Rightarrow \boxed{\angle ADC = 50^\circ}$$

[in parallelogram ABCD,
Opposite angles are
equal]

In ΔFDC

$$\angle DFC + \angle FCD + \angle CDF = 180^\circ$$

$$90 + \angle FCD + 50 = 180$$

$$\boxed{\angle FCD = 40^\circ}$$

In parallelogram ABCD,

Sum of adjacent angles = 180°

$$\angle ADC + \angle DCB = 180^\circ$$

$$\angle ADC + \angle DCF + \angle FCE + \angle ECB = 180^\circ$$

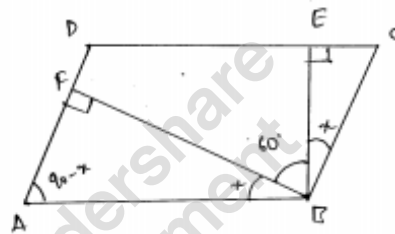
$$50 + \angle DCF + \angle FCE + \angle ECB = 180$$

$$50 + 40 + \angle FCE + 40 = 180$$

$$\boxed{\angle FCE = 50^\circ}$$

(21)

Let the parallelogram
be ABDC as
shown



$$\angle FBE = 60^\circ \text{ (given)}$$

$$\text{Let } \angle BEC = x^\circ$$

from ΔBEC

$$\angle BEC + \angle ECB + \angle CBE = 180^\circ$$

$$90 + \angle ECB + x = 180$$

$$\boxed{\angle ECB = 90 - x^\circ}$$



In parallelogram ABCD,

$$\angle DCB = \angle DAB \text{ (opposite angles)}$$

$$\Rightarrow \angle PCB = \angle DAB = (90 - x)^\circ$$

In $\triangle AFB$,

$$\angle AFB + \angle FBA + \angle BAF = 180^\circ$$

$$90 + \angle FBA + 90 - x = 180$$

$$\Rightarrow \boxed{\angle FBA = x^\circ}$$

In parallelogram ABCD,

$$\text{Sum of adjacent angles} = 180^\circ$$

$$\angle DAB + \angle ABC = 180^\circ$$

$$\angle DAB + \angle ABF + \angle FBE + \angle EBC = 180^\circ$$

$$90 - x + x + 60 + x = 180$$

$$\boxed{x = 30^\circ}$$

Now,

$$\begin{aligned} \angle DAB &= \angle DCB = 90 - x \\ &= 90 - 30 \end{aligned}$$

$$\boxed{\angle DAB = \angle DCB = 60^\circ}$$

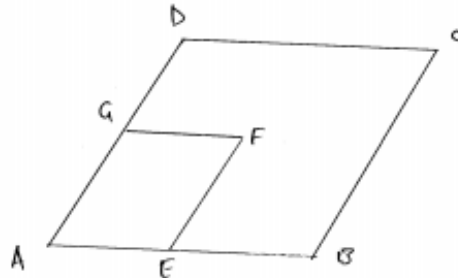
$$\begin{aligned} \angle ABC &= \angle ABF + \angle FBE + \angle EBC \\ &= 60 + 2x \\ &= 60 + 2(30) \end{aligned}$$

$$\Rightarrow \angle ABC = 120^\circ$$

$$\boxed{\angle ABC = \angle ADC = 120^\circ} \text{ (opposite angles in parallelogram)}$$

22

Given Figure



ABCD and AEFG = parallelograms

Given $\angle C = 55^\circ$

From parallelogram ABCD

$$\angle C = \angle A \text{ (opposite angles)}$$

$$\Rightarrow \boxed{\angle A = 55^\circ}$$

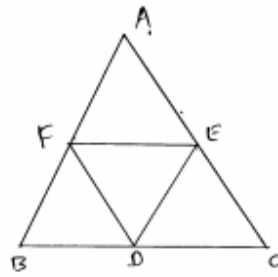
From parallelogram AEFG

$$\angle A = \angle F \text{ (opposite angles)}$$

$$\Rightarrow \boxed{\angle F = 55^\circ}$$



(23) Given Figure



BDEF and CDEF are parallelograms

In BDEF

$$FE = BD \quad \text{--- (Opposite sides) --- ①}$$

In DCFE

$$DC = FE \quad \text{--- (Opposite sides) --- ②}$$

① & ② $\Rightarrow$

$$\boxed{BD = DC}$$

(24) Given condition

$$DE = DF \quad \text{--- ③}$$

In BDEF, $DE = BF$ (Opposite sides) --- ①

In DCFE, $DF = EC$ (Opposite sides) --- ②

①, ②, ③ $\Rightarrow$ $\boxed{BF = EC}$ --- ④



In $AFDE$, $ED = AE$ — (Opposite sides) — (5)

In $EDAF$, $ED = AF$ — (Opposite sides) — (6)

(1), (5), (6) $\Rightarrow$

$$\boxed{AE = AF} \text{ — (7)}$$

(4), (7) $\Rightarrow$

$$AE + EC = AF + FB$$

$$\Rightarrow \boxed{AC = AB}$$

$\therefore$ The given ΔC is isosceles ΔC

(25)

(i), $\underline{OB = OD}$

because diagonals of parallelogram
bisect each other.

(ii), $\underline{\angle OBY = \angle ODY}$

They are alternate angles

(iii), $\underline{\angle BOY = \angle DOX}$

They are opposite angles



(iv) $\triangle BOY \cong \triangle DOX$

because $\frac{OB}{OD} = 1$
 $\angle BOY = \angle DOX$

$\therefore \angle BOY = \angle DOX$

By angle-side-angle symmetry, we can say that these $\triangle$ s are similar to each other.

(26)

(i) $\angle A = \angle C$ (True), Opposite angles in parallelogram are always equal.

(ii) $\angle FAB = \frac{1}{2} \angle A$ (True). Because AF is the angular bisector of $\angle A$.

(iii) $\angle DCE = \frac{1}{2} \angle C$ (True) Because CE is the angular bisector of $\angle C$.

(iv) $\angle CEB = \angle FAB$ [True]

Because

we know

$$\angle A = \angle C$$

But

$$\angle A = \frac{1}{2} \times 4 (\angle FAB) \text{ and}$$



$$\angle C = 2 \cdot \angle ACE$$

$$\Rightarrow \boxed{\angle CEB = \angle FAB}$$

(v) CE || AF (True).

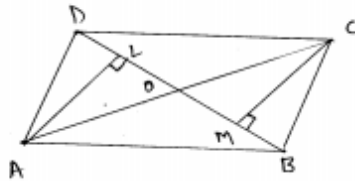
because corresponding angles are equal.

Q.7

Given parallelogram is ABCD

Here

$\angle LOA$ &
 $\angle COM$ are equal



$$\angle LOA = \angle COM$$

$$\angle ALO = \angle CMO \quad (\text{Right angles})$$

$$AO = OC \quad [\text{because diagonals bisect at their point of intersection}]$$

By ASA Symmetry,

$$\triangle CMO \cong \triangle ALO$$

$$\Rightarrow \boxed{AL = CM}$$

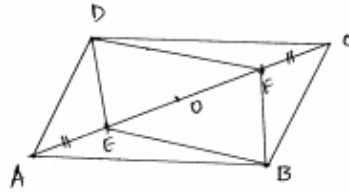
(28)

In parallelogram $ABCD$,

$$OB = OD$$

$$AO = CO$$

[Diagonals bisect at their point of intersection]

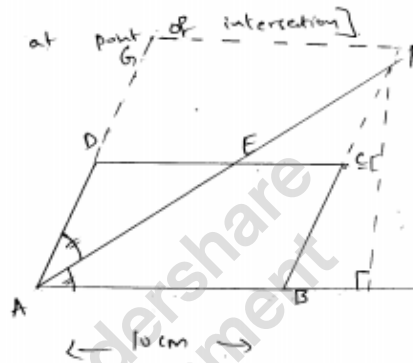


$$AE + EO = OF + CF$$

$$\Rightarrow EO = OF$$

Here $OB = OD$, & $OE = OF$
 $\Rightarrow$ $DEBF$ can be a parallelogram

[because diagonals bisect each other at point of intersection]



(29)

Given $ABCD$ is a parallelogram

Given

$$AB = 10 \text{ cm}$$

$$AD = 6 \text{ cm}$$

assume a point G such that the produced line of AD and horizontal line through F intersect at.

Now, the parallelogram, $ABFG$,

The bisector is intersecting/ passing through other vertex

 $\Rightarrow$ Their sides are equal

$$\Rightarrow AB = BF$$

$$\Rightarrow AB = BC + CF$$

$$\Rightarrow 10 = 6 + CF$$

$$\Rightarrow \boxed{CF = 4 \text{ cm}}$$



Special types of quadrilaterals

Exercise - 17.2

①

①

(i)

True

$$AB \parallel CD$$

$$AD \parallel BC$$

(ii)

True

$$AB = BC = CD = DA$$

(iii)

False,

It has four pairs of equal sides

(iv)

False,

angles need not be right angle

(v)

True,

Diagonals bisect each other at right angles

(vi)

False,

Diagonals need not be equal

(vii)

True

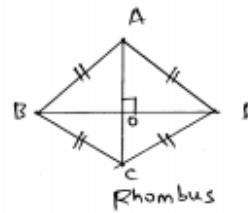
$$AB = BC = CD = DA$$

(viii)

True, Every Rhombus is a parallelogram

(ix)

A closed figure with four sides is called quadrilateral [True]





(X) True

If the angles, are equal to 90° ,
Rhombus becomes Square

(xi) false,
Rhombus may become Square, but not always

②

(i) all sides are equal

(ii) one angle is right angle

(iii) Equal

(iv) Bisect ; right

(v) Rhombus

③

If Diagonals of parallelogram are not perpendicular, then it is not rhombus. Because
Diagonals in rhombus always bisect each other
at right angles

④

No, the perpendicularity condition alone doesn't
satisfy the rhombus, the sides of quadrilateral
must be equal to make rhombus



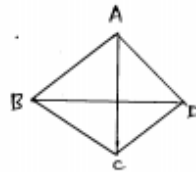
⑤

Given ABCD is a rhombus.

Given $\angle ACB = 40^\circ$

We know

$$\angle ACB = \angle ACD = 40^\circ \text{ [bisecting angles]}$$



$$\Rightarrow \angle BCD = \angle BCA + \angle ACD$$

$$\boxed{\angle BCD = 80^\circ}$$

$$\angle ADB = \angle BDC \text{ [bisecting angles]}$$

$$\Rightarrow \text{adjacent angles sum} = 180^\circ$$

$$\angle ADC + \angle BCD = 180^\circ$$

$$80^\circ + \angle BDC + \angle ADB = 180^\circ$$

$$2(\angle BDC) = 100^\circ$$

$$\boxed{\angle BDC = 100^\circ/2}$$

$$\boxed{\angle BDC = 50^\circ}$$

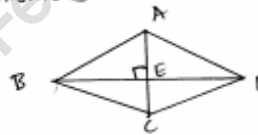
⑥

Let ABCD be given rhombus

Given

$$AC = 12\text{cm}$$

$$BD = 16\text{cm}$$





$$AE = \frac{1}{2} AC \quad [\text{Diagonals bisect each other}] \quad (4)$$

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

$$\Rightarrow AE = 6 \text{ cm} \quad ; \quad BE = 8 \text{ cm}$$

We know ΔAEB is Right-angled Δ

$$\Rightarrow AB^2 = BE^2 + AE^2$$

(Hypotenuse law)

$$AB = \sqrt{BE^2 + AE^2}$$

$$= \sqrt{8^2 + 6^2}$$

$$= \sqrt{64 + 36}$$

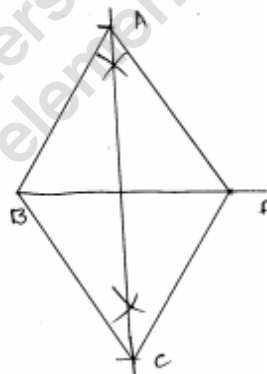
$$AB = 10 \text{ cm}$$

$$\Rightarrow \boxed{\text{length of the side} = 10 \text{ cm}}$$

⑦

① Draw a horizontal line
 $BD = 6 \text{ cm}$

② Taking more than half
on the compass, draw
arcs from both points
 B and D



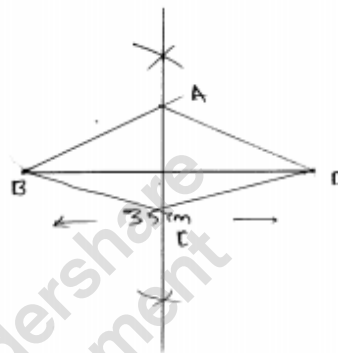


- ③ Draw a vertical line through the Intersection points of arcs.
- ④ Make a point A on the vertical line at 5 cm from horizontal line to the upper part.
- ⑤ Make a point C on the vertical line at 5 cm from horizontal line to downward.
- ⑥ Join ABCD,
- ⑦ Thus required ABCD rhombus is formed.

⑧ Sol:-

Steps followed here :-

- ① Draw a line $BD = 3.5$ cm.
- ② Taking more than half radius draw arcs on both sides on line through point B and D.
- ③ Draw a vertical line through intersection points of arcs.
- ④ Take angle $= 20^\circ$ and draw a point A on line from B to upwards.

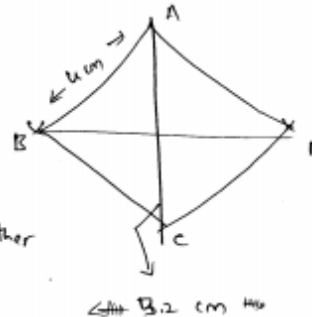




- ⑤ Take angle $= 20^\circ$ and draw a point 'c' on line from B to downwards.
- ⑥ Join ABCD,
- ⑦ Thus, the required rhombus is formed.

Q9 Sol:-

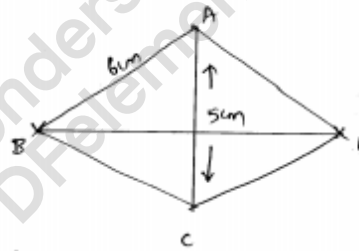
- ① Draw a vertical line AB
 $= 3.2$ cm.
- ② Taking radius as 4 cm, draw arcs from A and C on either side of the line



- ③ The intersection points are B and D.
- ④ Join ABCD.
- ⑤ The required Rhombus ABCD is done.

Q10 Sol:-

- ① Draw a vertical line
 $AC = 5$ cm
- ② Taking radius $= 6$ cm, draw arcs on either side of AC from A & C points

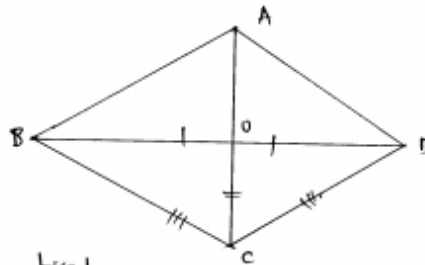




- ③ The New point of intersection of arcs is called to be B and D
- ④ Join ABCD
- ⑤ Thus the required rhombus is formed.

⑥

Here ABCD is a rhombus,



i) Here

$OB = OD$ [diagonals bisect each other]

$OC = OC$ [Common side]

$BC = CD$ [side of rhombus]

By S-S-S congruency, $\triangle BOC \cong \triangle DOC$

ii) Since $\triangle BOC$ & $\triangle DOC$ are congruent to each other, their alternative angles will also be equal.



(12)

Let us consider a Rhombus
ABCD

Let us consider

$\triangle ABO$ & $\triangle AOD$

Here

$OB = OD$ [Diagonals bisect each other]

$OA = OA$ [common side]

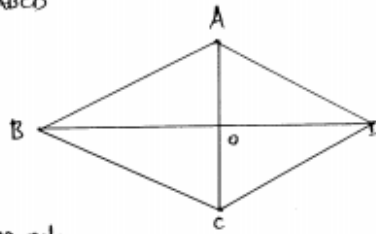
$AB = AD$ [Sides of rhombus]

$\Rightarrow \triangle AOB \cong \triangle AOD$

$\Rightarrow \angle AOB = \angle AOD$

$\Rightarrow AC$ is bisecting $\angle A$

Similarly,
every diagonal bisects the given angle

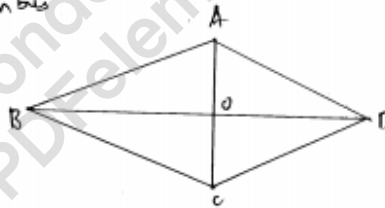


(13)

Given ABCD is rhombus

Let O be centre,

Given $AB = 10\text{cm}$
 $BD = 16\text{cm}$





$$BO = \frac{1}{2} BD \quad (\text{because diagonals bisect each other})$$

$$\Rightarrow \boxed{BO = 8 \text{ cm}}$$

In $\triangle AOB$

$$AB^2 = AO^2 + OB^2 \quad [\text{Hypotenuse theorem}]$$

$$10^2 = AO^2 + 8^2$$

$$AO^2 = 100 - 64$$

$$\boxed{AO = 6 \text{ cm}}$$

$$AC = 2AO \quad (\text{because diagonals bisect each other})$$

$$\Rightarrow \boxed{AC = 12 \text{ cm}}$$

(14)

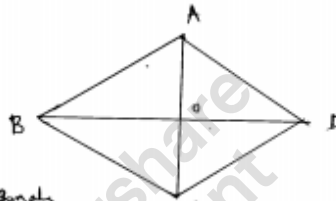
Given ABCD is a rhombus.

Given $AC = 6 \text{ cm}$

$$BD = 8 \text{ cm}$$

$$AO = \frac{1}{2} AC \quad (\text{because diagonals bisect each other})$$

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



$$\Rightarrow AO = 3 \text{ cm} \quad ; \quad BO = 4 \text{ cm}$$

From $\triangle AOB$

$$AO^2 + BO^2 = AB^2 \quad (\text{Hypotenuse theorem})$$

$$AB = \sqrt{3^2 + 4^2}$$

$$= \sqrt{9 + 16}$$

$$= \sqrt{25}$$

$$AB = 5 \text{ cm}$$

$$\boxed{\text{length of the quadrilateral} = 5 \text{ cm}}$$



Special types of quadrilaterals Ex 17.3

Exercise - 17.3

(1)

(1)

(i) True $AB = DC$ & $AD = BC$ (ii) False $AD \neq DC$

(iii) True

(iv) True

(v) false [need not be]

(vi) false

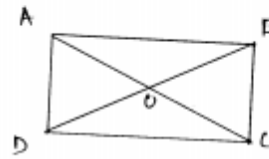
(vii) True [$AC = BD$ & $AO = OC$; $DO = OB$](viii) False [They are not $\perp$]

(ix) false [They possess different lengths]

(x) True

(xi) True

(xii) false [because all squares are parallelograms]



(2)

(i) True

(ii) True



(iii) True

(iv) False, (Diagonal = $\sqrt{2}$ x side)

③

i, angles are right angles

ii, angles are right angles

iii, all sides are equal

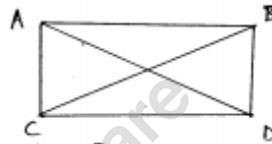
④ No, In rectangle, the length of diagonals are equal and they do bisect each other.

⑤

Given Rectangle ABCD,

Here $AD = BC$

[Diagonals are of
equal length in Rectangle]



$\angle BAC = \angle ACD = 90^\circ$ [Right angles]

$AC = AC$ = common sides

By S-A-S Congruency.

$\triangle ACB \cong \triangle CAD$

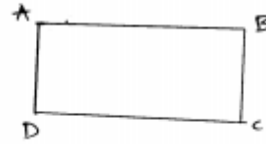


⑥

Let the Rectangle be ABCD

Given $AD:DC = 2:3$

$$\begin{aligned}\text{let } AD &= 2x \\ DC &= 3x\end{aligned}$$

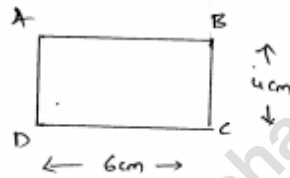


$$\begin{aligned}\text{Perimeter} &= 2(AD + DC) \\ &= 2[2x + 3x] \\ &= 10x\end{aligned}$$

But, given that perimeter is 20cm

$$\Rightarrow 10x = 20$$

$$\boxed{x = 2 \text{ cm}}$$

 $\Rightarrow$ Sides of Rectangle are 4cm and 6cm.

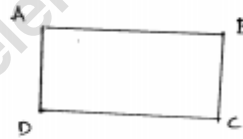
⑦

Let the Rectangle be ABCD

Given length : Breadth = 5:4

$$\text{let length} = 5x$$

$$\text{Breadth} = 4x$$





Perimeter is given by $p = 2(\text{length} + \text{breadth})$

$$= 2[5x + 4x]$$
$$= 18x$$

But, given that perimeter is 90 cm

$$\Rightarrow 18x = 90$$

$$x = \frac{90}{18}$$

$$\boxed{x = 5}$$

Sides of Rectangle are given by = $5x, 4x, 5x, 4x$

$$= \underline{25 \text{ cm}, 20 \text{ cm}, 25 \text{ cm}, 20 \text{ cm}}$$

⑧

Given the Rectangle be ABCD.

Given $AD = 5 \text{ cm}$

$DC = 12 \text{ cm}$

From ΔADC ,

$$AD^2 + DC^2 = AC^2 \quad (\text{Hypotenuse theorem})$$

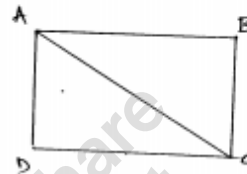
$$AC = \sqrt{5^2 + 12^2}$$

$$= \sqrt{25 + 144}$$

$$= \sqrt{169}$$

$$AC = 13 \text{ cm}$$

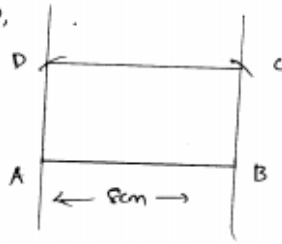
length of the diagonal = 13 cm





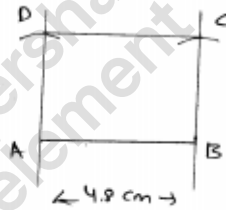
⑨ Sol :-

- 1) Draw a horizontal line $AB = 8\text{cm}$,
- 2) Draw vertical lines through A & B.
- 3) with radius of 10cm , from vertex A, cut an arc on vertical line through B. The point of intersection is named as 'C'.
- 4) with radius of 10cm , from vertex B, cut an arc on vertical line through A. The point of intersection is named as 'D'.
- 5) Join ABCD.
- 6) thus the required Rectangle ABCD is obtained.



⑩ Sol :-

- ① Draw $AB = 4.8\text{cm}$, a horizontal line
- ② Draw two vertical lines through A and B.
- ③ with radius of 4.8cm , from vertex A, cut a vertical line through 'A'. The point of intersection is named as 'D'.





- ④ with radius of 4.8 cm, from vertex B, cut a vertical line passing through 'B'. The point of intersection is named as 'c'.
- ⑤ Join ABCD.
- ⑥ thus, the rectangle ABCD is formed.
-

⑪

(i) Four sides of equal length:-

- * Square
- * Rhombus

(ii) Four right angles

- * Square
- * Rectangle.

⑫

- (i) A Square is always named as quadrilateral.
- (ii) Opposite sides are parallel and equal
- (iii) All sides are equal and opposite sides are parallel
- (iv) Opposite sides are equal and each angle is right angle.



(13)

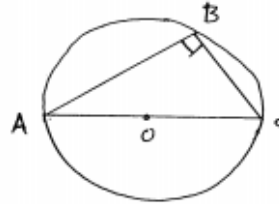
- (i) parallelogram, rectangle, rhombus, Square
- (ii) Rhombus, Square
- (iii) Square, Rectangle.

(14)

let us draw a line AC (hypotenuse)

→ Now, draw a circle with 'AC' as diameter.

→ If 'B' is the point such that it makes 90° then,



$$OB = OA = OC = \text{radius.}$$

Hence proved.

(15)

- (i) By whether all the angles are equal to right angles
- (ii) By measuring the length of the diagonals