Very Short Answer Type Questions

[1 MARK]

Que 1. In a parallelogram *ABCD,* if ∠*A* = 75^0, find ∠*C*.

Sol. Opposite angles of a parallelogram are equal.

∴ In parallelogram ABCD, ∠A = ∠C = 75^0

Que 2. Name the quadrilateral formed by joining the mid-points of the sides of any quadrilateral ABCD.

Sol. Parallelogram.

Que 3. Can the angles of a quadrilateral be 115^0, 85^0, 75^0, 80^0?

Sol. No. 115^0 + 85^0 + 75^0 + 80^0 = 355^0. Angle sum must be 360^0.

Que 4. Can all the angles of a quadrilateral be right angles? Give reason for your answer?

Sol. Yes, because angle sum of quadrilateral is 360^0.

Que 5. Three angles of a quadrilateral ABCD are equal. Is it a Parallelogram?

Sol. It need not be parallelogram, because we may have ∠A = ∠B = ∠C = 75^0 and ∠D = 135^0. Here ∠B ≠ ∠D.

Que 6. The diagonals of a quadrilateral are equal. Is it necessarily a parallelogram?

Sol. No. diagonals of a parallelogram bisect each other but may or may not be equal.

Que 7. If two adjacent sides of a kite are 5cm and 7cm, find its perimeter.

Sol. Two pair of adjacent sides of a kite are equal.

So, the sides of the given kite are equal.

∴ Perimeter of the kite = 5 + 5 + 7 + 7 = 24cm

Que 8. In Fig. 8.5, *ABCD* and *AEFG* are two parallelograms. If ∠C = 50^0, determine ∠F.

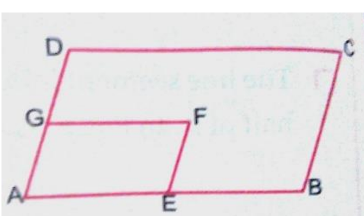

Fig. 8.5

Sol. In parallelogram *ABCD,*

$\angle A = \angle C$ (Opposite angles) $\therefore \angle A = 50^0$

Similarly, in parallelogram *ABCD,*

$\angle A = \angle F$ (Opposite angles) $\therefore \angle F = 50^0$

Que 9. In Fig. 8.6, *BDEF* and *FDCE* are parallelograms. Can you say that BD = CD?

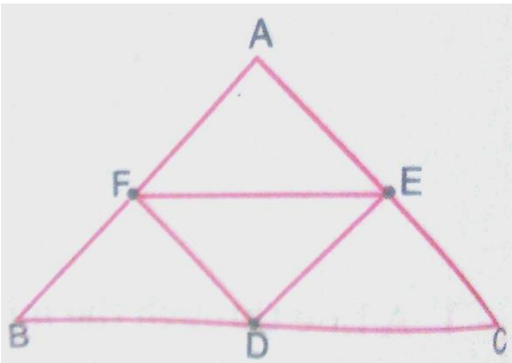

Fig. 8.6

Sol. As opposite sides of a parallelogram are equal.

Therefore, in parallelogram *BDEF* and *FDCE,*

We have BD = FE … (i)

DC = FE … (ii)

From (i) and (ii), we get BD = DC

Que 10. In parallelogram PQRS, If $\angle P = (3x - 5)^0$ and $\angle Q = (2x + 15)^0$. Find the value of x.

Sol. $\angle P + \angle Q = 180^0$ (Angles on the same side of a transversal are supplementary)

$\Rightarrow 3x - 5 + 2x + 15 = 180^0$

$5x + 10 = 180^0$

$\Rightarrow \quad 5x = 170^0 \quad \Rightarrow \quad x = 34^0$

Que 11. Diagonals of a quadrilateral ABCD bisect each other. If $\angle A = 35^0$, determine $\angle B$.

Sol. As diagonals of quadrilateral ABCD bisect each other, therefore ABCD is a $\|^{gm}$

$\angle A + \angle B = 180^0$ (Co-interior angles)

$35^0 + \angle B = 180^0$

⇒ $\angle B = 180^0 - 35^0$

⇒ $\angle B = 145^0$

Que 12. In the Fig. 8.7 *ABCD* is a $\|^{gm}$. Find x and y.

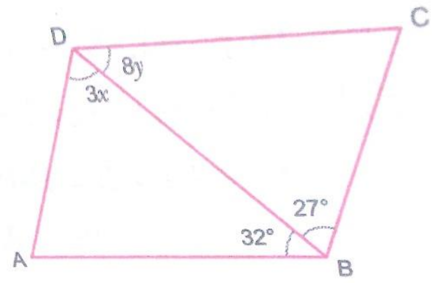

Fig. 8.7

Sol. AB|| DC (Opposite sides of a parallelogram)

∴ $8y = 32^0$ and $9x = 27^0$ (alternate angles)

⇒ $y = 4^0$ and $x = 3^0$

Que 13. Find all the angles of the $\|^{gm}$ ABCD given in fig. 8.8.

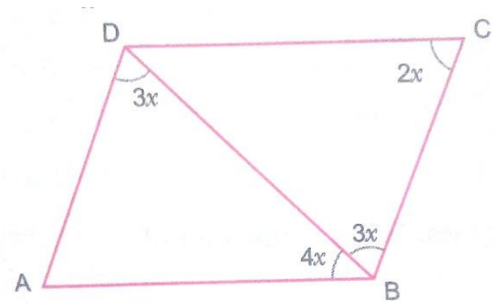

Fig. 8.8

Sol. $\angle A = \angle C = 2x$ (Opposite angles of parallelogram)

Also, $\angle DAB + \angle ADB + \angle ABD = 180^0$ (Angle sum property)

$2x + 3x + 4x = 180^0$

$9x = 180^0$

$x = 20^0$

∴ $\angle A = 2x = 2 \times 20^0 = 40^0$

Again $\angle A = \angle ABD + \angle DBC$

Also $\angle B = \angle ABD + \angle DBC$

$\Rightarrow \quad \angle B = 4x + 3x \;\Rightarrow\; \angle B = 7x$

Then $\angle B = 7 \times 20^0 = 140^0$

$\therefore \quad \angle B = \angle D = 140^0$

Que 14. The angles of a quadrilateral are $4x^0$, $7x^0$, $15x^0$ and $10x^0$. Find the smallest and largest angle of the quadrilateral.

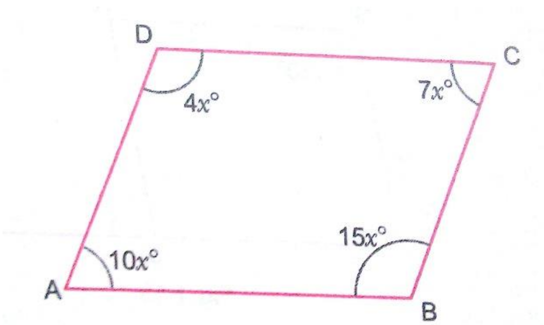

Fig. 8.9

Sol. $\angle A + \angle B + \angle C + \angle D = 360^0$

$\therefore 4x^0 + 7x^0 + 15x^0 + 10x^0 = 360^0$

$36x^0 = 360^0$

$x^0 = \frac{360^0}{36} = 10^0$

$\therefore$ Smallest angle $= 4x^0$

$= 4 \times 10 = 40^0$

And largest angle $= 15x^0 = 15 \times 10 = 150^0$

Que 15. ABCD is a $||^{gm}$ in which $\angle ADC = 75^0$ and side AB is produced to E as shown in figure, find (x + y).

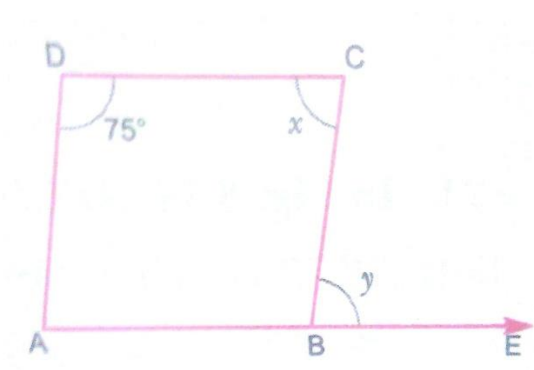

Fig. 8.10

Sol. ∵ ABCD is a parallelogram.

∴ $\angle D + \angle C = 180^0$

(Sum of co-interior angles)

$75^0 + x = 180^0$

$X = 180^0 - 75^0$

$X = 105^0$

Again $x = y = 105^0$ (Alt. angles)

∴ $x + y = 105^0 + 105^0 = 210^0$

Que 16. In parallelogram ABCD if $\angle A = (2x + 25)^0$ and $\angle B = (3x - 5)^0$, find the value of x.

Sol. ABCD is a parallelogram.

$\Rightarrow \angle A + \angle B = 180^0$

$(2x + 25)^0 + (3x - 5)^0 = 180^0$

$5x + 20^0 = 180^0$

$5x = 160^0$

$x = \frac{160^0}{5} = 32^0$

Que 17. In the fig. 8.11 ABCD is a parallelogram. What is the sum of the angles x, y and z?

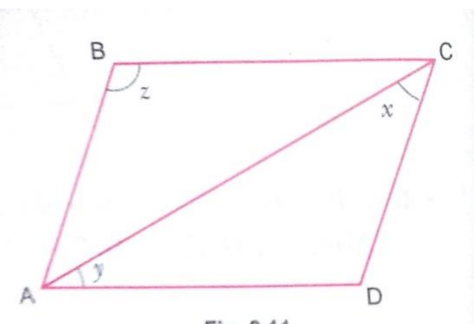

Fig. 8.11

Sol. $\angle D = \angle B = z$ (Opposite angles of $||^{gm}$)

Again in ΔABC.

$\angle CAD + \angle ACD + \angle CDA = 180^0$

$y + x + z = 180^0$

Que 18. PQRS is a square. PR and SQ intersect at O. state the measure of ∠POQ.

Sol. Since the diagonals of a square intersect at right angle.

∴ $\angle POQ = 90^0$

Que 19. In fig 8.12, ABCD is a square. Find x.

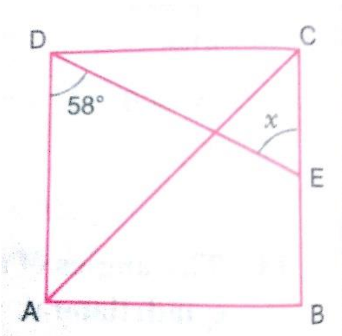

Fig. 8.12

Sol. AD||BC (Opposite sides of square)

⇒ $\angle DEC = \angle ADE$ (Alternate interior angles)

⇒ $x = 58^0$

Que 20. In Fig. 8.13, PQRS is a $||^{gm}$ in which $\angle PSR = 130^0$. Find ∠RQT

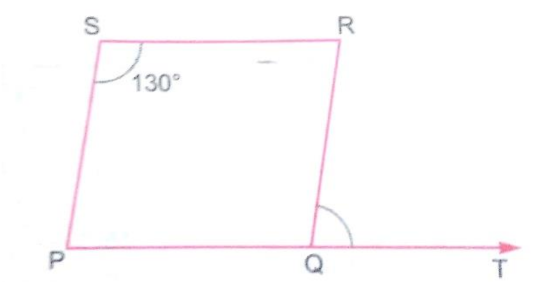

Fig. 8.13

Sol. We have $\angle S = \angle Q = 130^0$ (Opposite angles of a parallelogram)

Also, $130^0 + \angle RQT = 180^0$ (Linear pair)

$\angle RQT = 180^0 - 130^0$

$= 50^0$

Que 21. In fig. 8.14, ABCD is a rhombus. If ∠ABD = 40^0. Find the value of y.

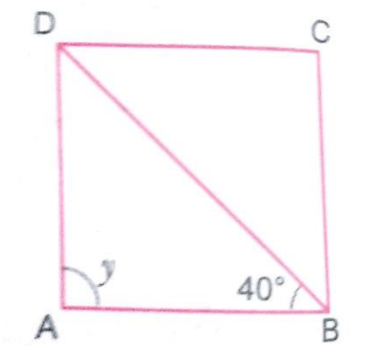

Fig. 8.14

Sol. ABCD is a rhombus.

⇒ AB = AD

∴ In ΔABD

And y + ∠ADB + ∠ABD = 180^0

y + 40^0 + 40^0 = 180^0 ⇒ y = 180^0 - 80^0

y = 100^0

Que 22. Two opposite angles of a $||^{gm}$ are (60 – x) ^{0} and (3x – 4)^0. Find the measure of each angles of the $||^{gm}$.

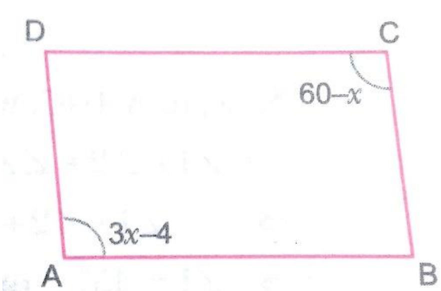

Fig. 8.15

Sol. ABCD is a parallelogram.

∴ ∠A = ∠C (Opposites angles of a parallelogram)

3x – 4 = 60 – x

4x = 64 ⇒ x = 16

∴ ∠A = 3(16) – 4 = 48 – 4 = 44^0

Also ∠A + ∠D = 180^0 (co-interior angles)

$44^0 + \angle D = 180^0 \quad \Rightarrow \quad \angle D = 180^0 - 44^0$

$\angle D = 136^0$

$\therefore \quad \angle A = \angle C = 44^0$

$\therefore \quad \angle B = \angle D = 136^0$

Que 23. ABCD is a parallelogram. If its diagonals are equal, then find the value of $\angle$ABC.

Sol. As diagonals of the parallelogram ABCD are equal, it is rectangle.

$\therefore \quad \angle ABC = 90^0$ (Each angle of rectangle is right angle)

Short Answer Type Questions – I

[2 MARKS]

Que 1. Diagonals of a quadrilateral PQRS bisect each other. If ∠P = 40⁰, Determine ∠Q.

Sol. Since the diagonals of quadrilateral PQRS bisect each other, therefore it must be a parallelogram.

$\therefore \angle P + \angle Q = 180^0$ (Angles on the same side of the transversal)

$\Rightarrow \quad 40^0 + \angle Q = 180^0$

$\Rightarrow \quad \angle Q = 180^0 - 40^0 \Rightarrow \angle Q = 140^0$

Que 2. In Fig. 8.16, ABCD is a parallelogram. If ∠DAB = 60⁰ and ∠DBC = 80⁰, Find ∠CDB.

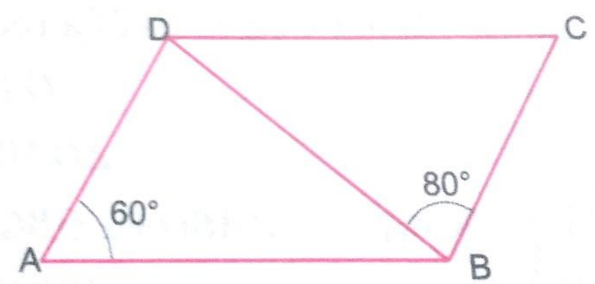

Fig. 8.16

Sol. We have, $\angle C = \angle A$ (Opposite angles of parallelogram)

$\Rightarrow \quad \angle C = 60^0$

Now, in ΔBDC

$\angle C + \angle CDB + \angle DBC = 180^0$

$\Rightarrow \quad 60^0 + \angle CDB + 80^0 = 180^0$

$\Rightarrow \quad \angle CDB = 180^0 - 140^0$

$\Rightarrow \quad \angle CDB = 40^0$

Que 3. In Fig. 8.17, ABCD is a rhombus. Find the value of x.

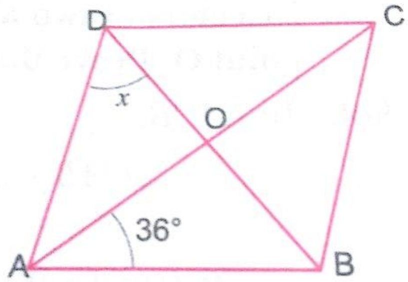

Fig. 8.17

Sol. $\angle AOB = 90^0$

(Diagonals of rhombus bisect each other at 90^0)

In ΔAOB, we have

$\angle OAB + \angle ABO + 90^0 = 180^0$

$36^0 + \angle ABO + 90^0 = 180^0 \Rightarrow \angle ABO = 180^0 - 126^0$

$\Rightarrow \angle ABO = 54^0$

$\Rightarrow \angle ADB = \angle ABD$ (Angles opposite to equal sides)

$\Rightarrow \angle ADB = 54^0 \Rightarrow x = 54^0$

Que 4. In fig. 8.18, ABCD is a square. Determine ∠DAC.

Sol. As ABCD is a square,

$\therefore$ AD = DC and $\angle ADC = 90^0$

$i.e$ $\angle DAC = \angle DCA$ and $\angle ADC = 90^0$

(Angles opposite to equal sides)

Now, in ΔADC, we have

$\angle 1 + \angle 2 + \angle ADC = 180^0$

$\Rightarrow \angle 1 + \angle 2 + 90^0 = 180^0 \Rightarrow 2\angle 1 = 90^0$ ($\because \angle 1 = \angle 2$)

$\Rightarrow \angle 1 = 45^0$ or $\angle DAC = 45^0$

Que 5. In ΔABC, median AM is produced to D such that AM = MD [Fig. 8.19].

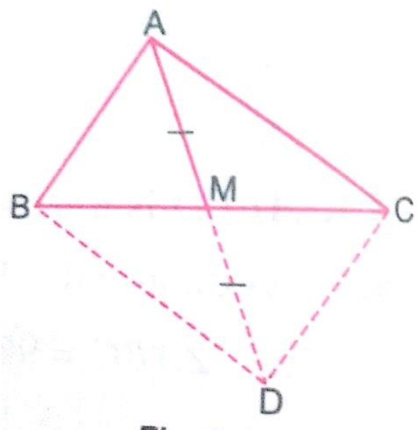

Fig. 8.19

Prove that ABCD is a Parallelogram.

Sol. In quadrilateral ABDC, we have

AM = MD (given)

BM = MC (AM is the Median)

As, diagonals AD and BC bisect each other. Therefore,

ABDC is a parallelogram.

Que 6. ABCD is a trapezium [Fig. 8.20] in which AB||CD and ∠A = ∠B = 45^0. Find ∠D of the trapezium.

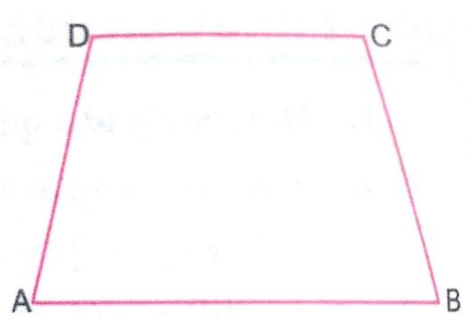

Fig. 8.20

Sol. Since, AB||CD and AD is the transversal.

∴ $\angle A + \angle D = 180^o$

$45^o + \angle D = 180^o$

⇒ $\angle D = 180^o - 45^o$ ⇒ $\angle D = 135^o$

Que 7. In rectangle ABCD, ∠BAC = 32º, Find the measure of ∠DBC.

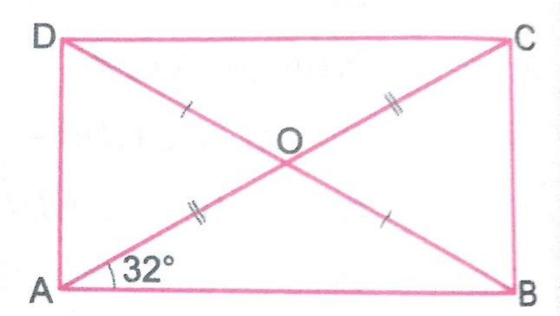

Fig. 8.21

Sol. Let AC and BD intersect at O [Fig 8.21].

Since diagonals of a rectangle bisect each other and are equal

∴ OA = OB

⇒ $\angle OAB = \angle OBA = 32^o$

Now, $\angle ABO + \angle OBC = 90^o$

⇒ $\angle OBC = 90^o - 32^o = 58^o$

⇒ $\angle DBC = \angle OBC = 58^o$

Que 8. Bisectors of two adjacent angles A and B of quad. ABCD intersect at a point O. Prove that 2∠AOB = ∠C + ∠D.

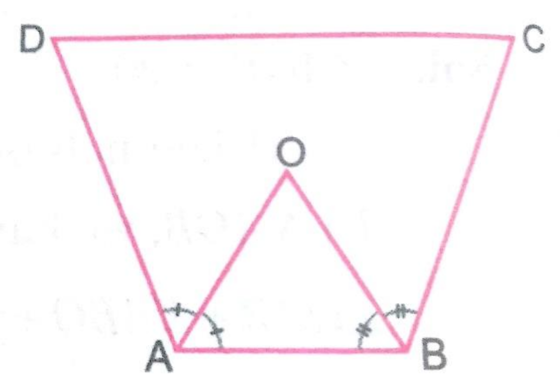

Fig. 8.22

Sol. In ΔAOB

$\angle OAB + \angle OBA + \angle AOB = 180^o$

(Angle sum property of Δ)

$2\angle OAB + 2\angle OBA + 2\angle AOB = 360^o$

$\angle A + \angle B + 2\angle AOB = 360^o$

But $\angle A + \angle B + \angle C + \angle D = 360^o$ (Angle sum property of quad.) ..(ii)

From (i) and (ii)

$\angle A + \angle B + 2\angle AOB = \angle A + \angle B + \angle C + \angle D$

$2\angle AOB = \angle C + \angle D$

Que 9. The sides BA and DC of quad. ABCD are produced as shown in Fig. 8.23. Prove that x + y = a + b.

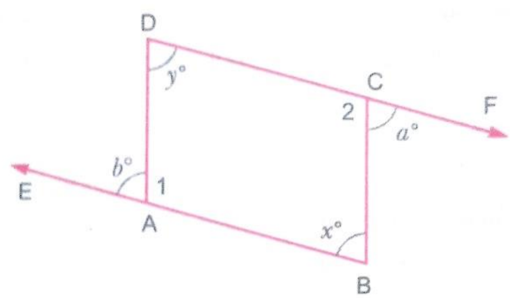

Fig. 8.23

Sol. Proof: $b + \angle 1 = 180^o$ (Linear pair)

$\angle 1 = 180^o - b$ ..(i)

Again $a + \angle 2 = 180^o$ (Linear pair)

$\angle 2 = 180^o - a$

But $\angle 1 + x + y + \angle 2 = 360^o$ (Angle sum property of quad.)

$180^o - b + x + y + 180^o - a = 360^o$ [From (i) and (ii)]

$x + y = a + b$

Que 10. In fig. 8.24, ABCD is a trapezium in which $\angle A = x + 25^o$, $\angle B = y^o$, $\angle C = 95^o$ and CD = $2x + 5^o$, then Find the value of x and y.

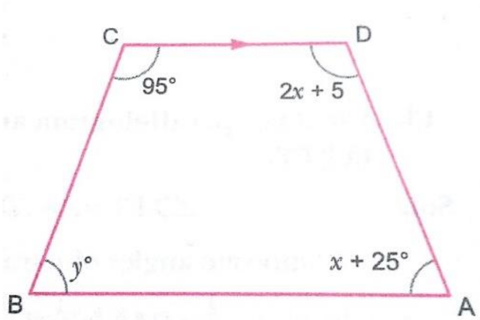

Fig. 8.24

Sol. As $CD \| BA$

$\angle C + \angle B = 180^o$ (Co-interior angles)

$\therefore$ $95^o + y = 180^o$ $\Rightarrow$ $y = 85^o$

Again, $\angle D + \angle A = 180^o$

$(2x + 5) + (x + 25) = 180^o$

$3x + 30^o = 180^o$

$\Rightarrow$ $3x = 150^o$ $\Rightarrow$ $x = 50^o$

$\therefore$ $x = 50^o$, $y = 85^o$

Que 11. Two adjacent angles of a||^{gm} are in the ratio 2:3. Find all the four angles of the parallelogram.

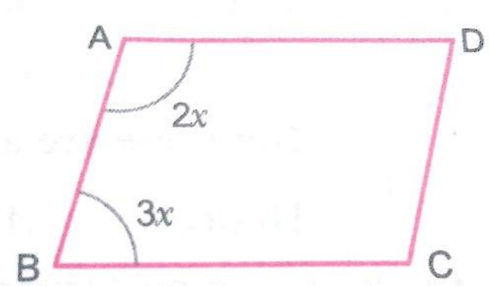

Fig. 8.25

Sol. Let the angles be 2x and 3x.

Also, $\angle A + \angle B = 180^o$ (Co-interior angles)

$\therefore$ $2x + 3x = 180^o$ $\Rightarrow$ $5x = 180^o$

$X = \frac{180^o}{5} = 36^o$

$\therefore$ $\angle A = 2 \times 36^o = 72^o$

$\angle B = 3 \times 36^o = 108^o$

Again $\angle A = \angle C = 72^o$ (Opposite angles of parallelogram)

$\angle B = \angle D = 108^o$ (Opposite angles of parallelogram)

Que 12. ABCD is a rhombus in which altitude from D to side AB bisects AB. Find the angles of the rhombus.

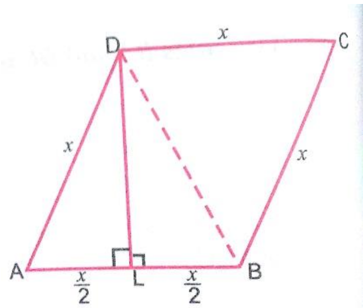

Fig. 8.26

Sol. Let sides of a rhombus be AB = BC = CD = DA = x

Now, join DB.

In ΔALD and ΔBLD, ∠DLA = ∠DLB = 90^o

[Since, DL is a perpendicular bisector of AB]

AL = BL = $\frac{x}{2}$

And DL = DL [common side]

∴ ΔALD ≅ ΔBLD [by SAS congruence rule]

AD = BD [by CPCT]

Now, in ΔADB, AD = AB = DB = x

Then, ΔADB is an equilateral triangle,

∴ ∠A = ∠ADB = ∠ABD = 60^o

Similarly, ΔDBC is an equilateral triangle,

∴ ∠C = ∠BDC = ∠DBC = 60^o

Also, ∠A = ∠C

∴ ∠D = ∠B = $180^o – 60^o = 120^o$

[Since, sum of interior angles is 180^o]

Que 13. ABCD is a parallelogram and line segments AX, CY bisect ∠A and ∠C respectively. Show that AX||CY.

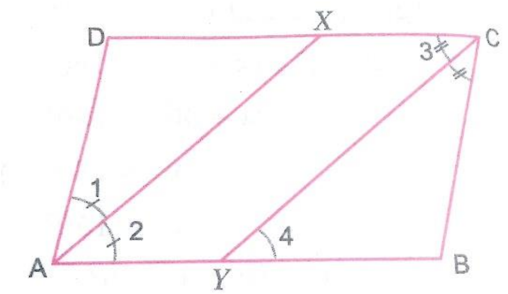

Fig. 8.27

Sol. ∠DAB = ∠BCD

(Opposite angles of parallelogram)

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

Or ∠2 = ∠3

But ∠3 = ∠4 (Alt. angles)

∴ ∠2 = ∠4

But these are alt. angles.

Hence AX||CY.

Que 14. In Fig. 8.28, ABCD is a parallelogram. Find the value of x, y and z.

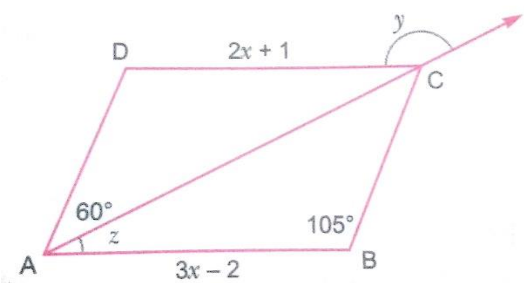

Fig. 8.28

Sol. 3x – 2 = 2x + 1 (Opposite sides of a parallelogram)

X = 3

∠B = ∠D = 105^o (Opposite angles of a parallelogram)

In ΔADC. ∠y = 60^o + ∠D (ext. angle property of Δ)

∠y = 60^o + 105^o = 165^o

Again, ∠D + ∠A

$60^o + z + 105^o = 180^o$

$Z + 165^o = 180^o \quad \Rightarrow \quad z = 15^o$

Que 15. In Fig. 8.29, ABCD is a parallelogram with perimeter 40cm. find x and y.

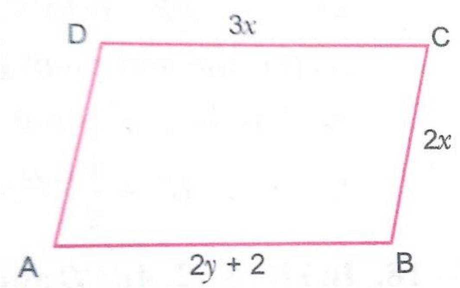

Fig. 8.29

Sol. Perimeter of parallelogram = 2(l+b)

∴ $40 = 2(l+b) = 20 = l + b$

$20 = (2y + 2) + 2x$

$20 = 2y + 2x + 2$

$18 = 2y + 2x$

$9 = y + x$

Also, opposite sides of a parallogram are equal.

∴ $3x = 2y + 2 \quad \Rightarrow \quad 3x - 2y = 2$

On putting (i) in (ii), we get

$3(9 - y) - 2y = 2$

$27 - 3y - 2y = 2 \quad \Rightarrow \quad 25 = 5y \quad \Rightarrow \quad 5 = y$

Putting the value of y in (i), we get

$x = 9 - 5 = 4$

Hence x = 4 cm and y = 5 cm.

Que 16. In fig. 8.30, D, E and F are the mid-points of the sides BC, CA and AB respectively of ΔABC. If AB = 6.2 cm, BC = 5.6 cm and CA = 4.6 cm, find the perimeter of:

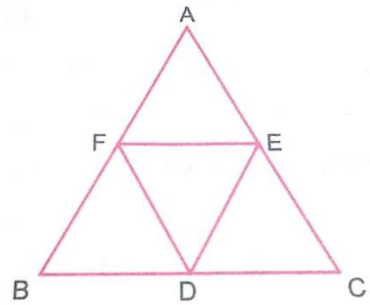

Fig. 8.30

(i) Trapezium FBCE and (ii) ΔDEF

Sol. (i) Perimeter of FBCE

$= FB + BC + CE + EF$

$= \frac{1}{2} AB + 5.6 + \frac{1}{2} AC + 2.8$

$= \frac{1}{2} (6.2) + 5.6 + \frac{1}{2} \times (4.6) + 2.8 = 13.8$ cm

(ii) F and E are the mid-points of AB and AC respectively.

∴ $FE = \frac{1}{2} BC$ (Midpoint theorem)

$FE = \frac{1}{2} \times 5.6 = 2.8$

Again, $DE = \frac{1}{2} AB = 3.1$ cm and $DF = \frac{1}{2} AC = 2.3$ cm

∴ Perimeter of $\Delta DEF = DE + EF + FD$

$= 3.1 + 2.8 + 2.3 = 8.2$ cm

Que 17. In Fig. 8.31, D is the mid-point of AB and PC = $\frac{1}{2}$ AP = 3 cm. If AD = DB = 4 cm and DE||BP. Find AE.

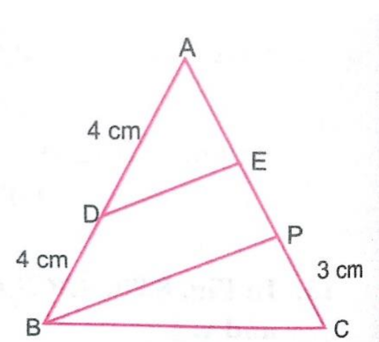

Fig. 8.31

Sol. $\frac{1}{2}$ AP = 3cm (Given)

⇒ AP = 6cm

As D is the mid-point and DE||BP

⇒ E is the mid-point of AP (By converse of midpoint theorem)

∴ AE = $\frac{1}{2}$ AP = $\frac{1}{2} \times 6 = 3$ cm

Que 18. In Fig. 8.32. ABCD and PQRB are rectangle where Q is the mid-point of BD. If QR = 5 cm, Find the measure of AB.

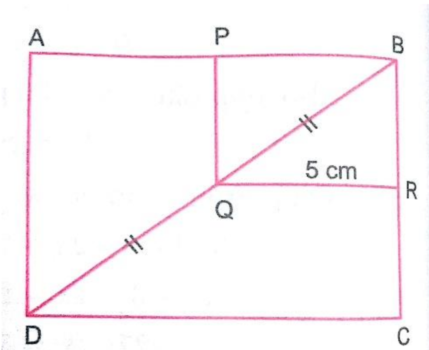

Fig. 8.32

Sol. In ΔBDC, Q is the mid-point of BD.

Again, QR||DC (As ABCD is rectangle and PQRB is a rectangle)

⇒ R is the mid-point of BC (by converse of mid-point theorem)

Again, in ΔBDC, Q and R are the mid-point of BD and BC.

⇒ QR = $\frac{1}{2}$ DC

5 = $\frac{1}{2}$ DC

So, DC = 10 cm

Also, DC = AB

(Opposite sides of rectangle)

∴ DC = AB = 10 cm

Que 19. Prove that each of a rectangle is a right angle.

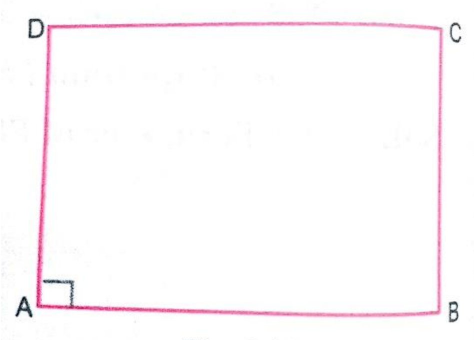

Fig. 8.33

Sol. Let ABCD be a rectangle and ∠A = 90°

⇒ ABCD is parallelogram also.

∴ AD||BC

⇒ ∠A + ∠B = 180°

Again ∠A = ∠C = 90° (Opposite angles of parallelogram)

∠B = ∠D = 90° (Opposite angles of parallelogram)

Que 20. In Fig. 8.34, side AC of ΔABC produced to E so that CE = $\frac{1}{2}$ AC. D is the mid-point of BC and ED produced meets AB at F. RC, DP are drawn parallel to BA. Prove that FD = $\frac{1}{3}$ FE.

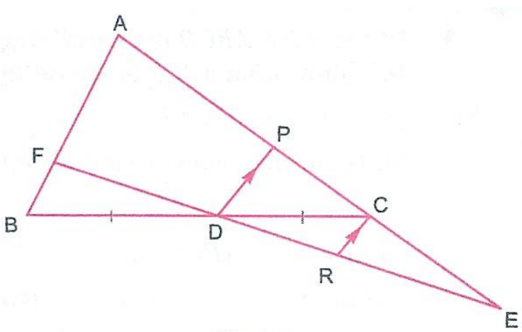

Fig. 8.34

Sol. In ΔABC, D is the mid-point of BC and DP||BA. (Given)

∴ P is the mid-point of AC ..(i) (By the converse of mid-point theorem)

Now, FA||DP||RC and AC is the transversal such that AP=PC and FDR is the other transversal on them.

∴ FD = DR ..(ii)

Also CE = $\frac{1}{2}$ AC

Or CE = PC [Using (i)]

Now in ΔEDP, C is the mid-point of DE.

[By the converse of mid-point theorem]

DR = RE

∴ FD = DR = RE [From (ii) and (iii)]

FD = $\frac{1}{3}$ FE [∵ FE = FD + DR + RE]

Short Answer Questions – II – 3 Marks

Que 1. The angles of a quadrilateral are in the ratio 1:2:3:4. Find all the angles of the angles of the quadrilateral.

Sol. Let the angles of the quadrilateral be x, 2x, 3x and 4x.

Since the sum of the angles of quadrilateral is 360°.

Therefore, $x + 2x + 3x + 4x = 360^\circ$

$$10x = 360^\circ \quad \Rightarrow \quad x = 36^\circ$$

Thus, required angles are

36°, $2 \times 36^\circ = 72^\circ$, $3 \times 36^\circ = 108^\circ$, $4 \times 36^\circ = 144^\circ$

Que 2. D, E and F are the mid-point of the sides BC, CA and AB, respectively of an equilateral triangle ABC. Show that ΔDEF is also an equilateral triangle.

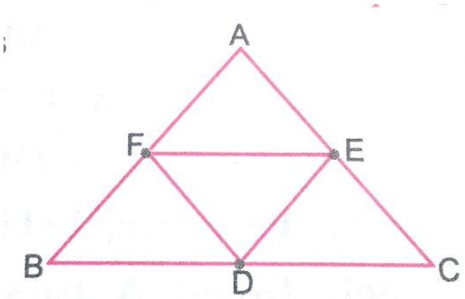

Fig. 8.35

Sol. Since the segment joining the mid-points of two sides of a triangle is half of the third side.

$\therefore$ $DE = \frac{1}{2} AB$, $EF = \frac{1}{2} BC$ and $FD = \frac{1}{2} CA$ ...(i)

Now, in equilateral ΔABC

$AB = BC = CA$

$\Rightarrow \quad \frac{1}{2} AB = \frac{1}{2} BC = \frac{1}{2} CA \quad \Rightarrow \quad DE = EF = FD$ [From eq. (i)]

Thus, all the sides of triangle DEF are equal. Hence, triangle DEF is an equilateral triangle.

Que 3. In Fig. 8.36, P is the mid-point of side BC of parallelogram ABCD, such that ∠1 = ∠2. Prove that AD = 2CD.

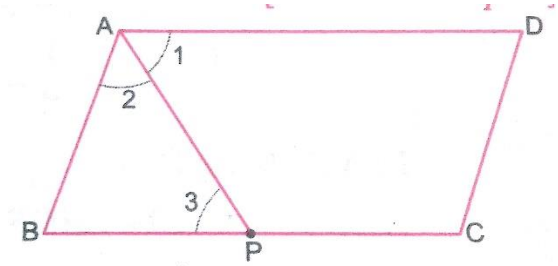

Fig. 8.36

Sol. In parallelogram ABCD, we have AD||BC

Also AP is the transversal

∴ ∠1 = ∠3 (Alternate interior angles)

∠1 = ∠2 (Given)

⇒ ∠2 = ∠3

⇒ AB = BP (sides opposite to equal angles)

Also, BC = 2BP (∵ P is the mid-point)

But AD = BC and BA = CD (Opposite sides of parallelogram)

Now, AD = BC = 2BP = 2AB

∴ AD = 2CD

Que 4. In Fig. 8.37, ABCD is a parallelogram and P, Q are the points on the diagonal BD such that BQ = DP. Show what APWQ is a parallelogram.

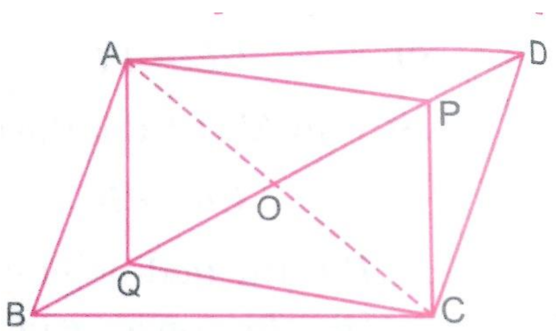

Fig. 8.37

Sol. Join AC, meeting BD to O.

Since the diagonals of a parallelogram bisect each other, we have

OA = OC

And OB = OD

Also BQ = PD (Given)

Now, OB – BQ = OD – PD

⇒ OQ = OP

Now, in quadrilateral APCQ, OA = OC and OP = OQ.

As the diagonals of the quadrilateral APCQ bisect each other.

∴ Quadrilateral APCQ is a parallelogram.

Que 5. In Fig. 8.38, AM and CN are perpendiculars to the diagonal BD of a parallelogram ABCD. Prove that AM = CN.

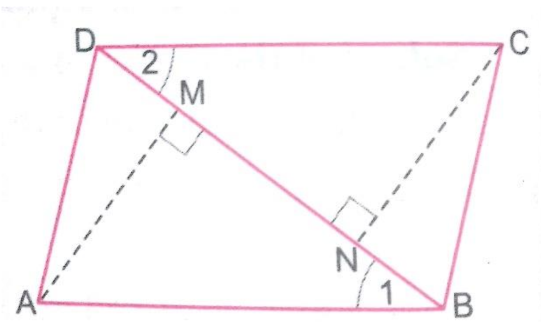

Fig. 8.38

Sol. As ABCD is a parallelogram

∴ AB||DC

Now AB||DC and transversal BD intersects them at B and D.

∴ ∠1 = ∠2 (Alternate interior angles)

Now, in triangle ABM and CDN, we have

∠1 = ∠2 (Prove above)

∠AMB = ∠CND (Each 90^o)

AB = DC (Opposite sides of parallelogram)

∴ ΔABM ≅ ΔCDN (By AAS criterion of congruence)

∴ AM = CN (CPCT)

Que 6. Prove that, the bisector of any two consecutive angles of parallelogram intersect at right angle.

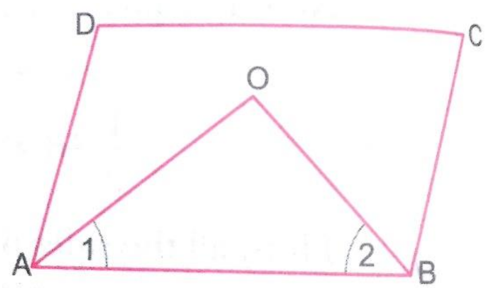

Fig. 8.39

Sol. Given: A parallelogram ABCD, such that the bisectors of consecutive angles A and B intersect at O.

To prove: ∠AOB = 90°

Proof: As ABCD is a parallelogram, therefore AD||BC and AB is the transversal.

∴ ∠DAB + ∠ABC = 180°

(Angles on the same side of the transversal are supplementary)

⇒ $\frac{1}{2}$ ∠DAB + $\frac{1}{2}$ ∠ABC = $\frac{180^o}{2}$ ⇒ ∠1 + ∠2 = 90°

In ΔAOB, we have

∠1 + ∠AOB + ∠2 = 180°

⇒ 90° + ∠AOB = 180° [From (i)]

⇒ ∠AOB = 90°

Que 7. In Fig. 8.40, Point M and N are taken on opposite sides AB and CD, respectively of a parallelogram ABCD such that AM = CN. Show that AC and MN bisect each other.

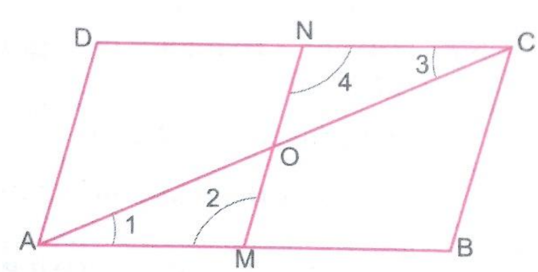

Fig. 8.40

Sol. Since, AB||CD

Therefore, in ΔAOM and ΔCON, we have

$\angle 1 = \angle 3$ (Alternate interior angles)

AM = CN (Given)

$\angle 2 = \angle 4$ (Alternate interior angles)

$\therefore$ ΔAOM $\cong$ ΔCON (By ASA congruence criterion)

$\Rightarrow$ AO = OC (CPCT)

And MO = NO (CPCT)

Hence, AC and MN bisect each other.

Long Answer Questions [4 Marks]

Que 1. In Fig. 8.41, ABCD is a parallelogram and ∠DAB = 60°. If the bisector of angles A and B meet at M on CD, Prove that M is the mid-point of CD.

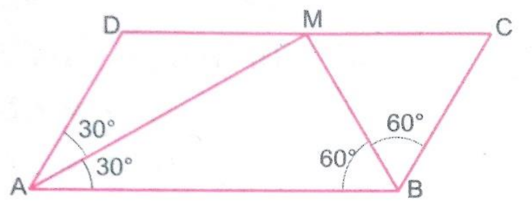

Fig. 8.41

Sol. We have, ∠DAB = 60°

Since, AD||BC and AB is the transversal.

∴ ∠A + ∠B = 180°

60° + ∠B = 180°

⇒ ∠B = 120°

Also, AM and BM are angle bisectors of ∠A and ∠B respectively.

∴ ∠DAM = ∠MAB = 30° and ∠CBM = ∠MBA = 60°

Now, AB||DC and transversal AM cuts them.

∴ ∠MAB = ∠DMA (Alternate interior angles)

⇒ ∠DMA = 30°

Thus, in ΔAMD, we have

∠MAD = ∠AMD (Each equals to 30°)

⇒ MD = AD (Sides opposite to equal angles) ..(i)

Again, AB||DC and transversal BM cuts them.

∴ ∠CMB = ∠MBA (alternate interior angles)

⇒ ∠CMB = 60°

Thus, in ΔCMB, we have

$\angle CBM = \angle CMB$ (Each equals to 60^o)

$\Rightarrow$ CM = BC (Sides opposite to equals angles)

$\Rightarrow$ CM = AD ($\because$BC = AD)

From (i) and (ii), we get

MD = CM

$\Rightarrow$ M is the mid-point of CD.

Que 2. ABC is a triangle right-angled at C. A line through the mid-point of hypotenuse AB and parallel to BC intersects AC at D. Show that
(i) MD $\perp$ AC
(ii) D is the mid-point of AC
(iii) MC = MA = $\frac{1}{2}$ AB.

Sol. Given : A triangle ABC right-angled at C. M is the mid-point of AB and MD||BC.

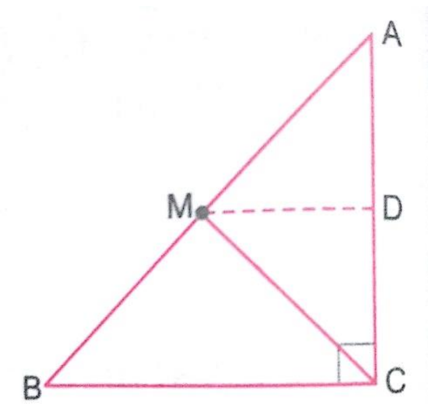

Fig. 8.42

To Prove: (i) MD $\perp$ AC

(ii) D is the mid-point of AC. (iii) MC = MA = $\frac{1}{2}$ AB.

Proof: (i) Since MD||BC.

Therefore, $\angle ADM = \angle ACB$ (Corresponding angles)

But $\angle ACB = 90^o$

$\therefore$ $\angle ADM = 90^o$

$\Rightarrow$ $90^o + \angle CDM = 180^o$ (Linear pair) or $\angle CDM = 90^o$

Hence, MD $\perp$ AC

(ii) In ΔABC, M is the mid-point of AB and MD||BC.

Therefore, D is the mid-point of AC,

i.e., AD = CD (By the converse of mid-point Theorem)

(iii) In triangle AMD and CMD, we have

AD = CD (Proved above)

$\angle ADM = \angle CDm$ (Each 90^o)

And MD = MD (Common)

$\therefore$ $\Delta AMD \cong \Delta CMD$ (By SAS congruence criterion)

$\Rightarrow$ MA = MC (CPCT)

Also $M4 = \frac{1}{2} AB$

Hence, $MC = MA = \frac{1}{2} AB$

Que 3. Prove that the diagonal divides a parallelogram into two congruent triangles.

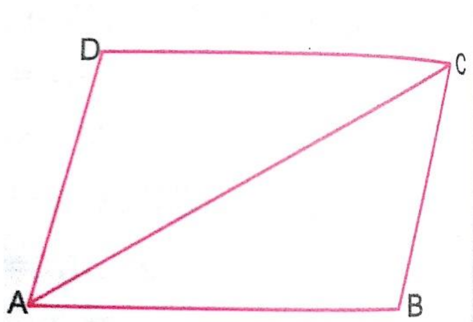

Fig. 8.43

Sol. Given: A parallelogram ABCD.

To Prove: $\Delta ABC \cong \Delta CDA$

Construction: Join AC.

Proof: Since ABCD is a parallelogram.

Therefore, AB||DC and AD||BC

Now, in AB||DC and transversal AC cuts them at A and C respectively.

$\therefore$ $\angle DCA = \angle BAC$ (Alternate interior angles)

Now, in ΔABC and ΔCDA; we have

$\angle BAC = \angle DCA$

AC = AC (Common)

$\angle DAC = \angle ACB$

∴ $\Delta ABC \cong \Delta CDA$ (By ASA Congruence criterion)

Que 4. Prove that the figure formed by joining the mid-point of the adjacent sides of a quadrilateral is a parallelogram.

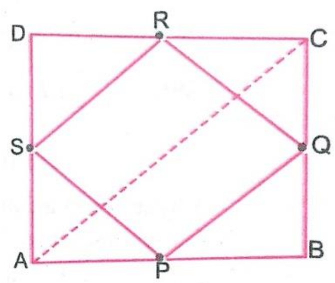

Fig. 8.44

Sol. Let ABCD be a quadrilateral which P, Q, R and S are the mid-points of AB, BC, CD and DA respectively.

Join AC.

In ΔABC, the points P and Q are the mid-points of sides AB and BC respectively.

∴ $PQ || AC$ and $PQ = \frac{1}{2}AC$ (By mid-point theorem)

Again, in ΔDAC, the points S and R are the mid-points of AD and DC respectively.

∴ $PQ || AC$ and $PQ = \frac{1}{2}AC$ (By mid-point theorem) ... (i)

Again, in ΔDAC, the points S and R are the mid-points of AD and DC respectively.

∴ $SR || AC$ and $SR = \frac{1}{2}AC$ ... (ii)

From (i) and (ii)

$PQ || SR$ and $PQ = SR$

Hence, quadrilateral PQRS is a parallelogram.

Que 5. Prove that the bisector of the angles of a parallelogram enclose a rectangle.

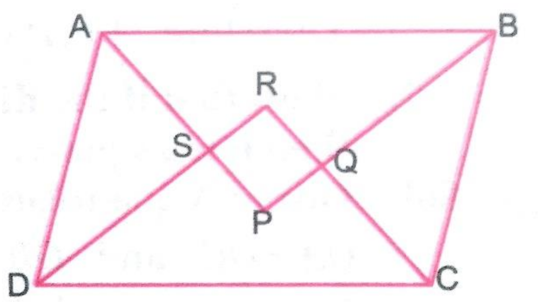

Fig. 8.45

Sol. Given: A parallelogram in which bisector of angles A, B, C, D intersect at P, Q, R, S to form a quadrilateral PQRS.

To Prove: Since ABCD is parallelogram. Therefore, AB||DC

Now, AB||DC, and transversal AD cuts them, so we have

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

$$\Rightarrow \quad \frac{1}{2}\angle A + \frac{1}{2}\angle D = \frac{180^o}{2}$$

$$\angle DAS + \angle ADS = 90^o$$

But, in ΔASD, we have

$$\angle ADS + \angle DAS + \angle ASD = 180^o$$

$$\Rightarrow \quad \angle 90^o + \angle ASD = 180^o$$

$$\Rightarrow \quad \angle ASD = 90^o$$

$$\angle RSP = \angle ASD \qquad \text{(Vertically opposite angles)}$$

$$\therefore \quad \angle RSP = 90^o$$

Similarly, we can prove that

$$\angle SRQ = 90^o, \angle RQP = 90^o \text{ and } \angle QPS = 90^o$$

Thus, PQRS is a quadrilateral each of whose angle is 90°

Hence, PQRS is a rectangle.

Que 6. Two parallel lines l and m are interacted by a transversal p (see Fig. 8.46). Show that the quadrilateral formed by the bisectors of interior angles is a rectangle.

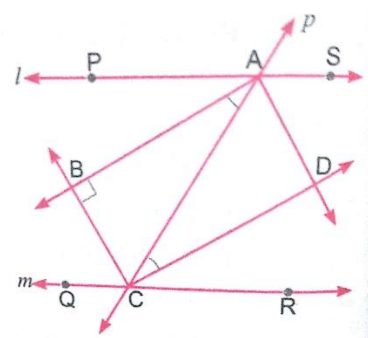

Fig. 8.46

Sol. It is given that PS||QR and transversal p intersects them at points A and C respectively.

The bisectors of ∠PAC and ∠ACQ intersect at B and bisectors of ∠ACR and ∠SAC intersect at D.

We are to show that quadrilateral ABCD is a rectangle.

Now, ∠PAC = ∠ACR (Alternate angles as l||m and p is a transversal)

So, $\frac{1}{2}\angle PAC = \frac{1}{2}\angle ACR$

i.e., ∠BAC = ∠ACD

These form a pair of alternate angles for lines AB and DC with AC as transversal and they are equal also.

So, AB||DC

Similarly BC||AD (Considering ∠ACB and ∠CAD)

Therefore, quadrilateral ABCD is a parallelogram

Also, ∠PAC + ∠CAS = 180° (Linear Pair)

So, $\frac{1}{2}\angle PAC + \frac{1}{2}\angle CAS = \frac{1}{2} \times 180^\circ = 90^\circ$

Or, ∠BAC + ∠CAD = 90°

Or, ∠BAD = 90°

So, ABCD is parallelogram in which one angle is 90°.

Therefore, ABCD is a rectangle.

Que 7. Show that if the diagonals of a quadrilateral are equal and bisect each other at right angles, then it is a square.

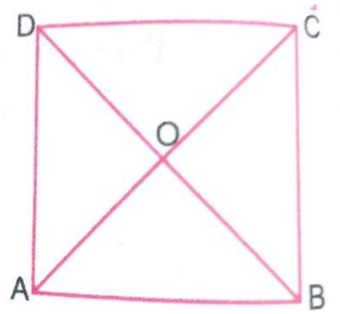

Fig. 8.47

Sol. Given: A quadrilateral ABCD in which in which diagonals AC = BD and AC ⊥ BD.

OA = OC and OB = OD.

To Proof: Quadrilateral ABCD is a square.

Proof: First, we shall prove that quadrilateral ABCD is parallelogram.

In triangles AOD and COB, we have

OA = OC (Given)

∠AOD = ∠BOC (Vertically opposite angles)

OD = OB (Given)

∴ ΔAOD ≅ ΔCOB (By SAS congruence criterion)

⇒ ∠OAD = ∠OCB (CPCT)

But these are alternate interior angles

∴ AD||BC

Similarly, AB||CD

Since both pair of opposite sides are parallel in quadrilateral ABCD.

Therefore, quadrilateral ABCD is a parallelogram.

Now, we shall prove that it is a square.

In triangles AOB and AOD, we have

OA = OA (Common)

$\angle AOB = \angle AOD$ (Each 90^o)

$OB = OD$ (Given)

$\therefore$ $\Delta AOB \cong \Delta AOD$ (By SAS congruence criterion)

$\Rightarrow$ $AB = AD$ (CPCT)

As opposite sides of a of a parallelogram are equal,

$\therefore$ $AB = CD$ and $AD = BC$

But $AB = AD$ (Proved above)

$\therefore$ $AB = BC = CD = DA$ ... (i)

Now, in triangles ABD and BAC, we have

$AD = BC$ (Opposite sides of parallelogram)

$AB = AB$ (Common)

$BD = AC$ (Given)

$\therefore$ $\Delta ABD \cong \Delta BAC$ (By SSS congruence criterion)

$\Rightarrow$ $\angle DAB = \angle CBA$ (CPCT)

Or $\angle A = \angle B$

But $\angle DAB + \angle CBA = 180^o$

(Interior angles on the same of transversal are supplementary)

$\Rightarrow$ $2\angle DAB = 180^o$ ($\because$ $\angle CBA = \angle DAB$)

$\Rightarrow$ $\angle DAB = 90^o$ i.e., $\angle A = 90^o$

As opposite angles of parallelogram are equal,

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

But $\angle A = \angle B$ and $\angle A = 90^o$ (Proved above)

$\therefore$ $\angle A = \angle B = \angle C = \angle D = 90^o$ ... (ii)

From (i) and (ii), we have

Quadrilateral ABCD is a square.

Que 8. ABCD is a parallelogram in which P and Q are the mid-points of opposite sides AB and CD (Fig. 8.48). If AQ intersects DP at S and BQ intersects CP at R, show that

(i) APCQ is a parallelogram
(ii) DPBQ is a parallelogram
(iii) PSQR is a parallelogram

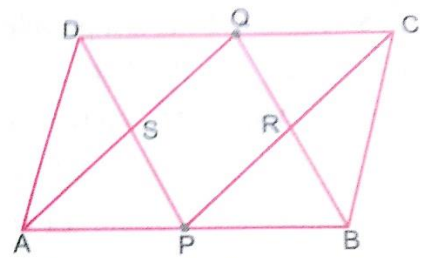

Fig. 8.48

Sol. (i) in quadrilateral APCQ,

AP||QC (∵ AB||CD) ... (i)

AP = $\frac{1}{2}$ AB, CQ = $\frac{1}{2}$ DC (Given)

Also, AB = CD

So, AP = QC ... (ii)

From (i) and (ii), we have AP||QC and AP = QC.

Therefore, APCQ is a parallelogram.

(ii) Similarly, quadrilateral DPBQ is parallelogram, because

DQ||PB and DQ = PB

(iii) In quadrilateral PSQR,

SP||QR (SR is a part of DP and QR is part QB)

Similarly, SQ||PR

So, PSQR is a parallelogram.

Que 9. Prove that the line segment joining the mid- points of the diagonals of a trapezium is parallel to the parallel sides and equal to half of their difference.

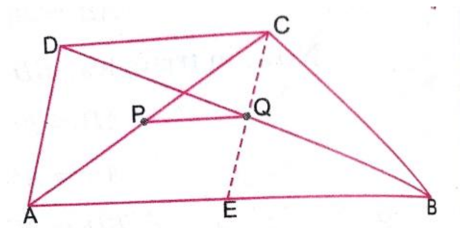

Fig. 8.49

Sol. Let ABCD be a trapezium in which AB||DC, and let P and Q be the mid-points of the diagonals AC and BD respectively.

Join CQ and produce it to meet AB at E.

In ΔCDQ and ΔEBQ, we have

DQ = BQ (∵ Q is mid-point of BD)

∠DCQ = ∠BEQ (Alternate interior angles)

∠CDQ = ∠EBQ (Alternate interior angles)

∴ ΔCDQ ≅ ΔEBQ (AAS congruence criterion)

⇒ CQ = QE and CD = EB (CPCT)

Thus in ΔCAE, the points P and Q are the mid-point of AC and CE respectively.

∴ PQ||AE and PQ = $\frac{1}{2}$ AE

⇒ PQ||AB||DC

And PQ = $\frac{1}{2}$ AE = $\frac{1}{2}$ (AB – ED)

= $\frac{1}{2}$ (AB – DC) (∵ EB = DC)

Que 10. In a parallelogram ABCD, the bisector of ∠A also bisects BC at X. Prove that AD = 2AB.

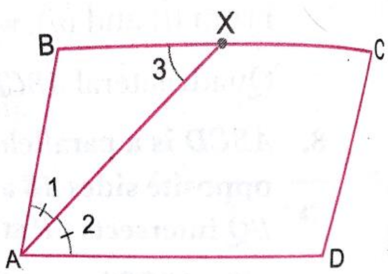

Fig. 8.50

Sol. As ABCD is a parallelogram,

∴ AD||BC

Also, AX is a transversal

∴ $\angle 3 = \angle 2$ (Alternate angles)

$\angle 1 = \angle 2$ (∵ AX is bisector of ∠A)

⇒ $\angle 1 = \angle 3$

In ΔABX, we have

$\angle 1 = \angle 3$ (Proved above)

⇒ AB = BX (Sides opposite to equal angles are equal)

⇒ $AB = \frac{1}{2} BC$ (X is the mid-point of BC)

Also, AD = BC (Opposite sides of parallelogram are equal)

⇒ $AB = \frac{1}{2} AD$ ⇒ 2AB = AD Hence Proved.

Que 11. AD is the median of ΔABC. E is mid-point of AD. BE produced to meet AC at F. Show that AF = $\frac{1}{3}$ AC.

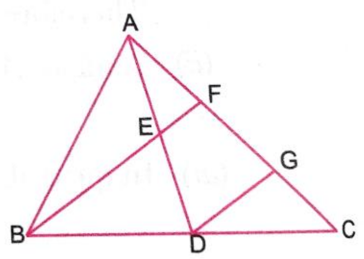

Fig. 8.51

Sol. Draw DG||BF

In ΔBFC,

D is the mid-point of BC (∵ AD is median)

DG||BF (By construction)

⇒ G is mid-pointy of FC (By the converse if mid-point theorem)

⇒ CG = GF ... (i)

In ΔADG, E is mid-point of AD

DG||EF

⇒ F is mid-point of AG ⇒ AF = GF

From (i) and (ii), we have

AF = GF = CG

Now, AC = AF + FG + GC

⇒ AC = 3AF ⇒ AF = $\frac{1}{3}$ AC

Que 12. E and F are respectively the mid-points of the non-parallel sides AD and BC of A trapezium ABCD. Prove that EF||AB and EF = $\frac{1}{2}$ (AB + CD).

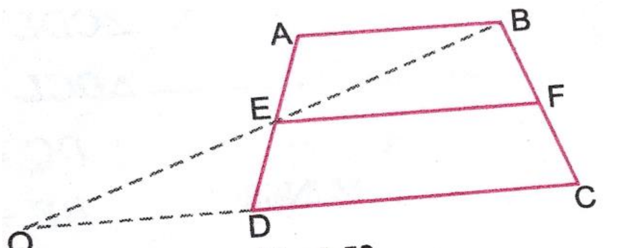

Fig. 8.52

Sol. Given: AB||Cd and E, F are the mid-point of sides AD and BC respectively.

To Prove: EF||AB, EF = $\frac{1}{2}$ (AB + CD)

Construction: Join BE and produce it to meet CD produced at Q.

Proof: In ΔBQC

Since E and F are the mid-point of sides BQ and BC respectively.

∴ By mid-point Theorem,

EF||QC and EF = $\frac{1}{2}$ QC ... (i)

⇒ EF||DC

⇒ CD||AB (Given)

⇒ EF||AB

Now, in ΔAEB and ΔDEQ, we have

∠AEB = ∠DEQ (vertically opposite angles)

AE = ED (E is the mid-point of AD)

∠BAE = ∠EDQ (Alternate interior angles)

AB = QD (CPCT)

From (i) EF = $\frac{1}{2}$QC = $\frac{1}{2}$(QD + DC) = $\frac{1}{2}$(AB + CD) [Using (ii)]

Hence, EF = $\frac{1}{2}$(AB + CD)

HOTS (Higher Order Thinking Skills)

Que 1. In Fig. 8.53, ABCD is a parallelogram and E is the mid-point of AD. A line through D, drawn parallel to EB, meets AB produced at F and BC at L. Prove that

(i) AF = 2 DC **(ii) DF = 2 DL**

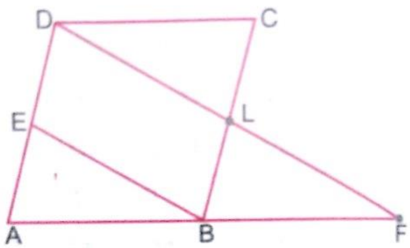

Fig. 8.53

Sol. (i) As EB\\ DL and ED\\ BL. Therefore, EBLD is a parallelogram.

∴ BL = ED = $\frac{1}{2}$ AD = $\frac{1}{2}$ BC = CL

Now in triangles DCL and FBL, we have

CL = BL (Proved above)

∠DLC = ∠FLB (Vertically opposite angles)

∠CDL = ∠BFL (Alternate angles)

∴ ΔDCL ≅ ΔFBL (By AAS congruence criterion)

∴ DC = BF and DL = FL

Now, BE = DC = AB

⇒ 2AB = 2DC ⇒ AF = 2DC

(ii) ∴ DL = FL ⇒ DF = 2DL

Que 2. PQ and RS are two equal and parallel line-segments. Any point M not lying on PQ or RS is joined to Q and S and lines through P parallel to QM and through R parallel to SM meet at N. prove that line segments MN and PQ are equal and parallel to each other.

Sol. Given: PQ = RS, PQ || RS, PN || QM, RN || MS

To prove: MN = PQ, MN || PQ

Proof: Since PQ = RS and PQ || RS

∴ PQSR is a parallelogram

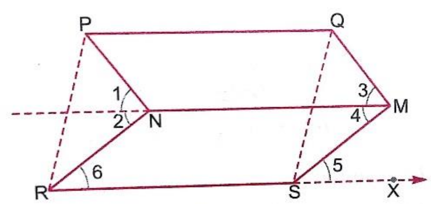

Fig. 8.54

⇒ PR = QS, PR || QS

Since PN || QM and MN is the transversal

∴ ∠1 = ∠3 (Corresponding angles) …(i)

Similarly, RN || MS

∴ ∠2 = ∠4 …(ii)

Adding (i) and (ii), we get

∠1 + ∠2 = ∠3 + ∠4 i.e., ∠PNR = ∠QMS

Again, ∠PRS = ∠QSX (Corresponding angles as PR || QS)

And ∠6 = ∠5 (Corresponding angles as RN || SM)

Subtracting the two equations, we get

∠PRS - ∠6 = ∠QSX - ∠5 I.e., ∠PRN = ∠QSM

Now, in ΔPNR and ΔQMS,

PR = QS (Opp. Sides of $||^{gm}$)

∠PNR = ∠QMS (Proved above)

∠PRN = ∠QSM

∴ ΔPNR ≅ ΔQMS (By AAS congruence criterion)

⇒ PN = QM (CPCT)

Also, PN = QM (Given)

∴ PNMQ is a parallelogram

⇒ PQ || MN and PQ = MN

Que 3. l, m and n are three parallel lines intersected by transversal p and q such that l, m and n cut-off equal intersepts AB and BC on p (Fig. 8.55). Show that l, m and n cut-off equal intercepts DE and EF on q also.

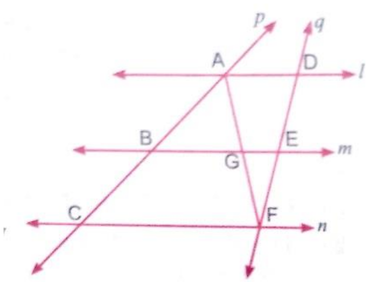

Fig. 8.55

Sol. We are given that AB = BC and have to prove that DE = EF.

Let us join A to F intersecting m at G.

The trapezium ACFD is divided into two triangles; namely ΔACF and ΔAFD.

In ΔACF, it is given that B is the mid-point of AC (AB = BC)

And BG || CF (Since m || n)

So, G is the mid-point of AF (By the converse of mid-point Theorem)

Now, in ΔAFD, we can apply the same argument as G is the mid-point of AF, GE || AD so E is the mid-point of DF,

i.e., DE = EF

In other words l, m and n cut-off equal intercepts on q also.

Unit - IV Geometry

Que 14. Teacher held two sticks AB and CD of equal length in her hands and marked their mid points M and N respectively. She then asked the students whether AM is equal to ND or not. Aprajita answered yes. Is Aprajita correct? State the axiom of Euclid that supports her answer.
Which values of Aprajita are depicted here?

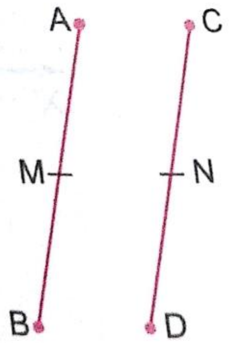

Fig. 5

Sol. Yes
Things which are halves of the same things are equal to one another.
Curiosity, knowledge, truthfulness.

Que 15. For her records, a teacher asked the students about their heights. Manav said his height is same as that of Arnav. Raghav also answered the same, way that his height is same as that of Arnav. She then asked the students to relate the height of Manav and Raghav. Arnav answered they both have same height. Is Arnav correct? If yes, state Euclid's axiom which supports his answer.
Which values of Arnav are depicted here?

Sol. Yes, Things which are equal to the same thing are equal to one another.
Knowledge, curiosity, truthfulness.

Que 16. The number of members of society A who participated in 'Say No to Crackers' campaign is double the number of members from society B. Also, the number of members from society C is double the number of members from society B. Can you relate the number of participants from society A and C? Justify your answer using Euclid's axiom.
Which values are depicted here?

Sol. The number of participants from society A and C is equal. Things which are double of the same thing are equal to one another.
Social service, helpfulness, cooperation, environmental concern.

Que 17. In a society, the number of persons using CNG instead of petrol for their vehicles has increased by 15 and now the number is 25. Form a linear equation to find the original number of persons using CNG and solve it using Euclid's axiom.
Which values are depicted in the question?

Sol. X + 15 = 25
⇒ $x + 15 - 15 = 25 - 15$ (Using Euclid's third axiom)
⇒ x = 10
Environmental care, responsible citizens, futuristic.

Que 18. Teacher asked the students to find the value of x in the following figure if l|| m. Shalini answered 35°. Is she correct? Which values are depicted here?

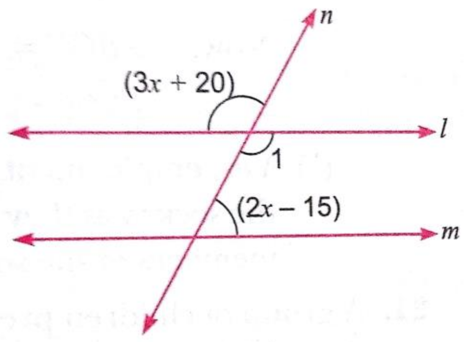

Fig. 6

Sol. ∠1 = 3x + 20 (Vertically opposite angles)
∴ 3x + 20 2x – 15 = 180 ° (Co-interior angles are supplementary)
⇒ $5x + 5 = 180°$ ⇒ $5x = 180° - 5°$
⇒ 5x = 175 ° ⇒ $x = \frac{175}{5} = 35°$

Yes, Knowledge, truthfulness.

Que 19. For spreading the message 'Save Environment Save Future' a rally was organised by some students of a school. They were given triangular cardboard pieces which they divided into two parts by drawing bisectors of base angles (say ∠B and ∠C) intersecting at O in the given figure. Prove that ∠BOC = $90 + \frac{1}{2}\angle A$
Which values are depicted by these students?

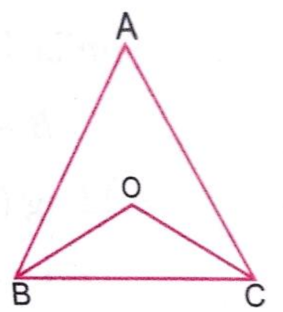

Fig. 7

Sol. In ΔABC, we have

$\angle A + \angle B + \angle C = 180°$ (∵ sum of the angles of a Δ is 180 °)

⇒ $\frac{1}{2}\angle A + \frac{1}{2}\angle B + \frac{1}{2}\angle C = \frac{180°}{2}$

⇒ $\frac{1}{2}\angle A + \angle 1 + \angle 2 = 90°$

∴ $\angle 1 + \angle 2 = 90° - \frac{1}{2}\angle A$ ....(i)

Now, in ΔOBC, we have:

$\angle 1 + \angle 2 + \angle BOC = 180°$ [∵ sum of the angles of Δ is 180 °]

⇒ $\angle BOC = 180° - (\angle 1 + \angle 2)$

⇒ $\angle BOC = 180° - (90° - \frac{1}{2}\angle A)$ [using (i)]

⇒ $\angle BOC = 180° - 90° + \frac{1}{2}\angle A$

∴ $\angle BOC = 90° + \frac{1}{2}\angle A$

Environmental care, social, futuristic.

Que 20. Three bus stops situated at A, B and C in the figure are operated by handicapped persons. These 3 bus stops are equidistant from each other. OB is the bisector of ∠ABC and OC is the bisector of ∠ACB.
(a) Find ∠BOC.
(b) Do you think employment provided to handicapped persons is important for the development of the society? Express your views with relevant points.

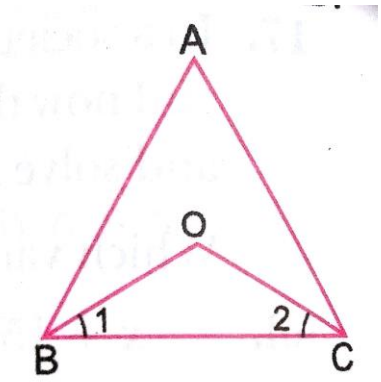

Fig. 9

Sol. (a) Since, A, B, C are equidistant from each other.

∴ ∠ABC is an equilateral triangle.

⇒ ∠ABC = ∠ABC = 60°

⇒ $\angle OBC = \angle OCB = \frac{1}{2} \times 60° = 30°$ (∵ OB and OC are angle bisectors)

Now, ∠BOC = 180° - ∠OBC - ∠OCB (Using angle sum property of triangle)

⇒ ∠BOC = 180°- 30°-30° = 120°

(b) Yes, employment provided to the handicapped persons is important for the development of the society as they would become independent, self-reliant, confident, social, helpful and useful members of the society.

Que 21. A group of children prepared some decorative pieces in the shape of a star for the orphans in an orphanage. Show that $\angle A + \angle B + \angle C + \angle D + \angle E + \angle F = 360°$
Which values of the children are depicted here?

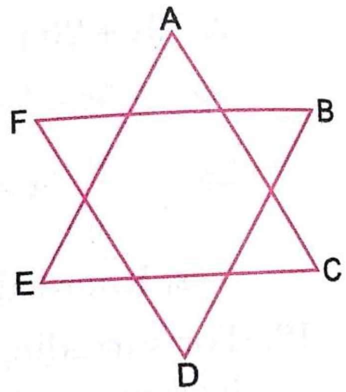

Fig. 10

Sol. In ΔAEC,
$\angle A + \angle E + \angle C = 180°$ … (i) (Angle sum property of a triangle)

Similarly, in ΔBDF,
$\angle B + \angle D \angle F = 180°$ …. (ii)

Adding (i) and (ii), we get
$\angle A + \angle B + \angle C + \angle D + \angle E + \angle F = 360°$
Social, caring, cooperative, hardworking.

Que 22. For annual day, Sakshi and Nidhi were asked to make one rangoli each on two different places. They started it with triangles (say ABC and ΔPQR) and their medians (AM and PN). If two sides (AB and BC) and a median (AM) of one triangle are respectively equal to two sides (PQ and QR) and a median (PN) of other triangle, prove that the two triangles (ΔABC and ΔPQR) are congruent.
Which values of the girls are depicted here?

Sol. In ΔABC and ΔPQR

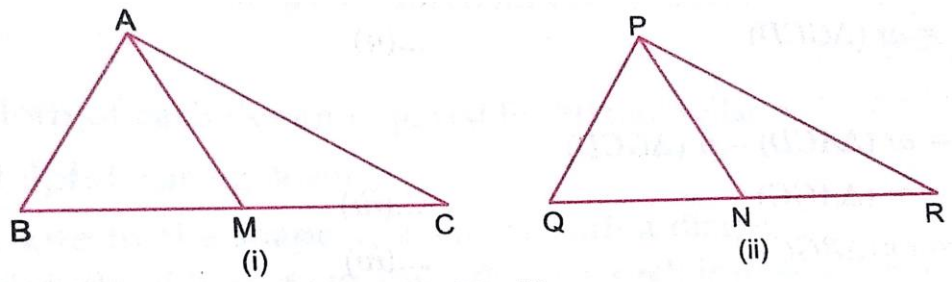

Fig. 11

BC = QR

$\Rightarrow \quad \frac{1}{2}BC = \frac{1}{2}QR$

$\Rightarrow$ BM = QN

In triangle ABM and PQN, we have

AB = PQ	(Given)
BM = QN	(Proved above)
AM = PN	(Given)

$\therefore \quad \Delta ABM \cong \Delta PQN$ (SSS congruence criterion)

$\Rightarrow \quad \angle B = \angle Q$ (CPCT)

Now, in triangles ABC and PQR, we have

AB = PQ	(Given)
$\angle B$ = ∠Q	(Proved above)
BC = QR	(Given)

∴ ΔABC ≅ ΔPQR (SSS congruence criterion)

Participation, beauty, hardworking.

Que 23. Triangular pieces of cardboards were cut out by some people who were organising 'No Pollution' campaign in their area. If the three angles of one cutout are respectively equal to the three angles of the other cutout, can we say the two cutouts are congruent? Justify your answer.
Which values of these people are depicted here?

Sol. The two cutouts may not be congruent. For example all equilateral triangles have equal angles but may have different sides.
Environmental concern, cooperative, caring, social.

Que 24. Anya wants to prepare a poster on education of girlchild for a campaign. She takes a triangular sheet and divides it into three equal parts by drawing its medians which intersect at the point G (see Fig. 12).

Show that ar (ΔAGC) = ar (ΔAGC) = ar (ΔAGB) = (ΔBGC) = $\frac{1}{3}ar\ (\Delta ABC)$

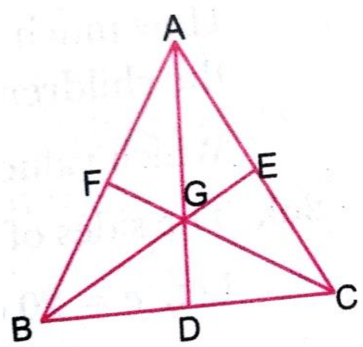

Fig. 12

Do you think education of a girl child is important for the development of a society? Justify your answer.

Sol. Given: A ΔABC in which medians AD, BE and CF intersects at G.

Proof: (ΔAGB) = ar (ΔBGC) = ar (ΔCGA) = $\frac{1}{3}$ ar (ΔABC)

Proof: In ΔABC, AD is the median. As a median of a triangle divides it into two triangles of equal area.

∴ ar (ΔABD) = ar (ΔACD) … (i)

In ΔGBC, GD is the median

∴ aq (ΔGBD) = ar (ΔGCD) …. (ii)

Subtracting (ii) from (i), we get

ar (ΔABD) – ar (ΔGBD) = ar (ACD) – ar (ΔGCD)

ar (ΔAGB) = ar (ΔAGC) … (iii)

Similarly, ar (ΔAGB) = ar (ΔBGC) … (iv)

From (iii) and (iv), we get

ar (ΔAGB) = ar (ΔBGC) = ar (ΔAGC) …. (v)

But, ar (ΔAGB) + ar (ΔBGC) + ar (ΔAGC) = ar (ΔABC) …. (vi)

From (v) and (vi), we get

3 ar (ΔAGB) = ar (ΔABC)

⇒ ar (ΔAGB) = $\frac{1}{3} ar(\Delta ABC)$

Hence, ar (ΔAGB) = ar (ΔAGC) = ar (ΔBGC) = $\frac{1}{3}$ ar (ΔABC)

Yes, for the development of a society, education of each girl child is essential. An educated society always progresses.