Very Short Answer Type Questions

[1 mark]

Que 1. If a triangle and a parallelogram are on the same base and between the same parallels, then find the ratio of the area of the triangle to the area of parallelogram.

Sol. The area of a triangle is half the area of a parallelogram, if they are on the same base and between the same parallel lines.

$\therefore \frac{Area\ of\ Triangle}{Area\ of\ parallelogram} = \frac{1}{2} = 1:2$

Que 2. The area of a rhombus is 10 cm^2. If one of its diagonal is 4 cm, then find the other diagonal.

Sol. Area of a rhombus = $\frac{1}{2}d_1d_2$

$\Rightarrow\ 10 = \frac{1}{2}x\ 4\ xd_2$

$\Rightarrow$ d_2 = 5 cm

Que 3. In Fig. 9.6, ABCD is a parallelogram and P is the point of intersection of its diagonals AC and BD. If the area of Δ APB is 10 cm^2, then find the area of parallelogram ABCD.

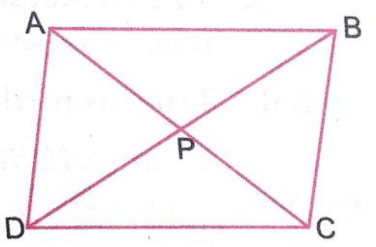

Fig. 9.6

Sol. ar (ΔAPB) = $\frac{1}{4}ar(\|^{gm}\ ABCD)$

$\Rightarrow$ ar ($\|^{gm}$ ABCD) = 4 x 10 = 40 cm^2

Que 4. What is the area of trapezium?

Sol. Area of trapezium = $\frac{1}{2}$ x Sum of the parallel sides x height.

Que 5. What is the formula of area of triangle?

Sol. Area of triangle = $\frac{1}{2}$ x base x altitude.

Que 6. The area of parallelogram ABCD is 25 cm^2. What is the area of ∆ ABCD?

Sol. Area of ∆ABC = $\frac{25}{2}$ = 12.5 cm^2 (∵ Area of ∆ABC = $\frac{1}{2}$ Area of ▫ ABCD)

Short Answer Type Questions – I

[2 marks]

Que 1. The diagonal of a square is 10 cm. Find its area.

Sol. Diagonal of a square = $\sqrt{2a}$

⇒ $10 = \frac{10}{\sqrt{2}}$

Area of the square = $a^2 = \left(\frac{10}{\sqrt{2}}\right)^2 = \frac{100}{2} = 50\ cm^2$

Que 2. The area of a stapezium is 39 cm^2. The distance between its parallel sides is 6 cm. If one of the parallel sides is 5 cm, then find the other parallel side.

Sol. Area of a trapezium = $\frac{1}{2}$ x sum of parallel sides x height

$\Rightarrow\ 39 = \frac{1}{2}(5 + x)\ x\ 6\ (Let\ other\ side\ be\ x)$

$\Rightarrow\ 13 = 5 + x\ \Rightarrow x\ =\ 8\ cm$

Que 3. In parallelogram PQRS, PQ = 10 cm. The altitudes corresponding to the sides PQ and SP are respectively 6 cm and 8 cm. Find SP.

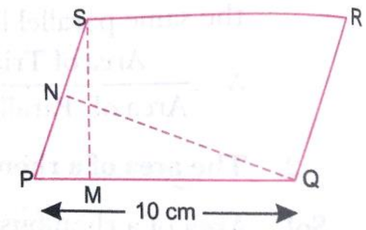

Fig. 9.7

Sol. Area of parallelogram = base x height

∴ $ar(\|^{gm}\ PQRS)\ =\ PQ\ \times\ SM$

$$=\ 10\ \times\ 6\ =\ 60\ cm^2\ \ ....(i)$$

Also ar $(\|^{gm}\ PQRS)\ =\ SP \times QN$

$=\ SP\ \times\ 8$ .....(ii)

From (i) and (ii), we have

$60 = SP \times 8\ \Rightarrow\ SP\ =\ \frac{60}{8} =\ 7.5\ cm.$

Que 4. In Fig. 9.8, if P is any point on the median AD of a ΔABC, Then or (ΔABP) = ar (ΔACP). Write true or false and justify your answer.

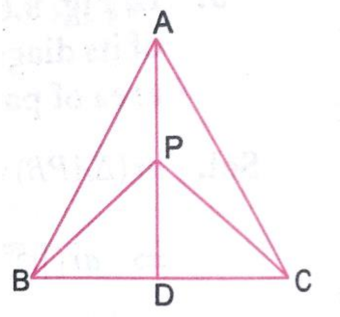

Fig. 9.8

Sol. True. As median of a triangle divides it into two triangles of equal area

∴ ar (ΔADB) = ar (ΔADC) …… (i)

and ar (ΔPDB) = ar (ΔPDC) …… (ii)

Subtracting (ii) from (i), we have

ar (ΔADB) – ar (ΔPDB) = ar (ΔADC) – ar (ΔPDC)

ar (ΔABP) = ar (ΔACP)

Que 5. In ΔABC, if L and M are the points on AB and AC, respectively such that LM || BC. Prove that ar (ΔLOB) =ar (ΔMOB).

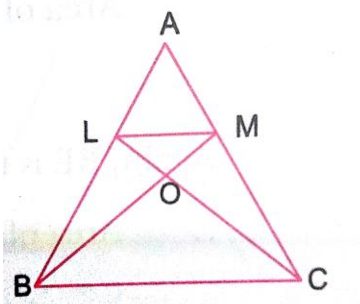

Fig. 9.9

Sol. Given in ΔABC, L and M are points on AB and AC respectively such that LM || BC.

To Prove: ar (ΔLOB) = ar (ΔMOC)

Proof: We know that, triangle on the same base and between the same parallels are equal in area.

Hence ΔLBC and ΔMBC lie on the same base BC and between the same parallel BC and LM.

So, ar (ΔLBC) = ar (MBC)

$\Rightarrow\ ar\ (\Delta LOB)\ + ar(\Delta BOC)\ = ar(\Delta MOC)\ + ar(\Delta BOC)$

On eliminating ar (ΔBOC) from both sides, we get

ar (ΔLOB) =ar (ΔMOC) Hence proved.

Que 6. Prove that median of a triangle divides in into two triangles of equal area.

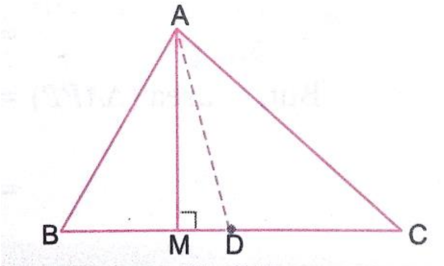

Fig. 9.10

Sol. Draw AM ⊥ BC, as AD is median

$\therefore\ BD = DC$

$$\frac{ar(\Delta ABD)}{ar(\Delta ACD} = \frac{\frac{1}{2}BD \times AM}{\frac{1}{2}DC \times AM} = \frac{\frac{1}{2}BD \times AM}{\frac{1}{2}BD \times AM} = 1$$

∴ ar (ΔABD) = ar (ΔACD)

Que 7. Prove that median of a triangle divides it into two triangles of equal area.

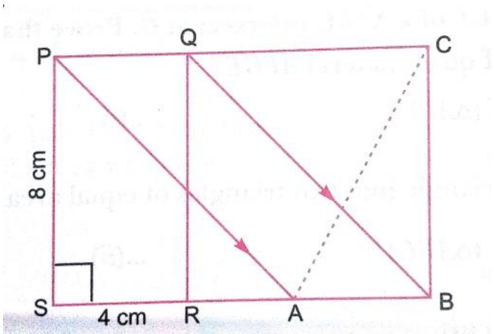

Fig. 9.11

Sol. Area of parallelogram PQRS = Area Of parallelogram PQBA

$[Parallelograms\ on\ the\ same\ base\ PQ\ and\ between\ the\ same\ parallels\ PC\ and\ SB]$

8 × 4 = Area of parallelogram PQBA

32 cm^2 = Area of parallelogram PQBA

Again,

∵ Area of parallelogram PQBA = 2(Area of ΔABC)

[Area of triangle is half of area of parallelogram, if they are on the same base and between the same parallel.]

∴ 16 cm^2 = Area of ΔABC

Que 8. D and E are mid-Point of BC hence AD respectively. If area of ΔABC = 10 cm^2, find area of ΔEBD.

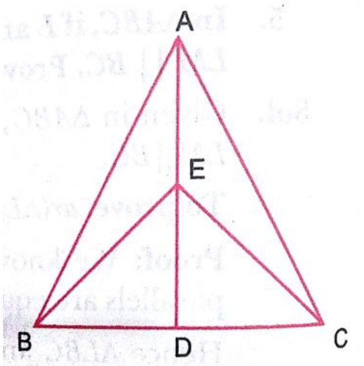

Fig. 9.12

Sol. ∵ D is the midpoint of BC hence AD is the median.

∴ Area of ΔABD = $\frac{1}{2}$ area of ΔABC [Median divides a triangle into two triangles of equal area]

Area of ΔABD = $\frac{1}{2} \times 10$ cm^2

= 5 cm^2

Again, BE in the median of ΔABD.

∴ Area of ΔEBD = $\frac{1}{2}$ area of ΔABD

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

= 2.5 cm^2

Que 9. ABCD is a parallelogram. P is any point on CD. If area (ΔDPA) = 15 cm^2 and area (ΔAPC) = 20 cm^2, find the area (ΔAPB).

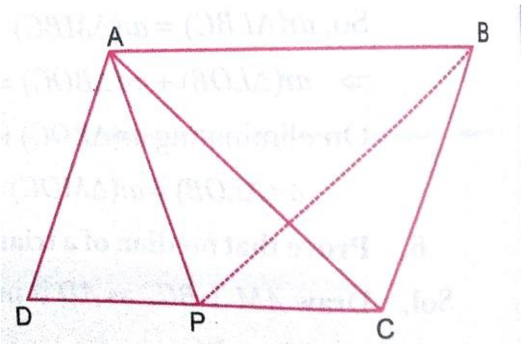

Fig. 9.13

Sol. area (ΔADC) = area (ΔADP) + area (ΔAPC)

= 15 + 20

$= 35\ cm^2$

But, area (ΔAPB) = $\frac{1}{2}$ (area of parallelogram ABCD)

= $\frac{1}{2}$ [2 (area of ΔADC)]

[As diagonal divides a parallelogram into equal areas]

$= \frac{1}{2} \times 2\,(35) = 35\ cm^2$

Que 10. The medians BE and CF of a ΔABC interest at G. prove that area (ΔGBC) = area of quadrilateral AFGE

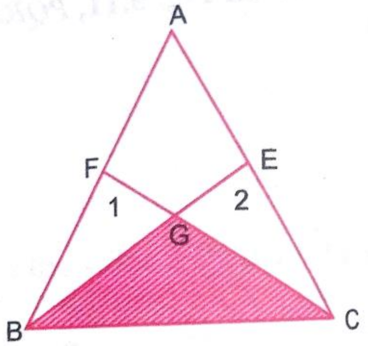

Fig. 9.14

Sol. area (ΔFBC) = $\frac{1}{2}$ area (ΔABC) …..(i)

[Median divides the triangles into triangles of equal area]

area (ΔEBC) = $\frac{1}{2}$ area (ΔABC) …….(ii)

From equation (i) and (ii),

area (ΔFBC) = area (ΔEBC)

subtract area (ΔBGC) from both sides

area (ΔFBC) – area (ΔBGC) = area (ΔEBC) – area (ΔBGC)

∴ area (ΔFGB) = area (ΔEGC) ……..(iii)

area (ΔABE) = area (ΔBEC) [∵ BE is median]

area (ΔBFG) + area (Quadrilateral AFGE) = area (ΔBGC) + area (ΔGEC)

⇒ area (Quadrilateral AFGE) = area (ΔBGC) [From equation (iii)]

Que 11. ABC and BDE are two equilateral triangles such that D is the mid-point of BC. Then prove that area (ΔBDE) = $\frac{1}{4}$ area (ΔABC)

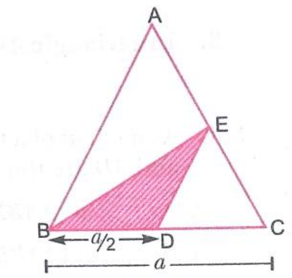

Fig. 9.15

Sol. Let the side of triangle, BC = a ⇒ BD = $\frac{a}{2}$

Area (ΔBDE) = $\frac{\sqrt{3}}{4}\left(\frac{a}{2}\right)^2$

$= \frac{\sqrt{3}}{4}\frac{a^2}{4} = \frac{1}{4}\left(\frac{\sqrt{3}}{4}a^2\right)$

area (ΔBDE) = $\frac{1}{4}$ area (ΔABC)

Que 12. PQRS is parallelogram whose area is 180 cm^2 and A is any point on the diagonal Qs. The area of ΔASR = 90 cm^2. Find this statement is true or false.

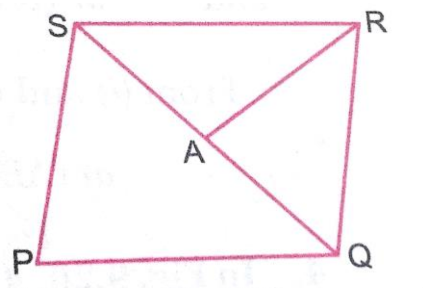

Fig. 9.16

Sol. As diagonal of the parallelogram divides it into triangles equal area.

∴ area (ΔSRQ) = $\frac{1}{2}$ area (PQRS)

area (ΔSRQ) = $\frac{1}{2} \times 180$

= 90 cm^2

But area (ΔASR) = 90 cm^2 (Given)
This is not possible unless area (ΔSRQ)
So, the given statement is false.

Short Answer Type Questions – II

[3 marks]

Que 1. O is any point on the diagonals PR of parallelogram PQRS. Prove that ar (ΔPSO) = ar (ΔPQO).

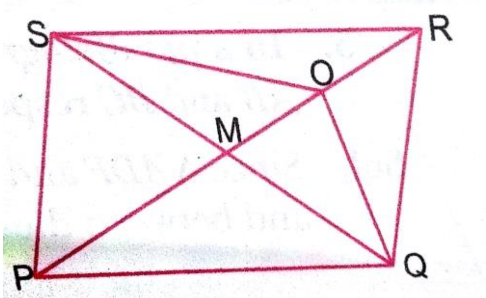

Fig. 9.17

Sol. Join SQ. Since diagonals of a parallelogram bisect each other. Therefore, M is the mid-point of PR as well as SQ.

In ΔSOQ, OM is a median

∴ (Δ SOM) = ar (ΔQOM) .....(i)

In ΔSPQ, PM is the median

∴ ar (ΔPSM) = ar (ΔPQM) ......(ii)

Adding (i) and (ii), we get

ar (ΔSOM) + ar (ΔPSO) = ar (ΔPQO)

ar (ΔPSO) = ar (ΔPQO)

Que 2. In Fig. 9.18, x and Y are points on the side LN of the triangle LMN such that LX = XY = YN. Through X, a line is drawn parallel to LM to meet MN at Z. Prove that ar (ΔLZY) = ar (□MZYX).

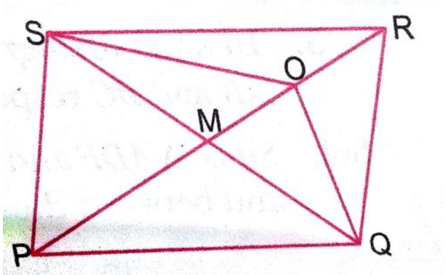

Fig. 9.17

Sol. Since, ΔLXZ and ΔMXY lie on the same base XZ and between the same parallels XZ and LM.

∴ ar (ΔLXZ) = ar (ΔMXZ)

Adding ar (ΔXYZ) to both sides, we get

ar (ΔLXZ) + ar (ΔXYZ) = ar (ΔMXZ) + ar (ΔXYZ)

⇒ ar (ΔLYZ) = ar (□ MZYX)

Que 3. In a triangle ABC, E is the mid-point of median AD. Show that ar (ΔBED) = $\frac{1}{4}$ ar (ΔBED) = $\frac{1}{4}$ ar (ΔABC).

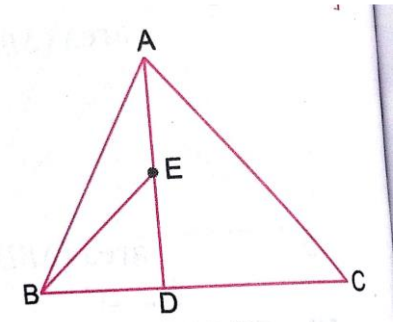

Fig. 9.19

Sol. As median of a triangle divides it into two triangles of equal area and BE and AD are the is a medians of the ΔABD and ΔABC respectively

∴ ar (ΔABD) = ar (ΔADC)

⇒ $ar\ (\Delta BED)\ = \frac{1}{2} ar\ (\Delta ABD)$ …… (i)

And ar (ΔABD) = $\frac{1}{2}$ ar (ΔABC) ……. (ii)

from (i) and (ii), we have

ar (ΔBED) = $\frac{1}{2}\left(\frac{1}{2} ar\ (\Delta ABC)\right) = \frac{1}{4} ar\ (\Delta ABC)$

Que 4. In Fig. 9.20, AP||BQ|| CR. Prove that ar (ΔAQC) = ar (ΔPBR).

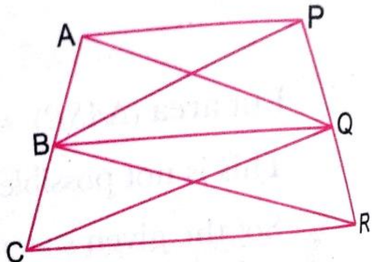

Fig. 9.20

Sol. Since Δ ABQ and ΔPBQ are on the same base BQ and between the same parallels AP and BQ.

∴ ar (Δ ABQ) = Ar (ΔPBQ) …..(i)

Similarly, ΔBCQ and ΔBRQ are on the same base BQ and between the same parallels BQ and CR.

∴ ar (ΔBCQ) = ar (ΔBRQ) …..(ii)

Adding (i) and (ii), we get

ar (ΔABQ) + ar (ΔBCQ) = ar (ΔPBQ) + ar (ΔBRQ)

⇒ ar (ΔAQC) = ar (ΔPBR)

Que 5. In a parallelogram, ABCD, E, F are any two points on the sides AB and BC respectively. Show that ar (ΔADF) = ar (ΔDCE)

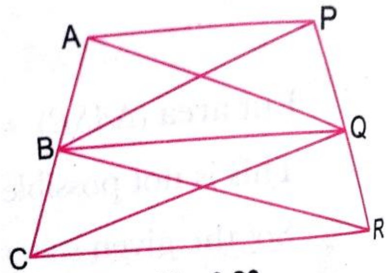

Fig. 9.20

Sol. Since ΔADF and parallelogram ABCD are on the same base AD and between the same parallels AD and BC.

$\therefore\ ar\ (\Delta ADF)\ =\frac{1}{2}ar\ (||^{gm}\ ABCD)$ ….. (i)

Also, ΔDCE and $||^{gm}$ ABCD are on the same base DC and between the same parallels DC and AB.

$\therefore$ ar (ΔDCE) = $\frac{1}{2}ar\ (||^{gm}\ ABCD)$ …..(ii)

From (i) and (ii), we get
ar (ΔADF) = ar (ΔDCE)

Que 6. ABCD is a trapezium in which AB || DC. DC is produced to E such that CE = AB, Prove that ar (ΔABD) = (ΔBCE).

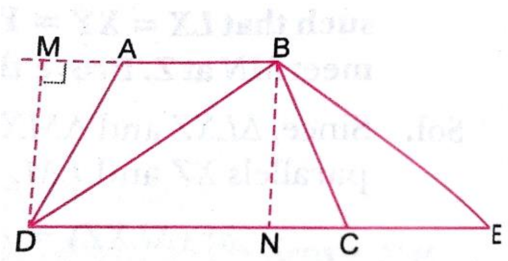

Fig. 9.22

Sol. Produce BA to M Such that DM ⊥ BM and draw BN ⊥ DC.

Now, ar (ΔABD) = $\frac{1}{2}(AB \times DM)$ …..(i)

Ar (ΔBCE) = $\frac{1}{2}$ (CE × BN) …..(ii)

Since, triangle ABD and BCE are between the same parallels, Therefore,
DM = BN …..(iii)
Also, AB = CE (Given) …..(iv)

From (iii) and (iv), we get

$$\frac{1}{2}(AB \times DM) = \frac{1}{2}(CE \times BN)$$

⇒ ar (ΔABD) = ar (ΔBCE) (Using (i) and (ii)

Que 7. In Fig. 9.23, ABCD is a parallelogram in which BC is produced to E such that CE = BC. AE intersects CD at F. If area of ΔBDF = 3 cm^{2}, find the area of parallelogram ABCD.

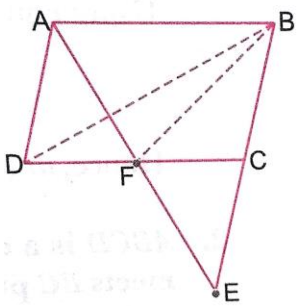

Fig. 9.23

Sol. In ΔADF and ΔECF, we have

$\angle ADF = \angle ECF$ (Alternate interior angles)

AD = CE (∵ AD=BC and =CE)

$\angle DFA = \angle CFE$ (Vertically opposite angles)

∴ $\Delta ADF \cong \Delta ECF$ (AAS congruence criterion)

⇒ $ar(\Delta ADF) = ar(\Delta ECF)$

Also, DF = CF (CPCT)

⇒ BF is the median in ΔBCD

⇒ ar (ΔBCD) = 2 ar (ΔBDF)

⇒ ar (ΔBCD) = 2×3 cm^2 = 6 cm^2

ar(||^{gm} ABCD) = 2 ar (ΔBCD)

2 × 6 cm^2 = 12 cm^2

Long Answer Type Questions

[4 Marks]

Que 1. In Fig. 9.24, ABCD is a parallelogram. Point P and Q on BC trisects BC. Prove that ar (ΔAPQ) = (ΔDPQ) = $\frac{1}{6}$ ar ($||^{gm}$ ABCD).

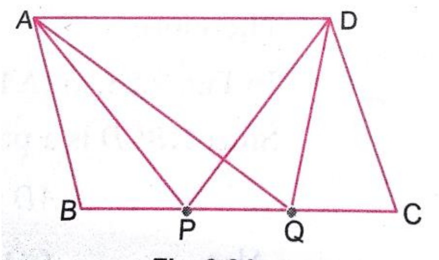

Fig. 9.24

Sol. Through P and Q, draw PR and QS parallel to AB [Fig. 9.25]. Now, PQSR is a parallelogram and its base PQ = $\frac{1}{3}$ BC.

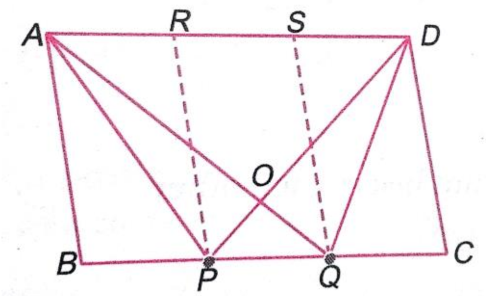

Fig. 9.25

Since ΔAPQ and ΔDPQ are on the same base PQ, and between the same parallel AD and BC.

∴ ar (ΔAPQ) = ar (ΔDPQ) …….(i)

Since ΔAPQ and ΔPQSR are on the same base PQ, and between same parallel PQ and AD.

∴ ar (ΔAPQ) = $\frac{1}{2}$ ar ($||^{gm}$ PQRS) …….(ii)

Now, $$\frac{ar(||^{gm}\ ABCD)}{ar(||^{gm}\ PQRS)} = \frac{BC\times height}{PQ\times height}$$

$$= \frac{3PQ}{PQ}\ (\because\ height\ of\ the\ two\ ||^{gm}\ is\ same)$$

⇒ $ar(||^{gm}\ PQRS) = \frac{1}{3}ar(||^{gm}\ ABCD)$ ……..(iii)

Using equation (ii) and (iii), we have

$$ar\ (\Delta APQ) = \frac{1}{2} ar(||^{gm}\ PQRS) = \frac{1}{2} \times \frac{1}{3} ar(||^{gm}\ ABCD)$$

Hence, ar(ΔAPQ) = ar (ΔDPQ) = $\frac{1}{6} ar\ (||^{gm}\ ABCD)$. [Using (i)]

Que 2. ABCD is a quadrilateral [Fig. 9.26]. Aline through D, parallel to AC meets BC produced in P. Prove ar (ΔABP) = ar (quad. ABCD).

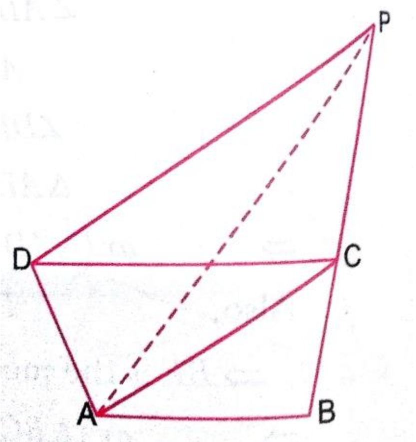

Fig. 9.26

Sol. Given: A quadrilateral ABCD in which DP||AC
To Prove: ar (ΔABP) = ar (quad. ABCD)
Proof: ΔACP and ΔACD are on same base AC and between same parallels AC and DP.
⇒ ar (ΔACP) = ar (ΔACD)
Adding, ar (ΔABC) on both sides,
⇒ ar (ΔABC) + ar (ΔACP) = ar (ΔABC) + ar (ΔACD)
ar (ΔABP) = (quad. ABCD)

Que 3. In Fig. 9.27, ABCD is a parallelogram and BC is produced to point Q such that BC = CQ. If AQ intersects DC at P. Show that ar (ΔBPC) = ar (ΔDPQ).

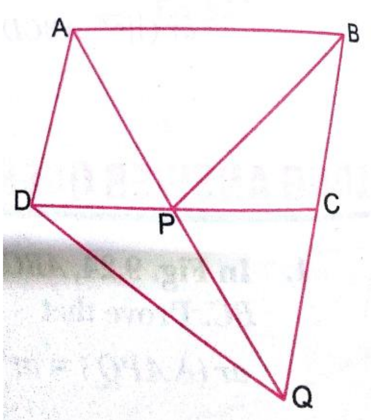

Fig. 9.27

Sol. Join AC. As triangle APC and BPC are on the same base PC and between the same parallels PC and AB.

Therefore,

In Fig. 9.28, ar (ΔAPC) = ar (ΔBPC) ….(i)

Since ABCD is a Parallelogram,

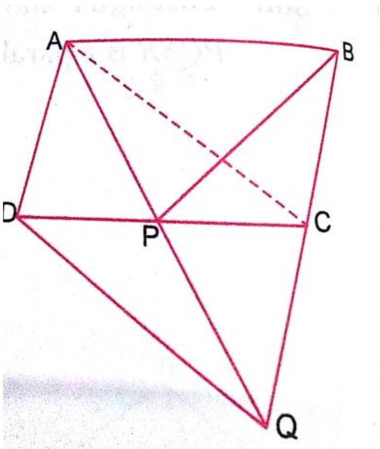

Fig. 9.28

∴ AD = BC (Opposite sides of parallelogram)

Also, CQ = BC (Given)

⇒ AD = CQ

Now, AD||CQ and AD=CQ

∴ ACQD is a parallelogram.

As diagonals of a parallelogram bisect each other.

∴ AP = PQ and CP = DP

In ΔAPC and ΔDPQ, we have

AP = PQ

∠APC = ∠DPQ Vertically opposite angles)

and PC = PD

∴ ΔAPC ≅ ΔDPQ (SAS congruence criterion)

⇒ ar (ΔAPC) = ar (ΔDPQ) ……(ii)

From (i) and (ii), we get

ar (ΔBPC) = ar (ΔDPQ)

HOTS (Higher Order Thinking Skills)

Que 1. In Fig. 9.29, ABCD and AEFD are two parallelograms. Prove that ar (ΔPEA) = ar (ΔQFD).

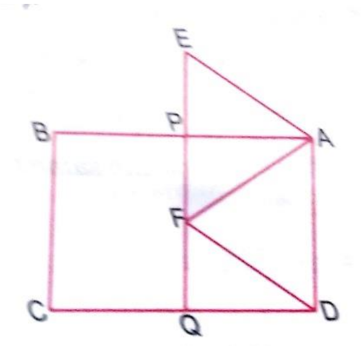

Fig. 9.29

Sol. In triangles PEA and QFD, we have

	∠APE = ∠DQF	(Corresponding angles)
	AE = DF	(Opposite sides of ||^{gm} AEFD)
	∠AEP = ∠DFQ	(Corresponding angles)
∴	ΔPEA ≅ ΔQFD	(AAS congruence criterion)

As congruent triangles have equal area.

∴ ar (ΔPEA) = ar (ΔQFD)

Que 2. In Fig. 9.30, ABCDE is any pentagon. BP drawn parallel to AC meets DC produced at P and EQ drawn parallel to AD meets CD produced at Q. Prove that ar(ABCDE) = ar(APQ).

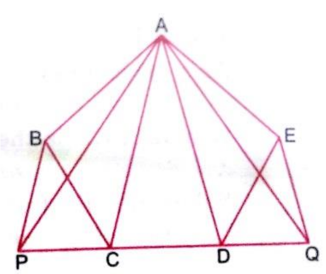

Fig. 9.30

Sol. Since, ΔABC and ΔAPC are on the same base AC and between the same parallels BP and AC

∴ ar (ΔABC) = ar (ΔAPC) …(i)

(Triangles on the same base and between the same parallels are equal in area)

Similarly, EQ || AD

∴ ar (ΔAED) = ar (AQD) …(ii)

Adding (i) and (ii), and then adding ar (ΔACD) to both the sides, we get

Ar (ΔABC) + ar (ΔAED) + ar (ΔACD) = ar (ΔAPC) + ar (ΔAQD) + ar (ΔACD)

⇒ ar (ABCDE) = ar (APQ).

Que 3. In Fig. 9.31, X and Y are the mid-point of AC and AB respectively, QP || BC and CYQ and BXP are straight lines. Prove that ar (ΔABP) = ar (ΔACQ).

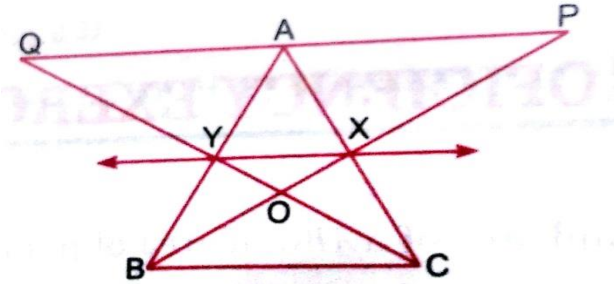

Fig. 9.31

Sol. As X and Y are the mid-point of AC and AB respectively.

∴ XY || BC

Since Δ BYC and Δ BXY are on the same base BC and between the same parallels XY and BC.

∴ ar (Δ BYC) = ar (Δ BXC)

⇒ ar (Δ BYC) – ar (Δ BOC) = ar (Δ BXC) – ar (Δ BOC)

⇒ ar (Δ BOY) = ar (Δ COX)

⇒ ar (Δ BOY) + ar (Δ XOY) = ar (Δ COX) + ar (Δ XOY)

⇒ ar (Δ BXY) = ar (Δ CXY) …(i)

Since quadrilaterals XYAP and XYQA are on the same base XY and between the same parallels XY and PQ.

∴ ar (XYAP) = ar (XYQA) …(ii)

Adding (i) and (ii), we get

Ar (Δ BXY) + ar (XYAP) = ar (Δ CXY) + ar (XYQA)

⇒ ar (Δ ABP) = ar (Δ ACQ)

Que 4. If the medians of a ΔABC intersect at G. Show that
Ar (ΔAGC) = ar (ΔAGB) = ar (ΔBGC) = $\frac{1}{3}$ ar (ΔABC)

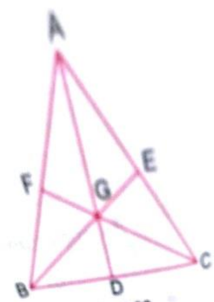

Fig. 9.32

Sol. Give: A Δ ABC in which medians AD, BE and CF intersect at G.

To prove:

Ar (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
∴ Ar (ΔGBD) = ar (ΔGCD) …(ii)

Subtracting (ii) from (i), we get
Ar (ΔABD) – ar (ΔGBD) = ar (ΔACD) – ar (ΔGCD)
ar (AGB) = 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
3ar (Δ AGB) = ar (Δ ABC)

⇒ ar (Δ AGB) = $\frac{1}{3}$ ar (Δ ABC)

Hence, ar (Δ AGB) = ar (Δ AGC) = ar (Δ BGC) = $\frac{1}{3}$ ar (Δ ABC)

Value Based Questions

Que 1. 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?

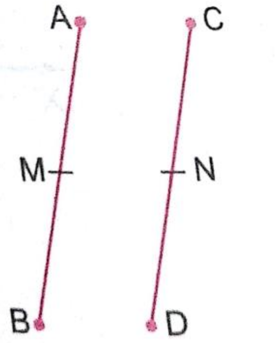

Fig. 5

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

Que 2. 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 3. 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 4. 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 5. 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?

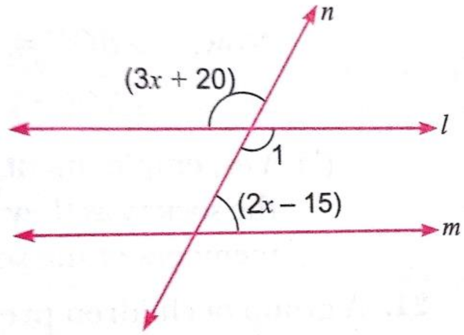

Fig. 6

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 6. 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?

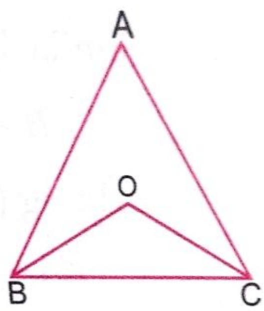

Fig. 7

Sol. In ΔABC, we have
∠A + ∠B + ∠C = 180 ° (∵ sum of the angles of a Δ is 180 °)

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

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

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

Now, in ΔOBC, we have:

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

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

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

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

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

Environmental care, social, futuristic.

Que 7. 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.

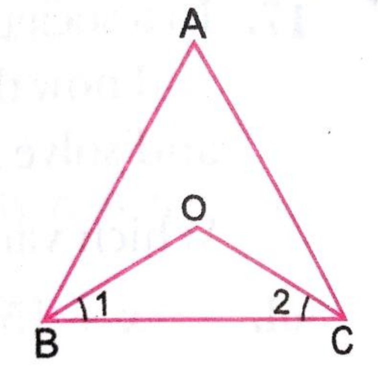

Fig. 9

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

$\therefore \quad \angle ABC$ is an equilateral triangle.

$\Rightarrow \quad \angle ABC = \angle ABC = 60°$

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

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

$\Rightarrow \quad \angle BOC = 180° - 30° - 30° = 120°$

(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 8. 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?

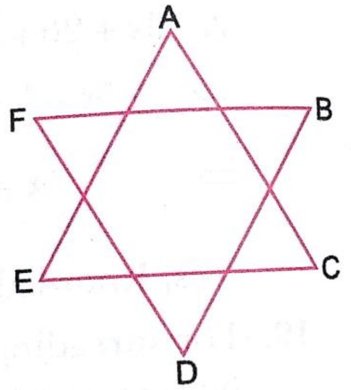

Fig. 10

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 9. 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

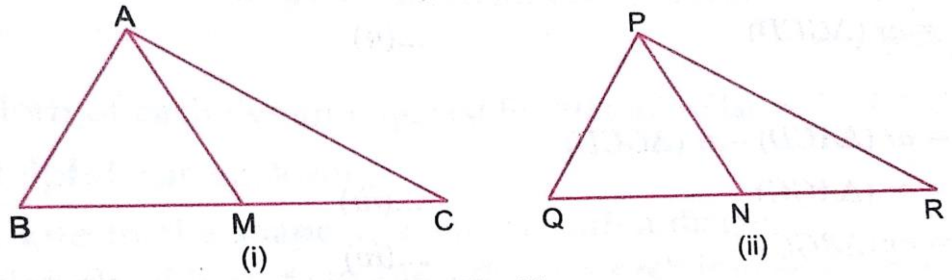

Fig. 11

BC = QR

⇒ $\frac{1}{2}BC = \frac{1}{2}QR$

⇒ BM = QN

In triangle ABM and PQN, we have

AB = PQ (Given)

BM = QN (Proved above)

AM = PN (Given)

∴ $\Delta ABM \cong \Delta PQN$ (SSS congruence criterion)

⇒ $\angle B = \angle Q$ (CPCT)

Now, in triangles ABC and PQR, we have

AB = PQ (Given)

$\angle B = \angle Q$ (Proved above)

BC = QR (Given)

∴ ΔABC ≅ ΔPQR (SSS congruence criterion)

Participation, beauty, hardworking.

Que 10. 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 11. 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) = $\frac{1}{3}ar\ (\Delta ABC)$

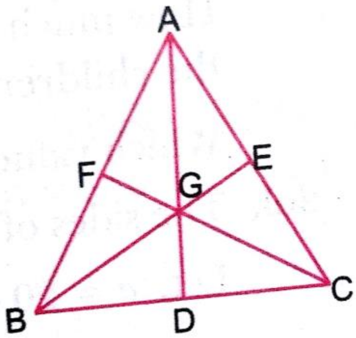

Fig. 12

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.