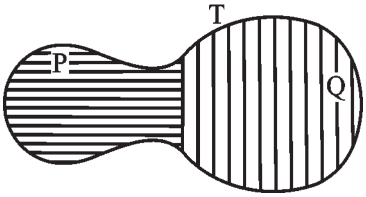
Chapter 9

Areas of Parallelograms and Triangles

In the Chapter

- Area of a figure is a number (in some unit) associated with the part of the plane enclosed by that figure.
- Two congruent figures have equal areas but the converse need not be true.
- If a planar region formed by a figure T is made up of two non-overlapping planar regions formed by figures P and Q, then ar (T) = ar (P) + ar (Q), where ar (X) denotes the area of figure X.
- Two figures are said to be on the same base and between the same parallels, if they have a common base (side) and the vertices, (or the vertex) opposite to the common base of each figure lie on a line parallel to the base.
- Parallelograms on the same base (or equal bases) and between the same parallels are equal in area.
- Area of a parallelogram is the product of its base and the corresponding altitude.
- Parallelograms on the same base (or equal bases) and having equal areas lie between the same parallels.
- If a parallelogram and a triangle are on the same base and between the same parallels, then area of the triangle is half the area of the parallelogram.
- Triangles on the same base (or equal bases) and between the same parallels are equal in area.
- Area of a triangle is half the product of its base and the corresponding altitude.
- Triangles on the same base (or equal bases) and having equal areas lie between the same parallels.
- A median of a triangle divides it into two triangles of equal areas.
- Area of a triangle = $\frac{1}{2}$ × Base × Height
- Area of a Trapezium = $\frac{1}{2}$ × (Sum of the parallel sides) × (Distance between them)
- Area of a rhombus = $\frac{1}{2}$ × Product of the diagonals
- The line segment joining the mid-points of two sides of a triangle is parallel to the third side. [Mid-point theorem]
- If a planar region formed by a figure T is made up of two non-overlapping planar regions formed by figures P and Q, then ar (T) = ar (P) + ar (Q).

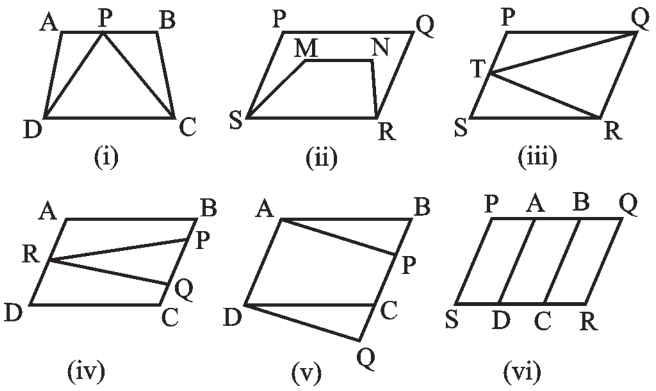


- Figures on the same base and between the same parallels :
  Two figures are said to be on the same base and between the same parallels, if they have a common base (side) and the vertices (or the vertex) opposite to the common base of each figure lie on a line parallel to the base.

NCERT TEXT BOOK QUESTION (SOLVED)

EXERCISE 9.1

Q.1. Which of the following figures lie on the same base and between the same parallels. In such a case, write the common base and the two parallels.



Ans. (i) ΔPCD and trapezium ABCD are on the same base DC and between the same parallels DC and AB.

(ii) The two figures are not between the same parallels.

(iii) ΔQRT and quad. RQTS are on the same base RQ and between the same parallels QR and PS.

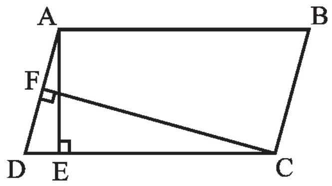
(iv) ΔPQR and quad. ABCD are not on the same base.

(v) Quad. ABCD and ADQP are on the same base AD and between the same parallels AD and BQ.

(vi) The figures are not on the same base.

EXERCISE 9.2

Q.1. In Fig., ABCD is a parallelogram, AE ⊥ DC and CF ⊥ AD. If AB = 16 cm, AE = 8 cm and CF = 10 cm, find AD.



Ans. Base DC = 16 cm as opposite AB = 16 cm, Height AE = 8 cm.

∴ Area of || gm ABCD = DC × AE

$= 16 \times 8$

$= 128\ \text{cm}^2$ ...(i)

Again taking AD as the base and height

$=$ CF = 10 cm.

Area of ||gm ABCD = AD × CF

$=$ AD × 10

$=$ 10 AD cm^2 ...(ii)

Clearly from (i) and (ii)

10. (AD) = 128

$$\text{AD} = \frac{128}{10} = \mathbf{12.8\ cm.}$$

Q.2. If E,F,G and H are respectively the mid-points of the sides of a parallelogram ABCD, show that ar (EFGH) = $\frac{1}{2}$ ar (ABCD).

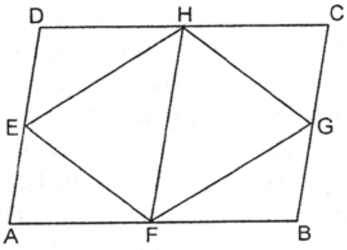
Ans. Given : A parallelogram ABCD in which E,F, G and H are mid-points of sides AB, BC, CD and DA respectively.

To prove : ar (EFGH) = $\frac{1}{2}$ ar (ABCD)

Proof : ΔEFG and ||gm BCGF are on the same base GE and between the same parallels GE and BC.

∴ ar (FGH) = $\frac{1}{2}$ ar (FBCH) ...(i)

and also ar (EFH) = $\frac{1}{2}$ ar (AFHD) ... (ii)



Adding (i) and (ii), we get
area (FGH) + ar (EFH)

$$= \frac{1}{2} \text{ ar (FBCH)} + \frac{1}{2} \text{ ar (AFHD)}$$

Hence, ar (EFGH) = $\frac{1}{2}$ ar (ABCD)

Q.3. P and Q are any two points lying on the sides DC and AD respectively of a parallelogram ABCD. Show that :

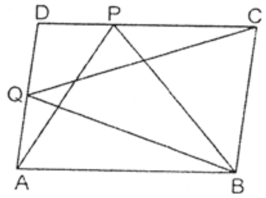
ar (APB) = ar (BQC).

Ans. A parallelogram ABCD in which two points P and Q are lying on DC and Ad respectively. Also ΔBCQ and ΔABP are formed.

To prove : ar (APB) = ar (BQC).

Proof : ΔAPB and parallelogram ABCD are on the same base AB and between the same parallels AB and DC.

$\therefore$ ar (APB) = $\frac{1}{2}$ ar (ABCD) ...(i)



Similarly, ar (BCQ) = $\frac{1}{2}$ ar (ABCD) ...(ii)

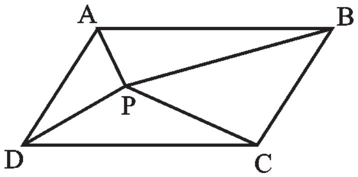
From (i) and (ii), we get
Hence, ar (APB) = ar (BCQ) Proved.

Q.4. In Fig., P is a point in the interior of a parallelogram ABCD. Show that

(i) ar (APB) + ar (PCD) = $\frac{1}{2}$ ar (ABCD)

(ii) ar (APD) + ar (PBC) = ar (APB) + ar (PCD)

[*Hint* : Through P, draw a line parallel to AB.]



Ans. Given : A parallelogram ABCD. P is a point inside it.

To Prove :

(i) ar (APB) + ar (PCD) = $\frac{1}{2}$ ar (ABCD)

(ii) ar (APD) + ar (PBC) = ar (APB) + ar (PCD)

Construction : Draw EF through P parallel to AB, and GH through P parallel to AD.

Proof : In parallelogram EPGA, AP is a diagonal.
$\therefore$ area of ΔAPG = area of ΔAPF ...(i)
In parallelogram BGPE, PB is a diagonal,
$\therefore$ area of ΔBPG = area of ΔEPB ...(ii)
In parallelogram DHPF, DP is a diagonal,
$\therefore$ area of ΔDPH = area of ΔDPF ...(iii)
In parallelogram HCEP, CP is a diagonal,
$\therefore$ area of ΔCPH = area of ΔCPE ...(iv)
Adding (i), (ii), (iii) and (iv)
area of ΔAPG + area of ΔBPG + are of ΔDPH + area of ΔCPH
= area of ΔAPF + area of ΔEPB + area of ΔDPF + area of ΔCPE
$\Rightarrow$ [area of ΔAPG + area of ΔBPG] + [area of ΔDPH + area of ΔCPH]
= [area of ΔAPB + area of ΔBPG] + [area of ΔEPB + area of ΔCPE]
$\Rightarrow$ area of ΔAPB + area of ΔCPD
= area of ΔAPD + area of ΔBPC ...(v)
But area of parallelogram ABCD
= area of ΔAPB + area of ΔCPD + area of ΔAPD + area of ΔBPC ...(vi)
From (v) and (vi), we get
area of ΔAPB + area of ΔPCD

$$= \frac{1}{2} \text{ area of ABCD}$$

or, ar (APB) + ar (PCD) = $\frac{1}{2}$ ar (ABCD)

Proved.

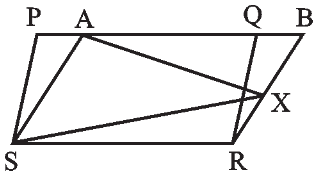
Also, from (v),
$\Rightarrow$ ar (APD) + ar (PBC) = ar (APB) + ar (CPD)

Proved.

Q.5. In Fig., PQRS and ABRS are parallelograms and X is any point on side BR. Show that

(i) ar (PQRS) = ar (ABRS)

(ii) ar (AX S) = $\frac{1}{2}$ ar (PQRS)



Ans. Given : Two parallelograms PQRS and ABRS and X is any point on side BR.

To prove : (i) ar (PQRS) = ar (ABRS)

(ii) ar (ΔAXS) = $\frac{1}{2}$ ar (PQRS)

Proof : (i) Parallelograms PQRS and ABRS are on the same base SR and between the same parallels SR and PB.

So, ar (PQRS) = ar (ABRS) ...(i)

(ii) ΔAXS are ||gm ABRS are on the same base AS and between the same parallels AS and RB.

So, ar (ΔAXS) = $\frac{1}{2}$ ar (ABRS) ...(ii)

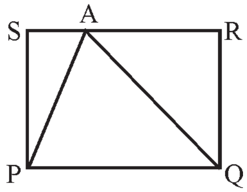
From (i) and (ii), we get

ar (ΔAXS) = $\frac{1}{2}$ ar (PQRS.

Q.6. A farmer was having a field in the form of a parallelogram PQRS. She took any point A on RS and joined it to points P and Q. In how many parts the field is divided? What are the shapes of these parts? The farmer wants to sow wheat and pulses in equal portions of the field separately. How should she do it?

Ans. Given : A parallelogram PQRS. A is any point on SR. A joined to P and Q. The field is divided into three parts (i) ΔASP, (ii) ΔAPQ and (iii) ΔAQR.

All the parts are triangles.



ΔAPQ and ||gm PQRS are on the same base PQ and between the same parallels, so

ar (APQ) = $\frac{1}{2}$ ar (ABC)

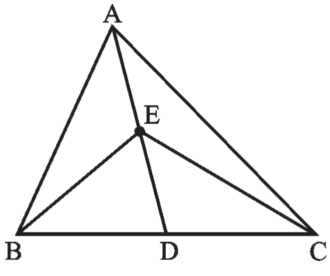
∴ ar (ASP) + ar (AQR) $\frac{1}{2}$ ar (PQRS) ...(ii)

From (i) and (ii), we get ar (APQ) = ar (ASP) + ar (AQR). Thus she should sow wheat in ΔAPQ and pulses in other two Δ, or vice-versa.

Proved.

EXERCISE 9.3

Q.1. In Fig., E is any point on median AD of a ΔABC. Show that ar (ABE) = ar (ACE).



Ans. Given : A triangle ABC, whose one median is AD. E is a point on AD.

To prove : ar (ABE) = ar (ACE)

Proof : Area of ΔABD = Area of ΔACD ...(i)

(Median divides the triangle into two equal parts)

Again, in ΔEBC, ED is the median, therefore,

Area of ΔEBD = area of ΔECD ...(ii)

(Median divides the triangle into two equal parts)

Subtracting (ii) from (i), we have

area of ΔABD – area of ΔEBD = area of ΔACD – area of ΔECD.

⇒ area of ΔABE = area of ΔACE

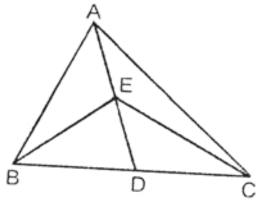
⇒ ar (ABE) = ar (ACE) **Proved.**

Q.2. In a triangle ABC, E is the mid-point of median AD. Show that ar (BED) = $\frac{1}{4}$ ar(ABC).

Ans. Given : In ΔABC, E is the mid-point of median AD.

To prove : ar (BED) = $\frac{1}{4}$ ar (ABC)

Proof : In ΔABC, AD is the median. We know that a median divides a triangle into two triangles of equal area.



$\therefore$ ar (ABD) = ar (ADC)

Thus ar (ABD) = $\frac{1}{2}$ ar (ABC) ...(i)

Again in a similar manner, in ΔABD, EB is the median.

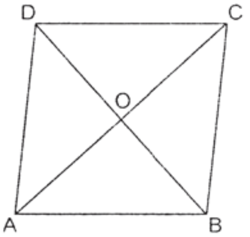
$\therefore$ Area (BED = $\frac{1}{2}$ area (ABD) ...(ii)

From (i) and (ii), we get

ar (BED) = $\frac{1}{2} \times \frac{1}{2}$ ar (ABC)

Hence, ar (BED) = $\frac{1}{4}$ ar (ABC). **Proved.**

Q.3. Show that the diagonals of a parallelogram divide it into four triangles of equal area.



Ans. Given : A ||gm ABCD in which diagonals interset each other at O.

To Prove : ar (ΔOAB) = ar (ΔBOC)

= ar (ΔCOD) = ar (ΔAOD)

Proof : We know that the diagonals of a parallelogram bisect each.

$\therefore$ In ΔABC, OB is the median and we know that A's median divided a triangle of two triangles of equal area.

$\therefore$ ar (ΔAOB) = ar (ΔBOC) ...(i)

Similarly,

ar (ΔBOC) = ar (ΔCOD) ...(ii)

Also ar ΔCOD) = ar (ΔAOD) ...(iii)

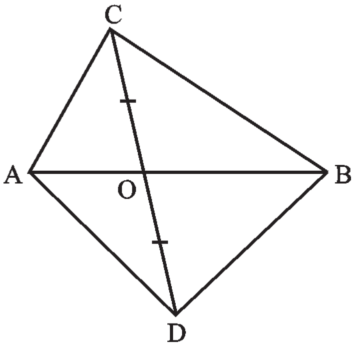
From (i), (ii) and (iii), we get

ar (ΔAOB) = ar (ΔBOC)

= ar (ΔCOD) = ar (ΔAOD)

Proved.

Q.4. In Fig., ABC and ABD are two triangles on the same base AB. If line-segment CD is bisected by AB at O, show that ar(ABC) = ar (ABD).



Ans. Given : ΔABC and ΔABD are on the same base AB. The line CD is bisected by AB at O. i.e., OC = OD.

To prove : ar (ABC) = ar (ABD)

Proof : In ΔACD, OA is the median

$\therefore$ ar (OAC) = ar (OAD) ...(i)

Similarly, in ΔBCD, OB is the median

$\therefore$ ar (OBC) = ar (OBD) ...(ii)

From (i) and (ii), we get

ar (OAC) + ar (OBC) = ar (OAD) + ar (OBD)

Hence, ar (ABC) = ar (ABD). **Proved.**

Q.5. D, E and F are respectively the mid-points of the sides BC, CA and AB of a ΔABC. Show that

(i) BDEF is a parallelogram.

(ii) ar (DEF) = $\frac{1}{4}$ ar (ABC)

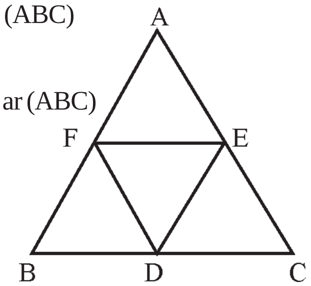
(iii) ar (BDEF) = $\frac{1}{2}$ ar (ABC)

Ans. Given : A ΔABC in which D, E and F are respectively the mid-points of sides BC, CA and AB.

To prove : (i) BDEF is a parallelogram

(ii) ar (DEF) = $\frac{1}{4}$ ar (ABC)

(iii) ar (BDEF) = $\frac{1}{2}$ ar (ABC)



Proof : (i) In ΔABC, F is the mid-point of AB and E is the mid-point of AC.

$\therefore$ FE || BC or BD (mid-point theorem) ...(i)

Again in DABC, E is the mid-point of AC and D is the mid-point of BC,

$\therefore$ DE || BE (Mid-point theorem) ...(ii)

From (i) and (ii), we get

BDEF is a parallelogram.

(ii) In ||gm BDEF,

$\Delta BDF \cong \Delta DEF$

[A diagonal of a ||gm divides it into two congruent triangles]

Also $\Delta AFE \cong \Delta DEC \cong \Delta DEF \cong \Delta BDF$

$\therefore$ ar (AFE) = ar (DEC) = ar(DEF) = ar (BDF)...(iii)

Hence, area (DEF) = $\frac{1}{4}$ ar (ABC)

(iii) ar (ΔBDEF) = ar (ΔFBD) + ar (ΔDEF)
= ar (ΔDEF) + ar (ΔDEF)
= 2ar (ΔDEF) + (From (iii)]
= 2ar (ΔABC)

$\Rightarrow$ ar ΔABC = $\frac{1}{2}$ ar (BDEF). **Proved**

Q.6. In Fig., diagonals AC and BD of quadrilateral ABCD intersect at O such that OB = OD.

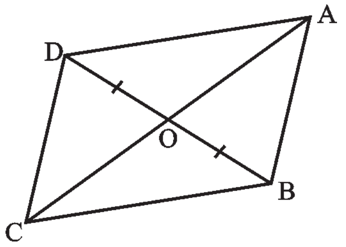
If AB = CD, then show that:

(i) ar (DOC) = ar (AOB)

(ii) ar (DCB) = ar (ACB)

(iii) DA || CB or ABCD is a parallelogram.

[*Hint* : From D and B, draw perpendiculars to AC.]



Ans. Given : A quadrilateral ABCD in which diagonal AC and BD intersect at O such that OB = OD.

Also AB = CD.

To prove : (i) ar (DOC) = ar (AOB)

(ii) ar (DCB) = ar (ACB)

(iii) DA || CB.

Construction : From D and B, draw DL and DM perpendiculars to A.

Proof : (i) In ΔDOL and ΔBMO

$\angle DLO = \angle BMO$ (each = 90°)

OB = OD (given)

$\angle DOL = \angle BOM$ (Ver. opposite angles)

$\therefore$ $\Delta DOL = \Delta BMO$ (AAS rule)

Thus DL $\cong$ MB (CPCT) ...(i)

Now ar (DOC) = $\frac{1}{2} \times CA \times DL$ ...(ii)

ar (AOB) = $\frac{1}{2} \times CA \times BM$ ...(iii)

or ar (AOB) = $\frac{1}{2} \times CA \times DL$ ...(iv)

From (ii) and (iv), we get

ar (DOC) = ar (AOB)

(ii) Now

ar (DOC) = ar (AOB)

Adding ar (BOC) to both sides.

ar (DOC) + ar (BOC) = ar (AOB) + ar (BOC)

Hence, ar (DCB) = ar (ABC)

(iii) ar (DCB) = ar (ABC)

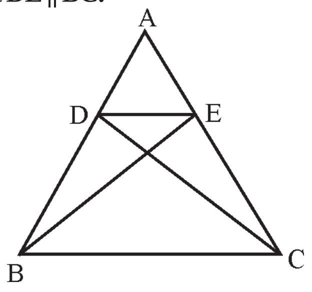
As the ΔDCB and ΔABC lie on the same base and they are equal in area.

Therefore, DA || CB

As DA || CB and AB = CD.

Hence ABCD is a parallelogram. **Proved.**

Q.7. D and E are points on sides AB and AC respectively of ΔABC such that ar (DBC) = ar (EBC). Prove that DE || BC.



Ans. Given : D and E are points on sides AB and AC respectively of ΔABC, such that

ar (ΔBCE) = ar (ΔBCD).

To prove : DE || BC.

Proof : ar (ΔBCE) = ar (ΔBCD)

Also, ΔBCE and ΔBCD have he same base BC. Since, triangles having the same base and between the same parallel lines are equal in area.

$\therefore$ ΔBCE and ΔBCD must be between the same parallel lines.

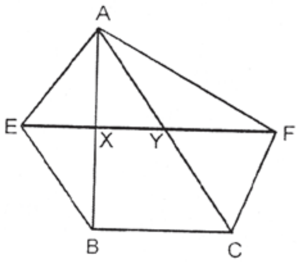
Hence, $DE \parallel BC$. **(Proved)**

Q.8. XY is a line parallel to side BC of a triangle ABC. If BE || AC and CF || AB meet XY at E and F respectively, show that ar (ABE) = ar (ACF)

Ans. Given : XY is a line parallel to side BE of a ΔABC.

BE || AC and CF || AB

To prove : ar (ABE) = ar (ACF)



Proof : ΔABE and parallelogram BCYE are on the same base BE and between the same parallels BE and AC.

$\therefore$ ar (ABE) = $\frac{1}{2}$ ar (BCYE) ...(i)

[If a triangle and ||gm are on the same base and between the same parallels then area of triangle is half of the area of ||gm]

Similarly,

ar (ACF) = $\frac{1}{2}$ ar (BCFX) ...(ii)

[Same Reason]

But parallelogram BCYE and BCFX are on the same base BE and between the same parallels BC and EF.

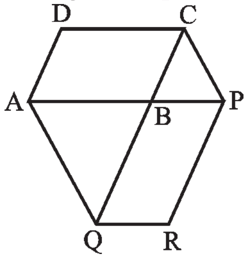
$\therefore$ ar (BCYE) = ar (BCFX) ...(iii)

From (i), (ii) and (iii), we get

Hence,

ar (ABE) = ar (ACF) **Proved.**

Q.9. The side AB of a parallelogram ABCD is produced to any point P. A line through A and parallel to CP meets CB produced at Q and then parallelogram PBQR is completed (see Fig.). Show that ar (ABCD) = ar (PBQR).



[*Hint* : Join AC and PQ. Now compare ar (ACQ) and ar (APQ).]

Ans. Join AC and PQ.

Now, ar (ACQ) = ar (AQP)

AQ || CP and base AQ is same.

Subtracting ar (AQB) from the both sides,

ar (ACQ) – ar (AQB) = ar (AQB) – ar (AQB)

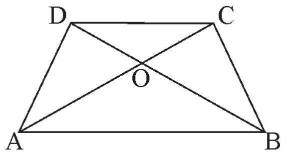
ar (ABC) = ar (BPQ)

ar (ABC) = $\frac{1}{2}$ ar (ABCD)

and ar (BPQ) = $\frac{1}{2}$ ar (PBQR)

Hence, ar (ABCD) = ar (PBQR).

Q.10. Diagonals AC and BD of a trapezium ABCD with AB || DC intersect each other at O. Prove that ar (AOD) = ar (BOC).



Ans. Diagonals AC and BD of a trapezium ABCD with AB || DC intersect each other at O.

As ΔABC and ΔABD are on the same base and between the same parallels.

$\therefore$ ar (ABD) = ar (ABC)

$\Rightarrow$ ar (ABD) – ar (AOB)

= ar (ABC) – ar (AOB)

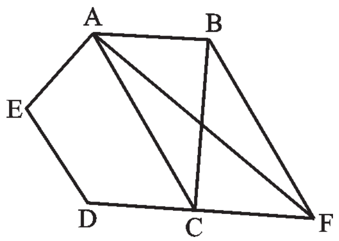
[Subtracting ar (AOB) from the both sides)

$\Rightarrow$ ar (AOD) = ar (BOC).

Q.11. In Fig., ABCDE is a pentagon. A line through B parallel to AC meets DC produced at F. Show that

(i) ar (ACB) = ar (ACF)

(ii) ar (AEDF) = ar (ABCDE)



Ans. Given ABCDE is a pentagon and BF || AC.

(i) ΔACB and ΔACF being on the same base AC and between the same parallels AC and BF.

$\therefore$ ar (ΔACB) = ar (ΔACF) ...(i)

(ii) ar (AEDC) = ar (AEDC) + ar (ΔACF)

= ar (AEDC) + ar (ΔACB)

= ar (ABCDE)

Q.12. A villager Itwaari has a plot of land of the shape of a quadrilateral. The Gram Panchayat of the village decided to take over some portion of his plot from one of the corners to construct a Health Centre. Itwaari agrees to the above proposal with the condition that he should be given equal amount of land in lieu of his land adjoining his plot so as to form a triangular plot. Explain how this proposal will be implemented.

Ans. We are given a quadrilateral plot ABCD.

Since the quadrilateral has to be constructed into a triangle of equal area, so we proceed as follows :

Draw CE || BD which inersects AB produced at E. Join D and E, intersecting BC at K.

Now AED is the required triangular plot left after giving to Gram Panchayat the triangular plot CDK, we know that

ar (BDE) = ar (BCD)

[Triangles on the same base and between the same parallels]

Adding ar (ABD) to both sides, we get

ar (ABD) + ar (BDE) = ar (ABD) + ar (BCD)

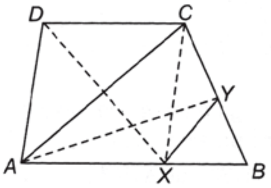
ar (ΔAED) = ar (quad. ABCD)

Proved.

Q.13. ABCD is a trapezium with AB || DC. A line parallel to AC intersects AB at X and BC at Y. Prove that ar (ADX) = ar (ACY).

[*Hint* : Join CX.]

Ans. Given, ABCD is a trapezium and AB || CD. Also, XY || AC. Now, join CX. Since, ΔADX and ΔACX lie on the same base AX and between the same parallel lines AB and DC.



∴ ar (ΔADX) = ar (ΔACX) ...(i)

Again, ΔACX and ΔACY lie on the same base AC and between the same parallel lines AC and XY.

∴ ar (ΔACX) = ar (ΔACY) ...(ii)

Hence, from Eqs.(i) and (ii), we get

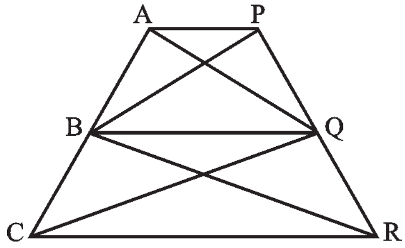
ar (ΔADX) = ar (ΔACY)

14. In Fig., AP || BQ || CR. Prove that ar (AQC) = ar (PBR).

Ans. Given : As given in the figure AP || BQ || CR.

To prove : ar (AQC) = ar (PBR)

Proof : ΔABQ and ΔPBQ are on the same base BQ and between the same parallels AP and BQ.



∴ ar (ABQ) = ar (PBQ) ...(i)

Again ΔBQC and ΔQBR are on the same base BQ and between the same parallels BQ and CR,

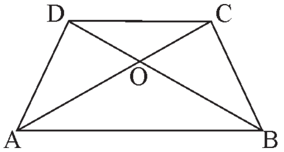
∴ ar (BQC) = ar (QBR) ...(ii)

Adding (i) and (ii), we get

ar (ABQ) + ar(BQC) = ar (PBQ) + ar (QBR)

ar (AQC) = ar (PBR). **Proved.**

Q.15. Diagonals AC and BD of a quadrilateral ABCD intersect at O in such a way that ar (AOD) = ar (BOC). Prove that ABCD is a trapezium.



Ans. Given : A quadrilateral ABCD in which diagonals AC and BD intersect at O in such a way that ar (AOD) = ar (BOC)

To prove : ABCD is a trapezium.

Proof : ar (AOD) = ar (BOC) (Given)

Adding ar (COD) to both sides, we get

ar (AOD) + ar (COD) = ar (BOC) + ar (COD)

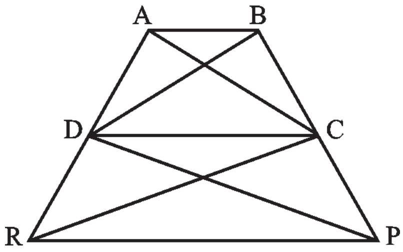
∴ ar (ACD) = ar (BCD)

we see that ΔACD and ΔBCD are on the same base CD and their areas are equal, therefore, AB || CD.

Now two opposite sides of quadrilateral ABCD are parallel, therefore

ABCD is a trapezium.

Q.16. In Fig., ar (DRC) = ar (DPC) and ar (BDP) = ar (ARC). Show that both the quadrilaterals ABCD and ΔCPR are trapeziums.



Ans. Given :

$$ar(\Delta DPC) = ar(\Delta DRC) \quad ...(i)$$

and $$ar(\Delta BDP) = ar(\Delta ARC) \quad ...(ii)$$

On subtracting Eq. (i) from Eq. (ii), we get

$ar(\Delta BDP) - ar(\Delta DPC) = ar(\Delta ARC) - ar(\Delta DRC)$

$\Rightarrow \quad ar(\Delta BDC) = ar(\Delta ADC)$

Since, these two triangles are on the same base DC.

$\therefore \quad DC \parallel AB$

Hence, ABCD is a trapezium.

Also, $\quad ar(\Delta DRC) = ar(\Delta DPC)$

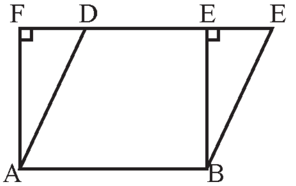
Since, both triangles have the same base DC.

$\therefore \quad RP \parallel DC$

Hence, PRCD is a trapezium.

EXERCISE 9.4 (Optional)

Q.1. Parallelogram ABCD and rectangle ABEF are on the same base AB and have equal areas. Show that the perimeter of the parallelogram is greater than that of the rectangle.



Ans. Given : Parallelogram ABCD and rectangle ABEF are on the same base AB and ar (ABCD) = ar (ABEF).

To prove : Perimeter of parallelogram > perimeter of rectangle.

or AB + BC + CD + DA > AB + BE + EF + AF.

Proof : In ΔAFD, $\angle F = 90°$

$\therefore \quad DA > FA \quad ...(i)$

Also in ΔBCE, $\angle CEF = 90°$

$\therefore \quad BC > BE \quad ...(ii)$

Also $\quad AB = EF \quad ...(iii)$

(Opposite sides of a rectangle)

$CD = AB$ ...(iv) (Opp. sides of a ||gm)

From (i), (ii), (iii) and (iv), we get

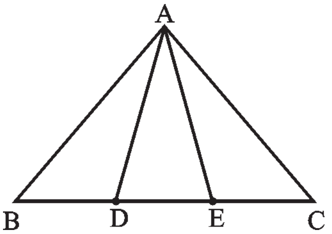
DA + BC + AB + CD > FA + BE + EF + AB

Hence, AB + BC + CD + DA > AB + BE + EF + FA.

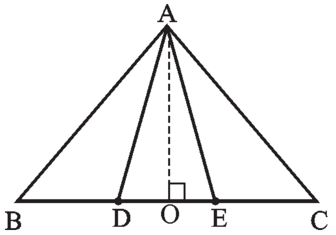
Q.2. In Fig., D and E are two points on BC such that BD = DE = EC. Show that ar (ABD) = ar (ADE) = ar (AEC).

Can you now answer the question that you have left in the 'Introduction' of this chapter, whether the field of *Budhia* has been actually divided into three parts of equal area?

[**Remark:** Note that by taking BD = DE = EC, the triangle ABC is divided into three triangles ABD, ADE and AEC of equal areas. In the same way, by dividing BC into *n* equal parts and joining the points of division so obtained to the opposite vertex of BC, you can divide $\angle ABC$ into *n* triangles of equal areas.]



Ans. Given : ABC is a triangle and D and E are two points on BC, such that



$$BD = DE = EC$$

Let AO be the perpendicular to BC.

$$\therefore \quad ar(\Delta ABD) = \frac{1}{2} \times BD \times AO$$

$$ar(\Delta ADE) = \frac{1}{2} \times DE \times AO$$

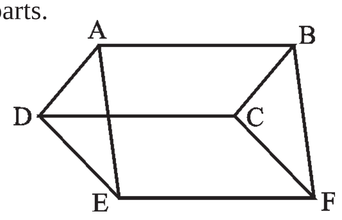
and $$ar(\Delta AEC) = \frac{1}{2} \times EC \times AO$$

Since, $\quad BD = DE = EC \quad$ (Given)

$\therefore \quad ar(\Delta ABD) = ar(\Delta ADE) = ar(\Delta AEC)$

Yes, altitudes of all triangles are same. Budhia has used the result of this question in dividing her land in three equal parts.

Q.3. In Fig., ABCD, DCFE and ABFE are parallelograms. Show that ar (ADE) = ar (BCF).



Ans. Given : There are three parallelograms ABCD, DCEF and ABFE.

To prove : ar (ADE) = ar (BCF).

Proof : In ΔADE and ΔBCF,

AE = BF
AD = BC
DE = CF

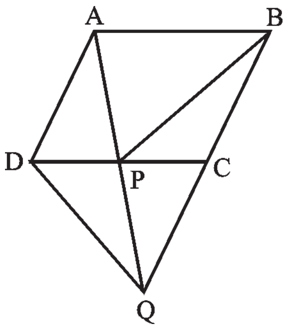
(Opposite sides of a parallelogram)

So, ΔADE ≅ ΔBCF (SSS Rule)

We know that congruent triangles are equal in areas.

Hence ar (ADE) = ar (BCF). **Proved.**

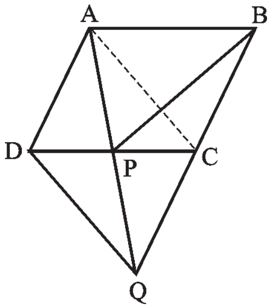
Q.4. In Fig., ABCD is a parallelogram and BC is produced to a point Q such that AD = CQ. If AQ intersect DC at P, show that ar (BPC) = ar (DPQ). [*Hint* : Join AC.]



Ans. Given : ABCD is a parallelogram.

BC is produced to a point Q such that AD = CQ, AQ intersects DC at P.

To prove : ar (BPC) = ar (DPQ)



Construction : Join A and C.

AD = CQ (Given)

and AD ∥ CQ

∴ ADQC is a parallelogram.

[A pair of opposite sides are equal and parallel]

∴ ar (ΔPDQ) = ar (PCQ)

Diagonals divide a parallelogram in 4 triangles of equal area.

Thus ar (DPQ) = ar (PCQ) ...(i)

Also in PBQ, BC = AD = CQ

∴ BC = CQ

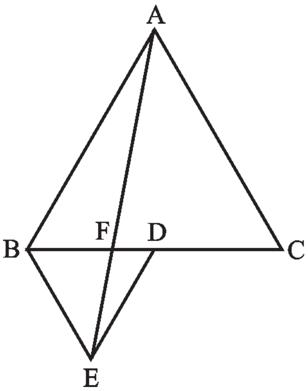
∴ ar (PCQ) = ar (BPC) ...(ii)

[Median of D divides it into two triangles of equal area]

From (i) and (ii), we get

ar (BPC) = ar (DPQ) **Proved.**

Q.5. In Fig., ABC and BDE are two equilateral triangles such that D is the mid-point of BC. If AE intersects BC at F, show that



(i) ar (BDE) = $\frac{1}{4}$ ar (ABC)

(ii) ar (BDE) = $\frac{1}{2}$ ar (BAE)

(iii) ar (ABC) = 2 ar (BEC)
(iv) ar (BFE) = ar (AFD)
(v) ar (BFE) = 2 ar (FED)

(vi) ar (FED) = $\frac{1}{8}$ ar (AFC)

[*Hint* : Join EC and AD. Show that BE || AC and DE || AB, etc.]

Ans. Given : Two equilatral triangles ABC and BDE such that D is the mid-point of BC.

AE intersects BC at F.

To prove :

(i) ar (BDE) = $\frac{1}{4}$ ar (ABC)

(ii) ar (BDE) = $\frac{1}{2}$ ar (BAE)

(iii) ar (ABC) = 2 ar (BEC)
(iv) ar (BFE) = ar (AFD)
(v) ar (BFE) = 2 ar (FED)

(vi) ar (FED) = $\frac{1}{8}$ ar (AFC)

Construction : Join E and C and also join A and D. Draw EL $\perp$ BC.

Proof : (i) Let side of ΔBDE = x.

$\therefore$ at (BDE) = $\frac{\sqrt{3}}{4}x^2$ ...(i)

Now side of ΔABC = 2x

$\therefore$ ar (ABC)= $\frac{\sqrt{3}}{4}(2x)^2 = \sqrt{3}x^2$ ...(ii)

On dividing (i) by (ii), we get

Thus, ar (ABC) = 4 ar (BDE)

Hence,

ar (BDE) = $\frac{1}{4}$ ar (ABC)

(ii) $\angle$ACB = $\angle$EBC (each = 60°)

But these are alternate angles because transversal BC intersects BE and AC.

$\therefore$ BE $\parallel$ AC

Now ΔBEC and ΔBAE are on the same base BE and between the same parallels AC and BE.

$\therefore$ ar (BEC) = ar (BAE) ...(ii)

Again in ΔBEC, Δ is the mid-point of BC.

$\therefore$ ar (BDE) = $\frac{1}{2}$ ar (BEC) ...(ii)

From (i) and (ii), we get

ar (BDE) = $\frac{1}{2}$ ar (BEC) **Proved.**

(iii) As median divides a Δ into two triangles of equal area, therefore

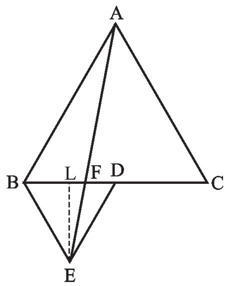
ar (BDE) = ar (CDE)

ar (BCE) = 2 ar (BED)

From part (i),

But (BED) = $2\left[\frac{1}{4}\text{ar (ABC)}\right]$

(Proved above)



$\therefore$ ar (BEC) = $\frac{1}{2}$ ar (ABC)

Hence ar (ABC) = 2 ar(BEC).

(iv) $\angle$BDE = $\angle$DBA = 60°

But these are alternate angles because BD intersects two lines AB and ED.

$\therefore$ AB $\parallel$ DE

Now ΔADE and ΔBED are on the same base ED and between the same parallels AB and DE.

$\therefore$ ar (ADE)= ar (BED)

Subtracting ar (FED) from both sides.

ar (ADE) – ar (FED) = ar (BED) – ar (FED)

ar (AFD) = ar (BFE)

(v) In ΔABC,

$AD^2 = AB^2 - BD^2$

$= a^2 - \frac{a^2}{4} = \frac{3a^2}{4}$

$\Rightarrow$ AD = $\frac{\sqrt{3}}{2}a$

[Let AB = a then BD = $\frac{a}{2}$]

In ΔBED

$EL^2 = DE^2 - DL^2$

$= \left(\frac{a}{2}\right)^2 - \left(\frac{a}{4}\right)^2$

$= \frac{a^2}{4} - \frac{a^2}{16} = \frac{3a^2}{16}$

$\Rightarrow$ EL = $\frac{\sqrt{3a}}{4}$ [BL = DL = $\frac{a}{4}$]

[ABC is an equilateral Δ and AD is median]

So, AD will be $\perp$ on BC, i.e. $\angle$ADF = 90°.

ΔABD $\cong$ ΔACD

$\therefore$ ar (AFD)= $\frac{1}{2}$ × FD × AD

$= \frac{1}{2}$ × FD × $\frac{\sqrt{3}}{2}a$ ...(i)

and ar (EFD) = $\frac{1}{2}$ × FD × EL

$= \frac{1}{2}$ × FD × $\frac{\sqrt{3}}{2}a$ ...(ii)

From (i) and (ii), we have

ar (AFD) = 2 ar (EFD)

Combining this result with part (iv).

We have ar (BFE) = ar (AFD) = 2 ar (EFD)

(iv) From part (i)

$$\text{ar (BDE)} = \frac{1}{4}\text{ ar (ABC)}$$

$$\therefore \quad \text{ar (BEF)} + \text{ar (FED)} = \frac{1}{4} \times 2\text{ar (ADC)}$$

$$\Rightarrow \quad 2\text{ar (FED)} + \text{ar (FED)}$$

$$= \frac{1}{2}(\text{ar(AFC)} - \text{ar (AFD)}) \quad \text{[Using part (v)]}$$

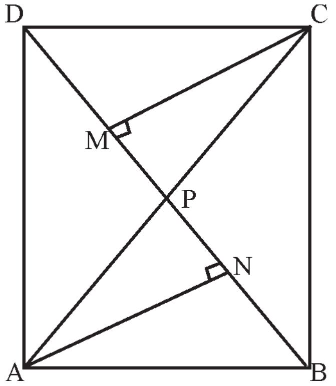
$$\Rightarrow \quad 3\text{ar (FED)} = \frac{1}{2}\text{ ar (AFC)} - \frac{1}{2} \times 2\text{ar (FED)}$$

$$\Rightarrow \quad 4\text{ar FED} = \frac{1}{2}\text{ ar (AFC)}$$

$$\Rightarrow \quad \text{ar (FED)} = \frac{1}{8}\text{ ar (AFC)}$$

Q.6. Diagonals AC and BD of a quadrilateral ABCD intersect each other at P. Show that ar (APB) × ar (CPD) = ar (APD) × ar (BPC).

[*Hint* : From A and C, draw perpendiculars to BD.]



Ans. Given : A quadrilateral in which diagonals AC and BD intersect each other at P.

To prove : ar (APB) × ar (CPD)

= ar (APD) × ar (BPC)

Proof : $\text{ar (APB)} = \frac{1}{2} \times \text{BP} \times \text{AN}$

and $\text{ar (APD)} = \frac{1}{2} \times \text{PD} \times \text{AN}$

Also $\text{ar (CPD)} = \frac{1}{2} \times \text{PD} \times \text{CM}$

and $\text{ar (BPC)} = \frac{1}{2} \times \text{BP} \times \text{CM}$

$$\text{L.H.S.} = \text{ar (APB)} \times \text{ar (CPD)}$$

$$= \frac{1}{2}(\text{BP} \times \text{AN}) \times \frac{1}{2}(\text{PD} \times \text{CM})$$

$$\text{R.H.S.} = \text{ar (APD)} \times \text{ar (CPD)}$$

$$= \frac{1}{2}(\text{PD} \times \text{AN}) \times \frac{1}{2}(\text{BP} \times \text{CM})$$

Hence, L.H.S. - R.H.S. **Proved.**

Q.7. P and Q are respectively the mid-points of sides AB and BC of a triangle ABC and R is the mid-point of AP, show that

(i) ar (PRQ) = $\frac{1}{2}$ ar (ARC)

(ii) ar (RQC) = $\frac{3}{8}$ ar (ABC)

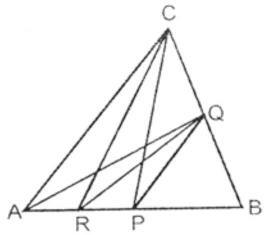
(iii) ar (PBQ) = ar (ARC)

Ans. Given : A triangle ABC, P and Q are mid-points of AB and BC, R is the mid-point of AP.

Proof : Since CP is a median of ΔABC.

$$\Rightarrow \quad \text{ar (APC)} = \text{ar (PBC)} = \text{ar }\frac{1}{2}\text{(ABC)}$$

[We know that the median divides a triangle into two triangles of equal area] ... (i)



Similarly, CR is a median of ΔAPC

$$\therefore \quad \text{ar (ARC)} = \text{ar (PRC)} = \frac{1}{2}\text{ ar (APC)} \quad \text{...(ii)}$$

QR is a median of ΔAPQ.

$$\therefore \quad \text{ar (ARQ)} = \text{ar (PRQ)} = \frac{1}{2}\text{ ar (APQ)} \quad \text{...(iii)}$$

PQ is a median of ΔPBC

$\therefore$ ar (PQC) = ar (PQB) = $\frac{1}{2}$ ar (PBC) ...(iv)

RQ is a median of ΔRBC.

ar (RQC) = ar (RQB) = $\frac{1}{2}$ ar (RBC) ...(v)

(i) ar (PQA) = ar (PQC)

(Triangles on the same base PQ and between the same parallels PQ and AC)

$\Rightarrow$ ar (ARQ) + ar (PRQ) = $\frac{1}{2}$ ar (PBC) [From (iv)]

$\Rightarrow$ 2ar (PRQ) = $\frac{1}{2}$ ar (APC) [From (i), (iii)]

$\Rightarrow$ 2(ar (PRQ) = ar (ARC) [From (ii)]

$\Rightarrow$ ar (PRQ) = $\frac{1}{2}$ ar (ARC) **Proved.**

[From equation (v)]

(ii) We have,

ar (RQC) = $\frac{1}{2}$ ar (RBC)

= $\frac{1}{2}$ ar (PBC) + $\frac{1}{2}$ ar (PRC)

$\Rightarrow$ ar (RQC) = $\frac{1}{2}$ ar (ABC) + $\frac{1}{4}$ ar (APC)

[From (i) and (ii)]

= $\frac{1}{4}$ ar (ABC) + $\frac{1}{8}$ ar (ABC)

$\Rightarrow$ ar (RQC) = $\frac{2\text{ar (ABC)} + \text{ar (ABC)}}{8}$

$\Rightarrow$ ar (RQC) = $\frac{3}{8}$ ar (ABC) **Proved.**

(iii) We have

ar (PBQ)= $\frac{1}{2}$ ar (PBC)

(Proved above in eqn. (iv)]

= $\frac{1}{4}$ ar (ABC) ...(i)

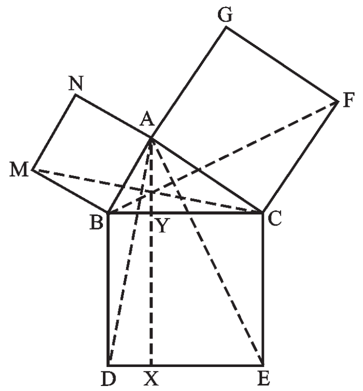
ar (ARC)= $\frac{1}{2}$ ar (APC)

= $\frac{1}{4}$ ar (ABC) ...(ii)

From equations (i) and (ii), we get

ar (PBQ) = ar (ARC). **Proved.**

Q.8. In Fig., ABC is a right triangle right angled at A. BCED, ACFG and ABMN are squares on the sides BC, CA and AB respectively. Line segment AX $\perp$ DE meets BC at Y. Show that:



(i) ΔMBC $\cong$ ABD

(ii) ar (BYXD) = 2 ar (MBC)

(iii) ar (BYXD) = ar (ABMN)

(iv) ΔFCB $\cong$ ACE

(v) ar (CYXE) = 2 ar (FCB)

(vi) ar (CYXE) = ar (ACFG)

(vii) ar (BCED) = ar (ABMN) + ar (ACFG)

Note : Result (vii) is the famous *Theorem of Pythagoras*. You shall learn a simpler proof of this theorem in Class X.

Ans. Given : ΔABC is right angled at A. On sides BC, CA and AB there are respective squares BCED, ACFG and ABMN on sides BC, CA and AB. Line segment AX $\perp$ DE which meets BC at Y.

To prove :

(i) $\Delta MBC \cong \Delta ABD$

(ii) ar (BYXD) = 2 ar (MBC)

(iii) ar (BYXD) = ar (ABMN)

(iv) $\Delta FCB \cong \Delta ACE$

(v) ar (CYXE) = 2 ar (FCB)

(vi) ar (CYXE) = ar (ACFG)

(vii) ar (BCED) = ar (ABMN) + ar (ACFG)

Proof : (i) In ΔMBC and ΔABD

MB = AB (Sides of a square)

BC = BD (Sides of a square)

$\angle$MBC = $\angle$ABD

[MBC = 90° + $\angle$ABC and $\angle$ABD = 90° + $\angle$ABC]

$\therefore$ $\Delta MBC \cong \Delta ABC$

(SAS Congruence Rule)

(ii) $\therefore$ ar (MBC) = ar (ABC) ...(i)

[Areas of congruent triangles are equal]

Now rectangle BYXD and ΔABD are on the same base BD and between the same parallels,

So, ar (BYXD) = 2ar (ABD) ...(ii)

From (i) and (ii), we get

ar (BYXD) = 2 ar (MBC) ...(iii)

(Proved)

(iii) Again square ABMN and ΔMBC are on the same base MB and between the same parallels MB and NA, So

2ar (MBC) = ar (ABMN) ...(iv)

From (iii) and (iv), we get

ar (BYXD) = ar (ABMN) ...(A)

(iv) In ΔFCB and ΔACE,

BC = CE (Sides of a ractangle)

CF = AC (sides of a square)

$\angle BCF = \angle ACE$

$[90° + \angle ACB = \angle BCF = \angle ACE]$

$\therefore$ $\Delta FCB \cong \Delta ACE$

(SAS congruence rule)

(v) $\therefore$ ar (FCB) = ar (ACE) ...(v)

(Congruent triangles, are equal in area)

ΔACE and rectangle CYXE are on the same base CE and between the same parallels AX and CE.

$\therefore$ ar (CYXE) = 2 ar (ACE) ...(vi)

From (v) and (vi), we get

ar (CYXE) = 2 ar (FCB) ...(vii)

(vi) ΔBCF and square ACFG are on the same base AC and between the same parallels CF and BAG.

$\therefore$ ar (ACFG) = 2 ar (CBF) ...(viii)

From (v), (vi), (vii) and (viii), we get

ar (CYXE) = ar (ACFG) ...(ix)

(Proved)

(vii) Adding (viii) and (ix), we get

ar (BYXD) + ar (CYXE)

= ar (ABMN) + ar (ACFG)

Hence ar (BCED) = ar (ABMN) + ar (ACFG)

(Proved)

Additional Questions

Q.1. If the ratio of altitude and the area of the parallelogram is 2 : 11, then find the length of the base of parallelogram.

Ans. Let the length of the altitude by *x* and base of the parallelogram be *b*.

Then area of the parallelogram = $b \times x$.

Now, $\dfrac{\text{altitude}}{\text{area}} = \dfrac{2}{11}$

$\Rightarrow \quad \dfrac{x}{b \times x} = \dfrac{2}{11}$

$\Rightarrow \quad \dfrac{1}{b} = \dfrac{2}{11}$

$\Rightarrow \quad b = \dfrac{11}{2}$ Units.

Q.2. The area of a triangle is equal to the area of a rectangle whose length and breadth are 18 cm and 12 cm respectively. If the base of the triangle is 24 cm, then, find its altitude.

Ans. Area of rectangle = length × breadth

$= (18 \times 12)\ \text{cm}^2$

And, area of triangle = $\dfrac{1}{2}$ × base × altitude

$= \left(\dfrac{1}{2} \times 24 \times h\right) \text{cm}^2$

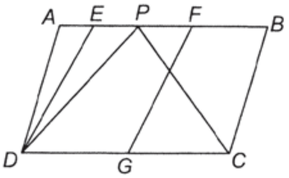
Also, area of triangle = Area of rectangle

Therefore, $\dfrac{1}{2} \times 24 \times h = 18 \times 12$

$\Rightarrow \quad h = \dfrac{2 \times 18 \times 12}{24}$

$\Rightarrow \quad h = 18\ \text{cm}$

Q.3. In figure ABCD and EFGH are two parallelogram and G is the mid-point of CD. Then,

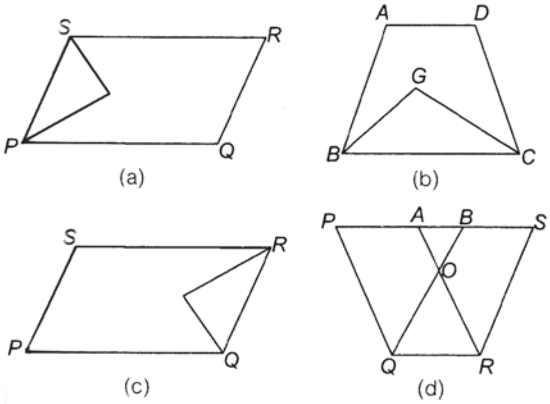


$\text{ar}(DPC) = \dfrac{1}{2}\ \text{ar}(EFGD)$

Ans. False. We know that, if a triangle and a parallelogram are on the same base and btween the same parallels, then area of triangle is equal to half of the area of parallelogram.

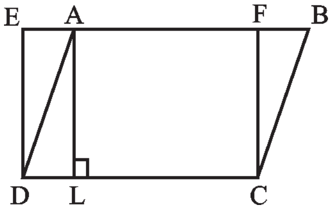
$\therefore$ ar (DPC) = $\frac{1}{2}$ (ABCD) = ar (EFGD)

Q.4. In which of the following (fig.). You find two polygons on the same base and between the same parallels?



Ans. (d) in figure (d) we have two polygons PQRA and PQOA on the same base PQ and between the same parallels PQ and AR. Similarly we have BQRS and BORS on the same base RS and between the same parallels RS and OB.

Q.5. In Fig., ABCD is a paralelogram and EFCD is a rectangle.



Also, AL ⊥ DC. Prove that

(i) ar (ABCD) = ar (EFCD)

(ii) ar (ABCD) = DC × AL

Ans. (i) As a rectangle is also a parallelogram, therefore,

ar (ABCD) = ar (EFCD) (Theorem 9.1)

(ii) From above result,

ar (ABCD) = DC × FC ...(i)

(Area of the rectangle = length × breadth)

As AL ⊥ DC, therefore, AFCL is also a rectangle

So, AL = FC ...(ii)

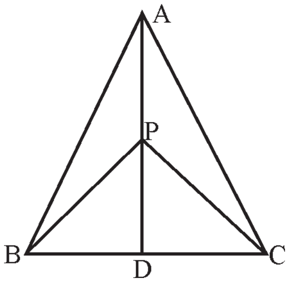
Therefore,

ar (ABCD) = DC × AL [From (i) and (ii)]

Q.6. P is any point on the median AD of ΔABC. Show that ar (APB) = ar (ACP)

Ans. Since AD is the median of ΔABC, therefore,

ar (ΔABD) = ar (ΔACD) ...(i)



Also, PD is the median of ΔPBC, therefore,

ar (ΔPBD) = ar (ΔPCD) ...(ii)

Subtracting (ii) from (i), we get

ar (ΔABD) – ar (ΔPBD)

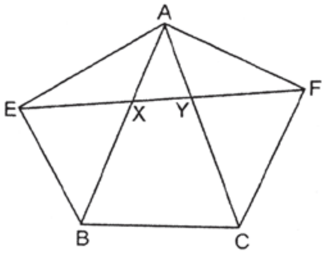
= ar (ΔACD) – ar (ΔPCD)

⇒ ar (ΔAPB) = ar (ΔAPC) Proved.

Q.7. XY is a line parallel to side BC of a triangle ABC passing through A. If BE || AC and CF || AB meet XY at E and F respectively, show that :

ar (ABE) = ar (ACF),

Ans.



Given : XY is a line parallel to side BE of ΔABC, BE || AC and CF || AB.

To prove : ar (ABE) = ar (ACF)

Proof : ar (ABE) = $\frac{1}{2}$ ar (BCYE) ...(i)

[ΔABE and || gm BCYE are on the same base BE and BE || AC]

Similarly,

ar (ACF) = $\frac{1}{2}$ ar (BCFX) ...(ii)

But ar (BCYE) = ar (BCFX) ...(iii)

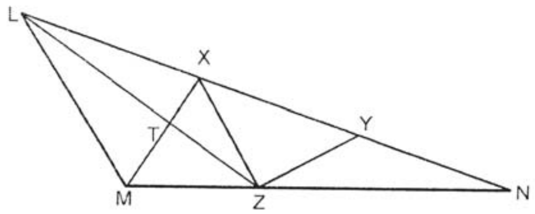
[Parallelograms on the same base and between the same parallels are equal in area]

$\therefore$ from (i), (ii) and (iii) we get

ar (ABE) = ar (ACF) **Proved.**

Q.8. 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 (See Fig.). Prove that

ar (LZY) = ar (MZYX)



Ans. Given : LX = XY = YN and

LM || XZ

To prove : ar (LZY) = ar (MZYX)

Proof : LM || XZ and ΔLXA and ΔXMZ are on the same base (XZ) and between the same parallels.

$\therefore$ ar (ΔLXZ) = ar (ΔXMZ) ...(i)

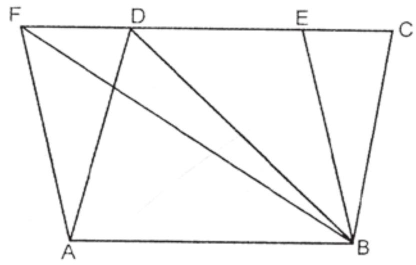
Adding ar (ΔXYZ) to both the sides of equation (i), we get

ar (ΔLXZ) + ar (ΔXYZ) = ar (ΔXMZ) + ar (ΔXYZ)

$\Rightarrow$ ar (ΔLZY) = ar (MZYX)

Q.9. The area of the parallelogram ABCD is 90 cm^2 (See fig). Find

(i) ar (ABEF) (ii) ar (ABD) (iii) ar (BEF)



Ans. Given : ar (||gm ABCD) = 90cm^2

To find :

(i) ar (ABEF) (ii) ar (ABD)

(iii) ar (BEF)

Proof : (i) ar (ABEF) = ar (||gm ABCD) = 90cm^2

[Since ||gm lie on the same base and between the same parallels)

$\Rightarrow$ ar (ABEF) = 90cm^2

(ii) ar (ΔABD) = $\frac{1}{2}$ ar (||gm ABCD)

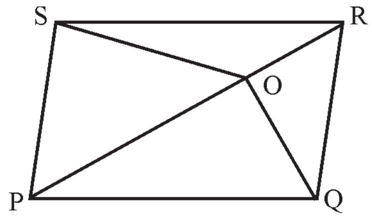
[A diagonal of a ||gm divides it into two equal parts)

= $\frac{1}{2} \times 90 = 45$ cm^2

(iii) ar (ΔBEF) = $\frac{1}{2}$ ar (||gm ABEF)

= $\frac{1}{2} \times 90 = 45$ cm^2

Q.10. O is any point on the diagonal PR of a parallelogram PQRS (Fig.). Prove that ar (PSO) = ar (PQO).



Ans. Given : PQRS is a || gm and O is any point on PR.

To prove : as (PSO) = ar (PQO)

Construction : Join Q to S.

Proof : ST = TQ

$\therefore$ PT is a median of ΔPQS

[Diagonal of a ||gm bisect each other]

$\therefore$ ar (ΔPTS) = ar (ΔPTQ) ...(i)

[Median of a Δ divides a triangle into two triangles of equal area.]

Also, OT is a median of ΔSOQ

$\therefore$ ar (ΔOST) = ar (ΔOQT) ...(ii)

On adding (i) and (ii), we get

ar (ΔPTS) + ar (ΔOPST) = ar (ΔPTQ) + ar (ΔOQT)

$\Rightarrow$ ar (PSO) = ar (PQO) Proved.

Multiple Choice Questions

Q.1. Two parallelogram are no n equal bases and between the same parallels. The ratio of their areas is:

(a) 1:2 (b) 1:1
(c) 2:1 (d) 3:1

Ans. (b) 1:1

Q.2. The median of a triangle divides it into two :

(a) right triangles
(b) isosceles triangles
(c) triangles of equal area
(d) congruent triangles.

Ans. (c) triangles of equal area

Q.3. The mid-point of the sides of a triangle along with any of the vertices as the fourth point make a parallelogram of area equal to

(a) $\frac{1}{2}$ ar (ABC) (b) $\frac{1}{3}$ ar (ABC)

(c) $\frac{1}{4}$ ar ABC (d) ar (ABC)

Ans. (a) $\frac{1}{2}$ ar (ABC)

Q.4. ABCD is a quadrilateral whose diagonal AC divides it into two parts, equal in area, then ABCD :

(a) is a rectanlge
(b) is always a rhombus
(c) is a parallelogram
(d) need not be any of (A), (B) or (C)

Ans. (d) need not be any of (A), (B) or (C)

Q.5. If a triangle and a parallelogram are on the same base and between same parallels, then the ratio of the area of the triangle to the area of parallelogram is :

(a) 1 : 3 (b) 1 : 2
(c) 3 :1 (d) 1 : 4

Ans. (b) 1 : 2

Q.6. If area of the parallelogram ABCD is 92.4 cm^2. If E and F are the mid– point of AB and CD respectively then area of parallelogram AEFD is:

(a) 92.4 cm^2 (b)184.8 cm^2
(c) 46.7 cm^2 (d) 46.2 cm^2

Ans. (d) 46.2 cm^2

Q.7. AD is median of ΔABC. If area of ΔABC is 50cm^2, the areaof ΔABD is is:

(a) 100 cm^2 (b) 25 cm^2
(c) 50 cm^2 (d) 75 cm^2

Ans. (b) 25 cm^2

Q.8. If the length of the diagonal of a square is 8cm, thenits area is :

(a) 64cm^2 (b) 32 cm^2
(c) 16 cm^2 (d) 48 cm^2

Ans. (b) 32 cm^2

Q.9. In ΔABC,D, E and F are the mid– points of BC, CA and AB respectively. if ar (ΔABC)= 56cm^2, the ar (AEDF) is:

(a) 92cm^2 (b) 28 cm^2
(c) 46 cm^2 (d) 42 cm^2

Ans. (b) 28 cm^2

Q.10. Two figures are called congruence if they have:

(a) same area (b) same shape
(c) same size
(d) same shape and size

Ans. (d) same shape and size