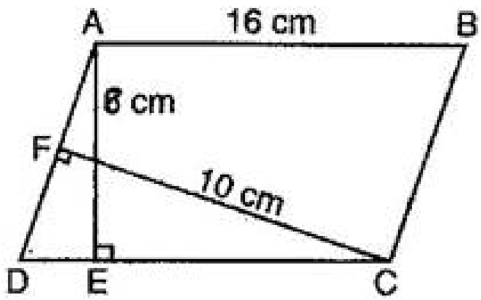
NCERT solutions for class-9 maths Areas of Parallelograms and Triangles Ex-9.2

Q1. In figure, ABCD is a parallelogram. AE $\perp$ DC and CF $\perp$ AD. If AB = 16 cm, AE = 8 cm and CF = 10 cm, find AD.



Ans. ABCD is a parallelogram.

$\therefore$ DC = AB $\Rightarrow$ DC = 16 cm

AE $\perp$ DC [Given]

Now Area of parallelogram ABCD = Base x Corresponding height

$= DC \times AE = 16 \times 8 = 128\ cm^2$

Using base AD and height CF, we can find,

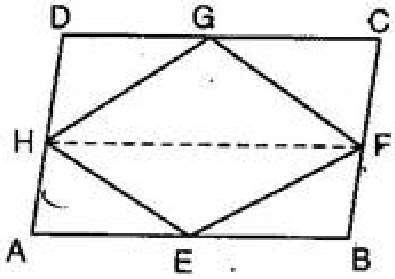
Area of parallelogram = $AD \times CF$

$\Rightarrow 128 = AD \times 10$

$\Rightarrow$ AD = $\frac{128}{10}$ = 12.8 cm

Q2. 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. E, F, G and H are mid-points of AB, BC, CD and DA respectively.



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

Construction: Join HF

Proof: ar (ΔGHF) = $\frac{1}{2}$ ar (|| gm HFCD) ....(i)

And ar (ΔHEF) = $\frac{1}{2}$ ar (|| gm HABF) ....(ii)

[If a triangle and a parallelogram are on the same base and between the same parallel then the area of triangle is half of area of parallelogram]

Adding eq. (i) and (ii),

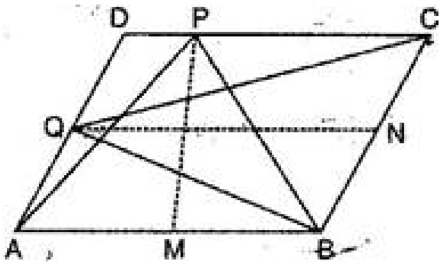
ar (ΔGHF) + ar (ΔHEF)

= $\frac{1}{2}$ ar (|| gm HFCD) + $\frac{1}{2}$ ar (|| gm HABF)

$\Rightarrow$ ar (|| gm HEFG) = $\frac{1}{2}$ ar (|| gm ABCD)

Q3. 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. Given: ABCD is a parallelogram. P is a point on DC and Q is a point on AD.



To prove: ar ($\triangle$APB) = ar ($\triangle$BQC)

Construction: Draw PM $\parallel$ BC and QN $\parallel$ DC.

Proof: Since QC is the diagonal of parallelogram QNCD.

$\therefore$ ar ($\triangle$QNC) = $\frac{1}{2}$ ar ($\parallel$gm QNCD) ....(i)

Again BQ is the diagonal of parallelogram ABNQ.

$\therefore$ ar ($\triangle$BQN) = $\frac{1}{2}$ ar ($\parallel$gm ABNQ) ....(ii)

Adding eq. (i) and (ii),

ar ($\triangle$QNC) + ar ($\triangle$BQN)

= $\frac{1}{2}$ ar ($\parallel$gm QNCD) + $\frac{1}{2}$ ar ($\parallel$gm ABNQ)

$\Rightarrow$ ar ($\triangle$BQC) = $\frac{1}{2}$ ar ($\parallel$gm ABCD) ....(iii)

Again AP is the diagonal of $\parallel$gm AMPD.

$\therefore$ ar ($\triangle$APM) = $\frac{1}{2}$ ar ($\parallel$gm AMPD) ....(iv)

And PB is the diagonal of $\parallel$gm PCBM.

$\therefore$ ar ($\triangle$PBM) = $\frac{1}{2}$ ar ($\parallel$gm PCBM) ....(v)

Adding eq. (iv) and (v),

ar (ΔAPM) + ar (ΔPBM)

$= \frac{1}{2}$ ar (|| gm AMPD) + $\frac{1}{2}$ ar (|| gm PCBM)

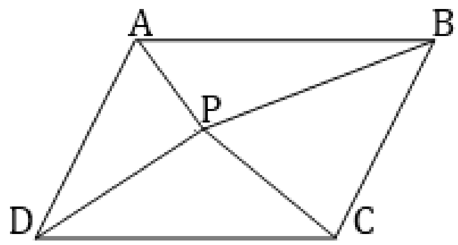
$\Rightarrow$ ar (ΔAPB) = $\frac{1}{2}$ ar (|| gm ABCD) ....(vi)

From eq. (iii) and (vi),

ar (ΔBQC) = ar (ΔAPB) or ar (ΔAPB) = ar (Δ BQC)

Q4. In figure, P is a point in the interior of a parallelogram ABCD.

Show that:

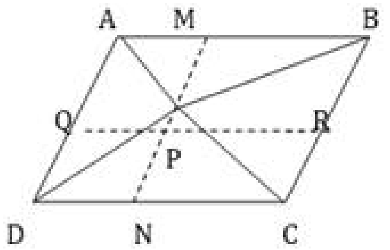


(i) ar (APB) + ar (PCD) = $\frac{1}{2}$ ar (ABCD)

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

Ans. (i) Draw a line passing through point P and parallel to AB which intersects AD at Q and BC at R respectively.

Now ΔAPB and parallelogram ABRQ are on the same base AB and between same parallels AB and QR.



$\therefore$ ar (ΔAPB) = $\frac{1}{2}$ ar (|| gm ABRQ) ....(i)

Also Δ PCD and parallelogram DCRQ are on the same base AB and between same parallels AB and QR.

$\therefore$ ar (ΔPCD) = $\frac{1}{2}$ ar (|| gm DCRQ) ....(ii)

Adding eq. (i) and (ii),

ar (ΔAPB) + ar (Δ PCD)

= $\frac{1}{2}$ ar (|| gm ABRQ) + $\frac{1}{2}$ ar (|| gm DCRQ)

$\Rightarrow$ ar (ΔAPB) = $\frac{1}{2}$ ar (|| gm ABCD) ....(iii)

(ii) Draw a line through P and parallel to AD which intersects AB at M and DC at N. Now Δ APD and parallelogram AMND are on the same base AD and between same parallels AD and MN.

$\therefore$ ar (ΔAPD) = $\frac{1}{2}$ ar (|| gm AMND) ....(iv)

Also Δ PBC and parallelogram MNCB are on the same base BC and between same parallels BC and MN.

$\therefore$ ar (ΔPBC) = $\frac{1}{2}$ ar (|| gm MNCB) ....(v)

Adding eq. (i) and (ii),

ar (ΔAPD) + ar (ΔPBC)

$= \frac{1}{2}$ ar (|| gm AMND) + $\frac{1}{2}$ ar (|| gm MNCB)

$\Rightarrow$ ar (ΔAPD) = $\frac{1}{2}$ ar (|| gm ABCD) ....(vi)

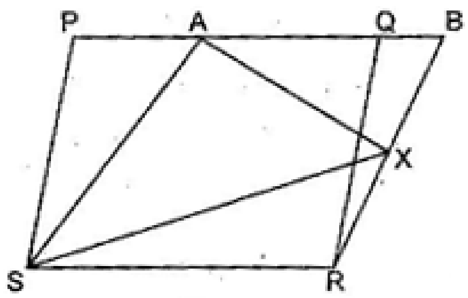
From eq. (iii) and (vi), we get,

ar (ΔAPB) + ar (ΔPCD) = ar (ΔAPD) + ar (Δ PBC)

or ar (ΔAPD) + ar (ΔPBC) = ar (ΔAPB) + ar (Δ PCD)

Hence proved.

Q5. In figure, PQRS and ABRS are parallelograms and X is any point on the side BR. Show that:



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

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

Ans. **(i)** Parallelogram PQRS and ABRS are on the same base SR and between the same parallels SR and PB.

$\therefore$ ar (|| gm PQRS) = $\frac{1}{2}$ ar (|| gm ABRS) ....(i)

[$\because$ parallelograms on the same base and between the same parallels are equal

in area]

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

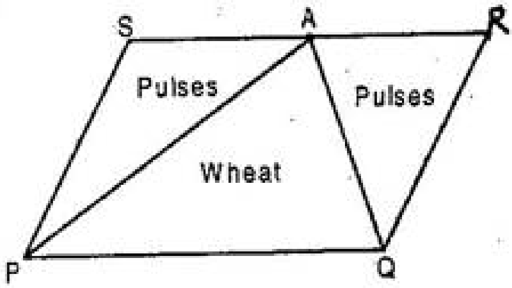
$\therefore$ ar (ΔAXS) = $\frac{1}{2}$ ar (|| gm ABRS) ....(ii)

Using eq. (i) and (ii),

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

Q6. 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. When A is joined with P and Q; the field is divided into three parts viz. ΔPAS, ΔAPQ and Δ AQR. ΔAPQ and parallelogram PQRS are on the same base PQ and between same parallels PQ and SR.



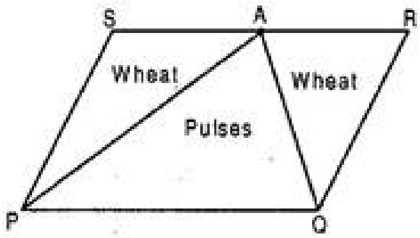
$\therefore$ ar (ΔAPQ) = $\frac{1}{2}$ ar (|| gm PQRS)

It implies that triangular region APQ covers half portion of parallelogram shaped field PQRS.

So if farmer sows wheat in triangular shaped field APQ then she will definitely sow pulses in other two triangular parts PAS and AQR.

Or

When she sows pulses in triangular shaped field APQ then she will sow wheat in other two triangular parts PAS and AQR.



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