

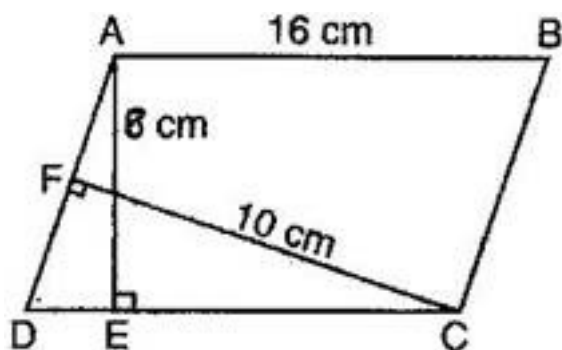
CBSE Class 9 Mathematics

NCERT Solutions

CHAPTER 9

Areas of Parallelograms and Triangles(Ex. 9.2)

1. 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.

$$\therefore DC = AB \Rightarrow DC = 16 \text{ cm}$$

$AE \perp DC$  [Given]

Now Area of parallelogram ABCD = Base x Corresponding height

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

Using base AD and height CF, we can find,

$$\text{Area of parallelogram} = AD \times CF$$

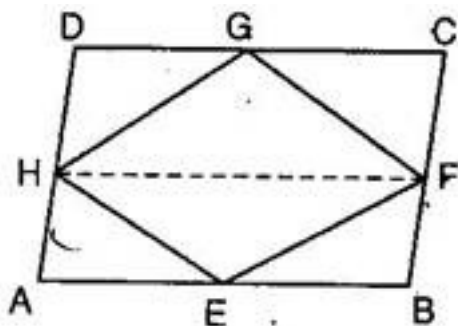
$$\Rightarrow 128 = AD \times 10$$

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

2. If E, F, G and H are respectively the mid-points of the sides of a parallelogram ABCD,

show that  $\text{ar}(\text{EFGH}) = \frac{1}{2} \text{ar}(\text{ABCD})$ .

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



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

**Construction:** Join HF

**Proof:** In a parallelogram ABCD,  $AD = BC$   $AD \parallel BC$  (Opp. sides of parallelogram are equal and parallel)

H and F are mid point of AD and BC

so we can say  $AH = \frac{1}{2} AD$ ,  $FB = \frac{1}{2} BC$

And  $AH \parallel BF$

so we can say that ABFH is a parallelogram

since  $\triangle \text{HEF}$  and parallelogram ABFH are on same base HF and between same parallel HF and AB so

$$\text{ar}(\triangle \text{HEF}) = \frac{1}{2} \text{ar}(\text{ABFH}) \dots\dots\dots(1)$$

Similarly we can prove that

$$\text{ar}(\triangle \text{HGF}) = \frac{1}{2} \text{ar}(\text{HDFC}) \dots\dots\dots(2)$$

add equation (1) and(2)

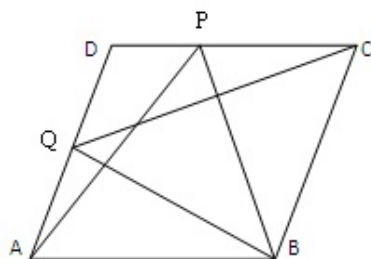
$$\text{ar}(\triangle \text{HEF}) + \text{ar}(\triangle \text{HGF}) = \frac{1}{2} \text{ar}(\text{ABFH}) + \frac{1}{2} \text{ar}(\text{HDFC})$$

$$\text{ar}(\text{EFGH}) = \frac{1}{2} [\text{ar}(\text{ABFH}) + \text{ar}(\text{HDFC})]$$

$$\text{ar}(\text{EFGH}) = \frac{1}{2} [\text{ar}(\text{ABCD})]$$

**3. P and Q are any two points lying on the sides DC and AD respectively of a parallelogram ABCD. Show that  $\text{ar}(\triangle APB) = \text{ar}(\triangle BQC)$ .**

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



**To prove:**  $\text{ar}(\triangle APB) = \text{ar}(\triangle BQC)$

**Proof.**

$\triangle BQC$  and parallelogram ABCD are on same base BC and between same parallel BC and AD  
so

$$\text{ar}(\triangle BQC) = \frac{1}{2} \text{ar}(\text{ABCD}) \dots\dots\dots(1)$$

Now

$\triangle APB$  and parallelogram ABCD are on same base AB and between same parallel DC and AB  
so

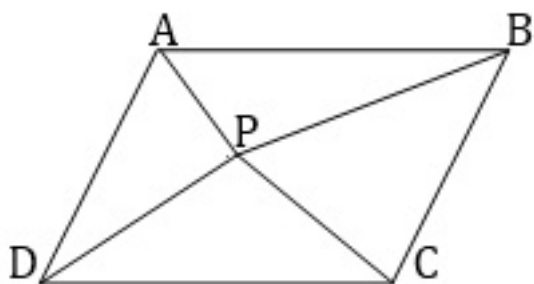
$$\text{ar}(\triangle APB) = \frac{1}{2} \text{ar}(\text{ABCD}) \dots\dots\dots(2)$$

From eq.(1) and eq(2) we can say that

$$\text{ar}(\triangle BQC) = \text{ar}(\triangle APB)$$

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

Show that:

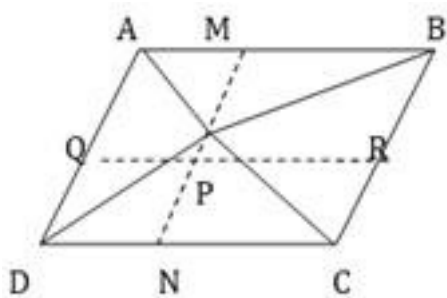


(i)  $\text{ar}(\triangle APB) + \text{ar}(\triangle PCD) = \frac{1}{2} \text{ar}(\text{ABCD})$

(ii)  $\text{ar}(\triangle APD) + \text{ar}(\triangle PBC) = \text{ar}(\triangle APB) + \text{ar}(\triangle PCD)$

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

Now  $\triangle APB$  and parallelogram ABRQ are on the same base AB and between same parallels AB and QR.



$\therefore \text{ar}(\triangle APB) = \frac{1}{2} \text{ar}(\parallel \text{gm ABRQ}) \dots\dots\dots(i)$

Also  $\triangle PCD$  and parallelogram DCRQ are on the same base AB and between same parallels AB and QR.

$$\therefore \text{ar} (\triangle PCD) = \frac{1}{2} \text{ar} (\parallel \text{gm DCRQ}) \dots\dots\dots(\text{ii})$$

Adding eq. (i) and (ii),

$$\begin{aligned} &\text{ar} (\triangle APB) + \text{ar} (\triangle PCD) \\ &= \frac{1}{2} \text{ar} (\parallel \text{gm ABRQ}) + \frac{1}{2} \text{ar} (\parallel \text{gm DCRQ}) \end{aligned}$$

$$\Rightarrow \text{ar} (\triangle APB) = \frac{1}{2} \text{ar} (\parallel \text{gm ABCD}) \dots\dots\dots(\text{iii})$$

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

$$\therefore \text{ar} (\triangle APD) = \frac{1}{2} \text{ar} (\parallel \text{gm AMND}) \dots\dots\dots(\text{iv})$$

Also  $\triangle PBC$  and parallelogram MNCB are on the same base BC and between same parallels BC and MN.

$$\therefore \text{ar} (\triangle PBC) = \frac{1}{2} \text{ar} (\parallel \text{gm MNCB}) \dots\dots\dots(\text{v})$$

Adding eq. (i) and (ii),

$$\begin{aligned} &\text{ar} (\triangle APD) + \text{ar} (\triangle PBC) \\ &= \frac{1}{2} \text{ar} (\parallel \text{gm AMND}) + \frac{1}{2} \text{ar} (\parallel \text{gm MNCB}) \end{aligned}$$

$$\Rightarrow \text{ar} (\triangle APD) = \frac{1}{2} \text{ar} (\parallel \text{gm ABCD}) \dots\dots\dots(\text{vi})$$

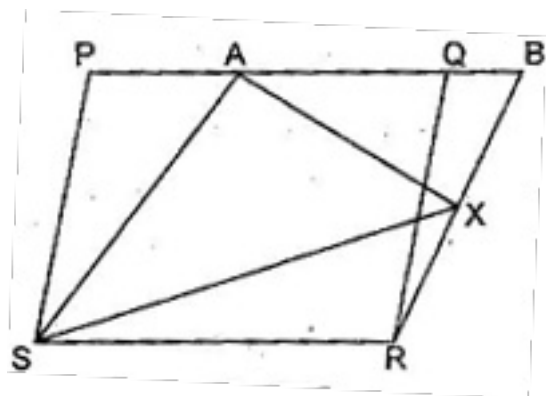
From eq. (iii) and (vi), we get,

$$\text{ar} (\triangle APB) + \text{ar} (\triangle PCD) = \text{ar} (\triangle APD) + \text{ar} (\triangle PBC)$$

$$\text{or ar} (\triangle APD) + \text{ar} (\triangle PBC) = \text{ar} (\triangle APB) + \text{ar} (\triangle PCD)$$

Hence proved.

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



**(i)  $\text{ar} (\text{PQRS}) = \text{ar} (\text{ABRS})$**

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

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

$$\therefore \text{ar} (\text{II gm PQRS}) = \text{ar} (\text{II gm ABRS}) \dots\dots\dots(\text{i})$$

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

**(ii)**  $\triangle AXS$  and II gm ABRS are on the same base AS and between the same parallels AS and BR.

$$\therefore \text{ar} (\triangle AXS) = \frac{1}{2} \text{ar} (\text{II gm ABRS}) \dots\dots\dots(\text{ii})$$

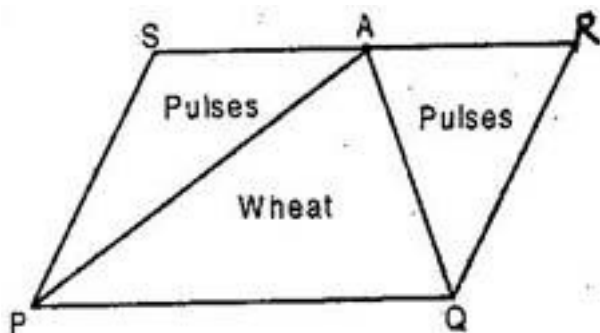
Using eq. (i) and (ii),

$$\text{ar} (\triangle AXS) = \frac{1}{2} \text{ar} (\text{II gm PQRS})$$

**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.** When A is joined with P and Q; the field is divided into three parts viz.  $\triangle PAS$ ,  $\triangle APQ$  and  $\triangle AQR$ .  $\triangle APQ$  and parallelogram PQRS are on the same base PQ and between same parallels PQ and SR.



$$\therefore \text{ar}(\triangle APQ) = \frac{1}{2} \text{ar}(\text{IIgm PQRS})$$

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.

