## CHAPTER 09

# Areas of Parallelogram and Triangles

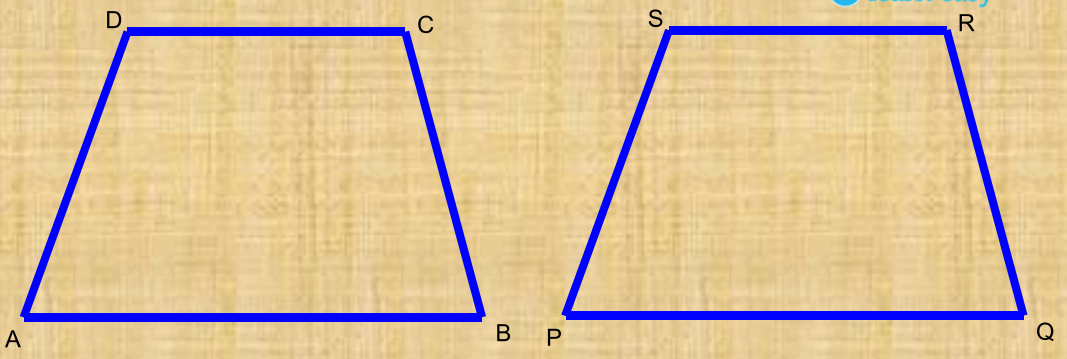
- The study of geometry originated with the measurement of lands in the process of recasting boundaries of the fields and dividing them into appropriate parts.
- The part of the plane enclosed by a simple closed figure is called a planar region corresponding to that figure.

**How can you define area of planar region?**

- The magnitude or measure of the planar region is called its area. The magnitude or measure is always expressed with the help of a number such as 6 $cm^2$, 9 $m^2$ and 3 hectares etc. i.e. Units for area is square units.
- We can say that the area of a figure is a number associated with the part of the plane enclosed by the figure.
- If two quadrilaterals ABCD and PQRS overlap each other completely, then what we can call those two quadrilaterals?

They are said to be congruent figures.

i.e. Both the quadrilaterals have same shape and have same size as shown in the figure.



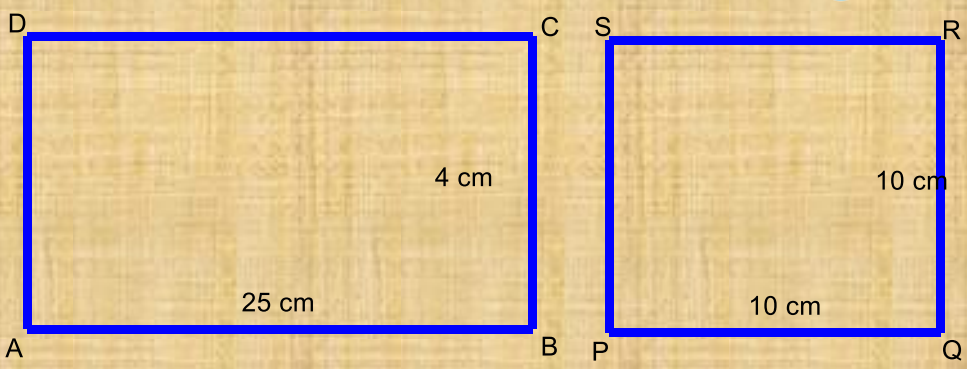

- If two figures X and Y are congruent, then they must have equal areas.

Both the converse of this statement is not true.

In other words,

Two figures having equal areas need not be congruent.

- For example, rectangles ABCD and PQRS have equal areas.




Area of rectangle ABCD is 25 cm x 4 cm = 100 $cm^2$

Area of rectangle PQRS is 10 cm x 10 cm = 100 $cm^2$

Here we can observe that,

Areas of two figures are same, but their sizes are not same.

We can conclude that they are not congruent.

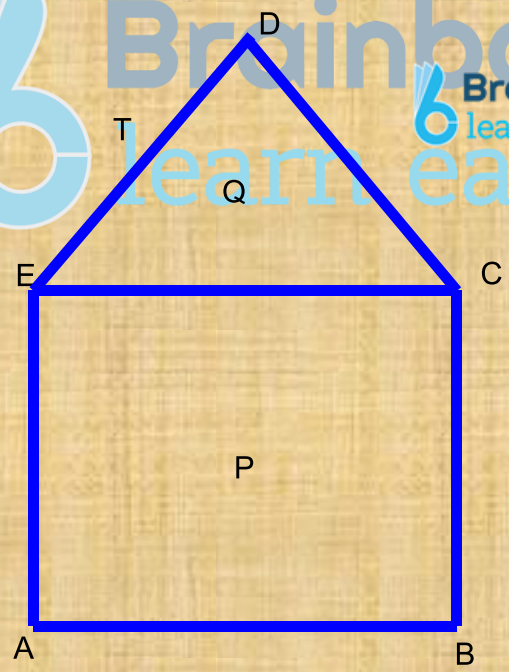
**Example:**

Find are of the given figure associated with different shapes.

**Sol.**

The figure ABCDE, which is made up of quadrilateral ABCE and triangle CDE.

Area of ABCDE = Area of ABCE + Area of CDE




Planar region formed by figure T is made up two planar regions formed by figures P and Q.

Area of T = Area of P + Area of Q

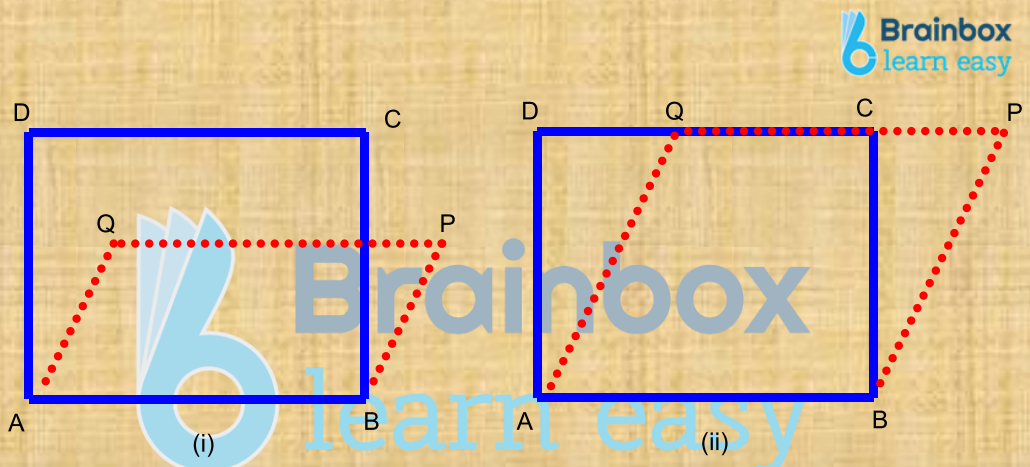
- If A and B are two congruent figures,

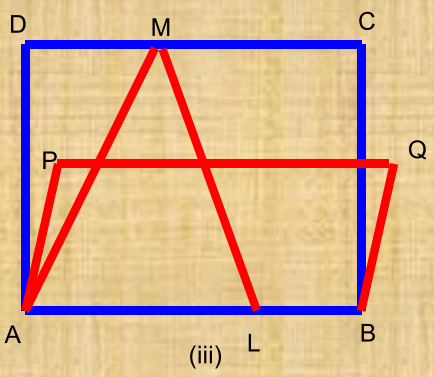
  Area (A) = Area (B)

- If a planar region formed by a figure T is made up of two non – overlapping planar regions formed by the P and Q then,

  Area (T) = Area (P) + Area (Q)

These figures are on the same base and between the same parallel.




In figure (i), Parallelograms ABCD and ABPQ are on the same base AB.

If two geometric figures have a common side, we say that they are on the same base.

In figure (ii), Parallelograms ABCD and ABPQ are on the same base AB and between the same parallels AB and DP as the vertices C and D of parallelogram ABCD and P & Q of parallelogram ABPQ lie on a line DP parallel to base AB.

Two geometric figures are said to be on the same base and between the same parallel lines; if they have a common side and the vertices opposite to the common base of each figure lie on the line parallel to the base.

In figure (iii), we find the parallelograms ABCD and ABQP are on the same base AB but they are not between the same parallel lines as the vertices P, Q of parallelogram ABCD and C, D of parallelogram ABCD do not lie on the same line and also $\Delta$MAL and parallelogram ABCD are between the same parallel lines but they are not on the common base.

**Base and Altitude of a parallelogram:**

**Base:**

Any side of the parallelogram can be called its base.

**Height:**

The perpendicular line segment drawn from a vertex to its opposite side is called height or altitude of the parallelogram corresponding to the given base.

In the adjoining figure,

- DP is the altitude of parallelogram ABCD, corresponding to the base AB.
- DQ is the altitude of parallelogram ABCD, corresponding to the base BC.