Find the Formula For the Area Of a Trapezium

OBJECTIVE

To find the formula for the area of a trapezium experimentally.

Materials Required

1. Cardboard
2. Thermocol
3. Geometry box
4. Drawing sheets
5. Scissors
6. Adhesive

Prerequisite Knowledge

1. Concept of a trapezium.
2. Area of a parallelogram.

Theory

1. A quadrilateral in which one pair of opposite sides are parallel and one pair of opposite sides are non-parallel, is called a trapezium. In Fig. 19.1, ABCD is a trapezium, in which AB||CD and AD, BC are non-parallel.
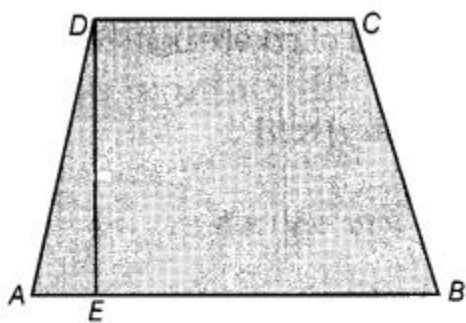

Fig. 19.1

Area of trapezium = ½ (Sum of parallel sides) x Distance between parallel sides (Altitude) = ½(AB + CD) x DE

If two non-parallel sides of a trapezium are equal, then it is called an isosceles trapezium.

2. Area of parallelogram = Base x Height
    1. Parallelograms on the same base and between the same parallels are equal in area.
    2. If a triangle and a parallelogram are on the same base and between the same parallels, then the area of the triangle is equal to half the area of the parallelogram.

Procedure

1. Take a cardboard piece of suitable size and by using adhesive, paste a drawing sheet on it.
2. By using thermocol sheet, cut out two congruent trapeziums of parallel sides x and y units with h units altitude.(see Fig. 19.2)
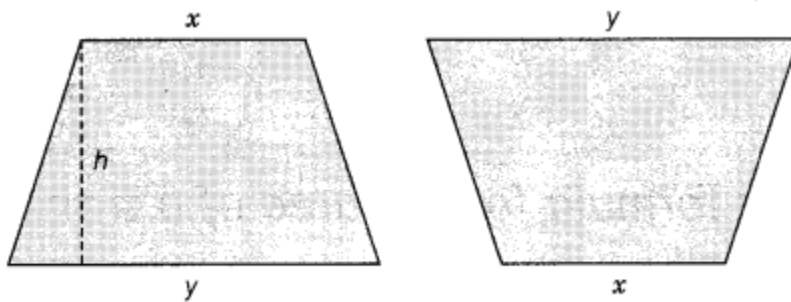

Fig. 19.2

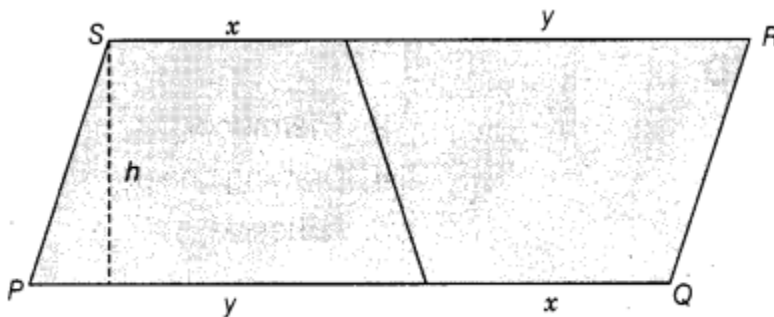3. Now, place both trapeziums on cardboard, (see Fig. 19.3)

Fig. 19.3

Demonstration

1. In Fig. 19.3, figure formed by placing, both trapeziums together is a parallelogram.
2. Base of parallelogram = (x + y) units and corresponding altitude = h units
3. Now, Area of trapezium = ½ (Area of parallelogram)
    = ½ (Base of parallelogram x Corresponding altitude)

= ½[(x + y) x h]
Hence, area of trapezium = ½ x (x + y) x h .
= ½ x (Sum of parallel sides) x Altitude Here, area is in square units.

Observation
Lengths of parallel sides of the trapezium = ………….. , ……………
Length of altitude of the parallelogram = ……………
Area of the parallelogram = ……………
Area of the trapezium = ½ (Sum of …… sides) x ………….

Result
We have verified experimentally the formula for the area of a trapezium.

Application
This concept is used in

1. finding the formula for area of a triangle, in coordinate geometry.
2. deriving the area of a field which can be split into different trapeziums and right triangles.

Viva Voce

Question 1:
How will you define a trapezium?
Answer:
Trapezium is a quadrilateral in which one pair of opposite sides are parallel and the other pair of sides are non-parallel.

Question 2:
In a trapezium ABCD, if AB||CD, then which pair of angles are supplementary?
Answer:
∠A and ∠D, ∠B and ∠C are supplementary pairs of angles.

Question 3:
Are the opposite angles of trapezium supplementary?
Answer:
No, the opposite angles of a trapezium are not supplementary.

Question 4:
"Congruent trapeziums have unequal area". Is this statement true?
Answer:
No, because they have equal area.

Question 5:
How will you find the area of a parallelogram?
Answer:
Area of parallelogram = Base x Altitude to the base

Question 6:
Write the condition that any trapezium should be an isosceles trapezium.
Answer:
The condition that any trapezium should be an isosceles trapezium if and only if non-parallel sides of a trapezium are equal.

Question 7:
If we take any two points E and F on the line AS of trapezium ABCD such that AB||CD, then check whether the area of ΔCED and ΔCFD are equal.
Answer:
We know that the area of two triangles on the same base and between two parallel lines'are equal. Here, CD is base, points E and F are on the parallel line AB, then area of triangles, ΔCED and ΔCFD are equal.

Question 8:
Is it correct that every parallelogram is a trapezium?
Answer:
No

Question 9:
Is it true that sum of all the angles of a parallelogram and trapezium are equal?
Answer:
Yes, we know that the sum of all angles of a quadrilateral is 360°.
Here, parallelogram and trapezium are quadrilateral.

Suggested Activity

Using the above activity, find the area of an isosceles trapezium, if one of its non-parallel side is 5 cm and lengths of two parallel sides are 4 cm and 10 cm.