Verify the Algebraic Identity $(a+b)^2 = a^2 + 2ab+b^2$

OBJECTIVE

To verify the algebraic identity $(a+b)^2 = a^2 + 2ab+b^2$.

Materials Required

1. Drawing sheet
2. Pencil
3. Cello-tape
4. Coloured papers
5. Cutter
6. Ruler

Prerequisite Knowledge

1. Square and its area.
2. Rectangle and its area.

Theory

1. A square is a quadrilateral whose all sides are equal and all the angles are 90°.

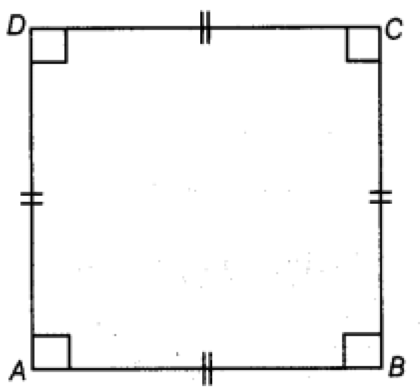

Fig. 3.1

2. A rectangle is a quadrilateral whose opposite sides are equal and all the angles are 90°

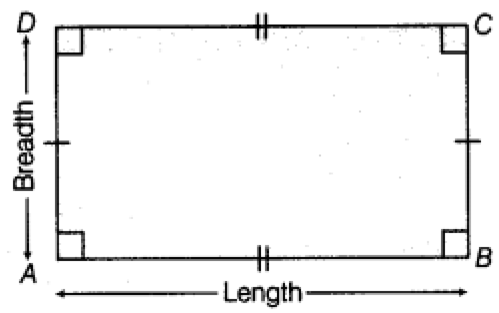

Fig. 3.2

Area of rectangle = Length x Breadth

Procedure

1. From a coloured paper, cut out a square whose length of each side is a units and name it as square PQRS. (see Fig. 3.3)

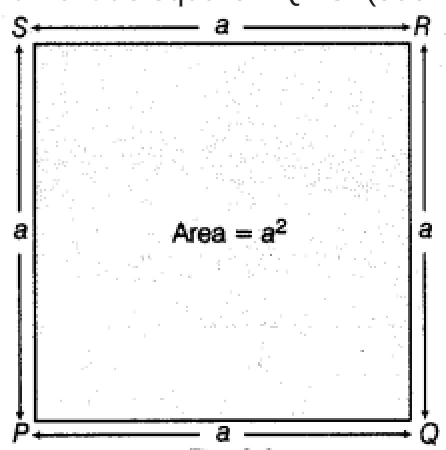

Fig. 3.3

2. From same coloured paper as in step 1st, cut out another square whose length of each side is b units (a > b) and name it as square RFGH. (see Fig 3.4)

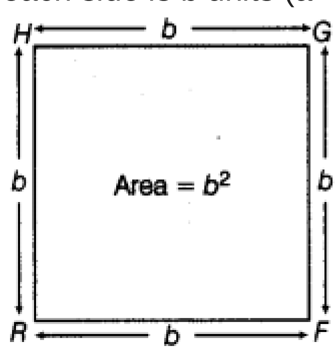

Fig. 3.4

3. From different coloured paper, cut out a rectangle of length a units and breadth b units and name it as rectangle SRHE. (see Fig. 3.5)

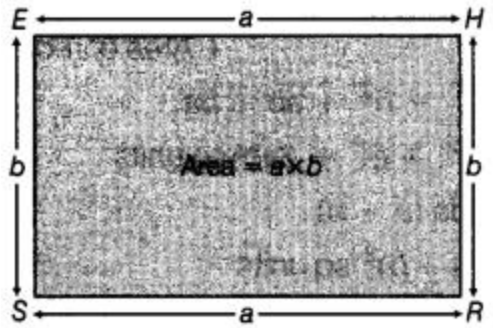

Fig. 3.5

4. From same coloured paper as in step 3rd cut out a rectangle of length b units and breadth a units and name it as rectangle QIFR. (see Fig. 3.6)

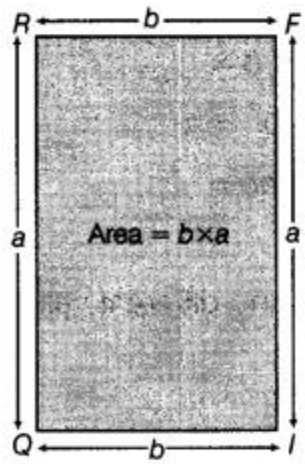

Fig. 3.6

5. Arrange the above cutted figures (squares and rectangles) as shown in figure and paste it on drawing sheet using cello-tape, (see Fig. 3.7).

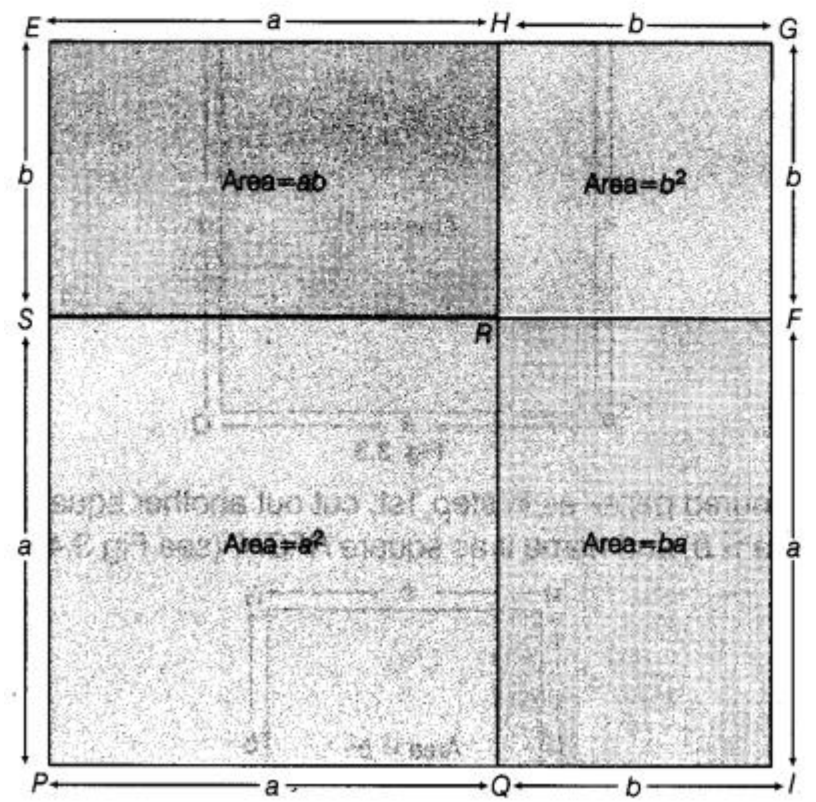

Fig. 3.7

figure, it is clear that we have obtained a square PIGE of side (a + b).

Demonstration

From Fig. 3.7, area of PIGE
= Area of square PQRS + Area of square RFGH + Area of rectangle SRHE + Area of rectangle QIFR
$= a^2 + b^2 + ab + ba$
$= a^2 + 2ab + b^2$ sq units ,..(i)
Also, PIGE is a square of side (a + b).
So, area of PIGE= $(a+b)^2$ sq units …(ii)
Hence, from Eqs. (i) and (ii), we can write $(a+b)^2 = a^2 + 2ab+b^2$.

Observation

On actual measurement, we get
a = ………… , b = ………… , (a + b) = ………… ,
Now, a^2 = ……….. , b^2 = ……….. , ab = ……….. ,
$(a+b)^2$ = ……….. , 2ab = ……….. .
Hence, $(a+b)^2 = a^2 + 2ab+b^2$.
The identity may be verified by taking different values of a and b.

Result

The identity $a^2 + 2ab+b^2 = (a+b)^2$ has been verified.

Application

The identity is useful for

1. calculating the square of a number, which can be expressed as the sum of the two convenient numbers.
2. simplification and factorisation of some algebraic expressions.

Viva Voce

Question 1:

What do you mean by algebraic expression?

Answer:

A combination of constants and variables, connected by four fundamental arithmetic operations +, -, x and + is called an algebraic expression.

Question 2:

Are $(a+b)^2$ and $a^2 + 2ab+b^2$ algebraic expressions?

Answer:

Yes, both $(a+b)^2$ and $a^2 + 2ab+b^2$ are algebraic expressions because they contain both variables (a and b) and arithmetic operations (+).

Question 3:

What is the difference between algebraic expression and polynomial?

Answer:

In algebraic expression, variables may have negative exponents but in polynomial, variables have only positive integer powers.

Question 4:

\sa2 + 2ab+b2 a polynomial?

Answer:

Yes, because the variables a and b have positive integer powers.

Question 5:

Is the identity $(a+b)^2 = a^2 + 2ab+b^2$ hold for negative values of a and b?

Answer:

Yes, given identity also hold for negative values.

Suggested Activity

Verify this activity by taking

1. a = 2 and b = 3
2. a = 6 and b = 9