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. Coloured papers
4. Scissors
5. Ruler
6. Adhesive

Prerequisite Knowledge

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

Theory

1. For square and its area refer to Activity 3.
2. For rectangle and its area refer to Activity 3.

Procedure

1. From a coloured paper, cut a square PQRS of side a units, (see Fig. 4.1)

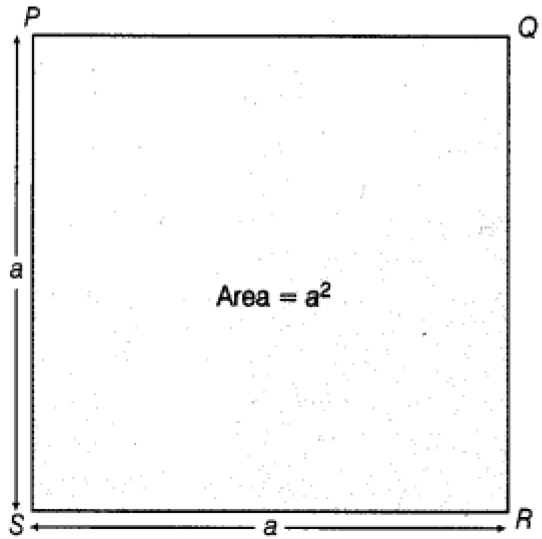

Fig. 4.1

2. Further, cut out another square TQWX of side b units such that b < a. (see Fig. 4.2)

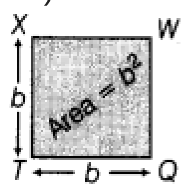

Fig. 4.2

3. Now, cut out a rectangle USRV of length a units and breadth b units from another coloured paper, (see Fig. 4.3)

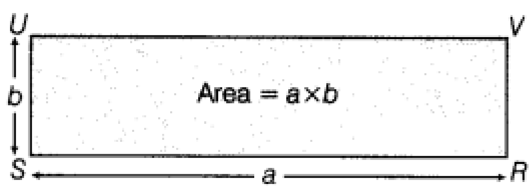

Fig. 4.3

4. Now further, cut out another rectangle ZVWX of length a units and breadth b units, (see Fig. 4.4)

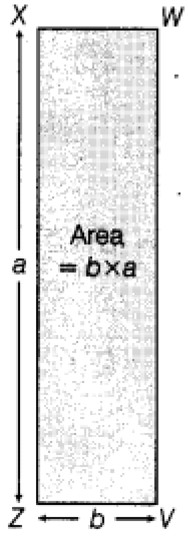

Fig. 4.4

5. Now, arrange figures 4.1, 4.2, 4.3 and 4.4, according to their vertices and paste it on a drawing sheet, (see Fig. 4.5)

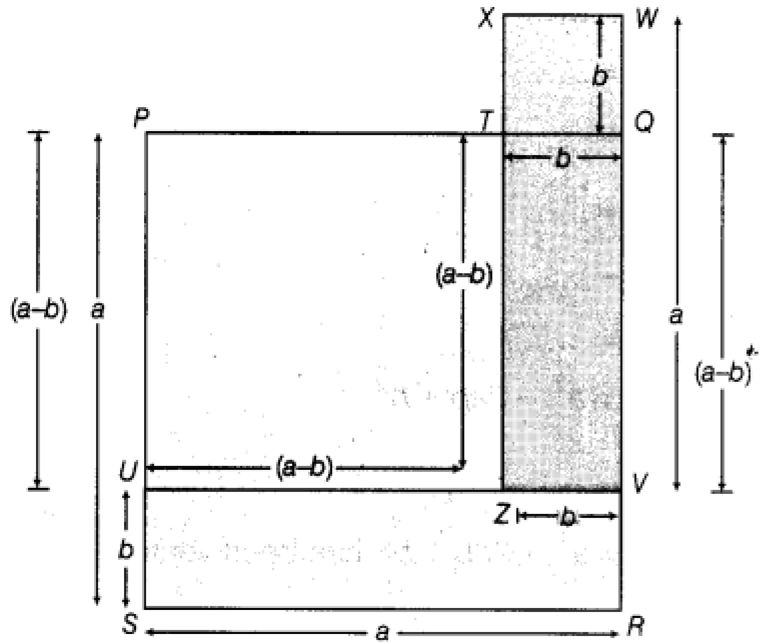

Fig. 4.5

Demonstration

From the figures 4.1,4.2, 4.3 and 4.4, we have Area of square PQRS = a^2
Area of square TQWX = b^2
Area of rectangle USRV = ab and Area of rectangle ZVWX – ab
Area of square PUZT = Area of square PQRS + Area of square TQWX – Area of rectangle ZVWX – Area of rectangle USRV

$= a^2 + b^2 – ba-ab$
$= (a^2 -2ab + b^2)$ …(i)
Also, from Fig. 4.5, it is clear that PUZT is a square whose each side is $(a – b)$.
Area of square PUZT = $(Side)^2$
$= [(a-b)]^2 =(a-b)^2$ …(ii)
From Eqs. (i) and (ii), we get $(a – b)^2 = (a^2 – 2ab + b^2)$
Here, area is in square units.

Observation

On actual measurement, we get
a = ………… ,
b= ………… ,
(a-b) = ………… ,
a^2 = ………… ,
b^2 = ………… ,
$(a^2 – b^2)$ = ………… ,
ab = ………… ,
and 2ab = ………… ,
Hence, $(a – b)^2 = a^2 – 2ab + b^2$

Result

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

Application

The identity $(a – b)^2 = a^2 -2ab + b^2$ may be used for

1. calculating the square of a number which can be expressed as a difference of two convenient numbers.
2. simplification and factorization of algebraic expressions.

Viva Voce

Question 1:
What do you mean by an algebraic identity?
Answer:
An algebraic identity is an algebraic equation which is true for all values of variables occurring in it.

Question 2:
Is $(x – 3y)^2 = x^2 – 6xy + 9y^2$ an algebraic identity?
Answer:
Yes

Question 3:
Which identity should be use to expand $(3x – 2y)^2$?

Answer:
$(a - b)^2 = a^2 - 2ab + b^2$

Question 4:
Is the identity $(a - b) = a^2 - 2ab + b^2$ hold for negative values of a and b?
Answer:
Yes

Question 5:
What do we mean by degree of an algebraic expression?
Answer:
The highest power of the variable involved in the algebraic expression is called its degree.

Question 6:
The algebraic identity is true for every real number.
Answer:
Yes

Question 7:
Suppose we want square of any natural number, then it is possible to find the square of any natural number by using the identity
$(a - b)^2 = a^2 + b^2 - 2ab$
Answer:
Yes

Question 8:
In an identity $(a - b)^2 = a^2 + b^2 - 2ab$, if both variables are equal, then find the value of $(a - b)^2$.
Answer:
When a = b, then
$(a-b)^2 = (b-b)^2 = 0$

Suggested Activity
Verify the algebraic identity $(a-b)^2 = a^2 - 2ab + b^2$ by taking a = 9 and b = 4.