



TARANG SCIENTIFIC INSTRUMENTS

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ALGEBRA KIT - II

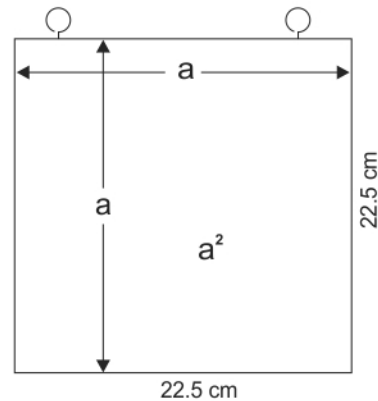
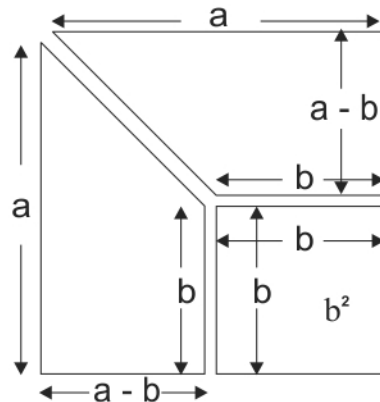
To prove geometrically

1. $a^2 - b^2 = (a + b)(a - b)$
2. $(a - b)^2 = a^2 + b^2 - 2bc$
3. $(a - b - c)^2 = a^2 + b^2 + c^2 - 2ab + 2bc - 2ac$

I. Identity : $a^2 - b^2 = (a + b)(a - b)$

It consists of square made out of 12 mm eva rubber of the size 22.5 x 22.5 cm. It has two hooks fixed to it and acts a base for the demo.

Also consists of 3 pieces which are cut out of 22.5x22.5 cm size 12 mm thick eva rubber as follows.



To do and observe :

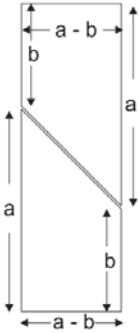
Step 1 : Hang the a^2 piece to the wall (or place it on a table)

Step 2 : Now pin the 3 piece on a^2 base as shown in the above diagram.

Step 3 : Remove the b^2 piece . By doing this you are subtracting b^2 from a^2

Now the remaining area is $a^2 - b^2$ (1)

Step 4 : Now take out the top right cut pieces turn it back and arrange it as shown in the below diagram so as to form the rectangle

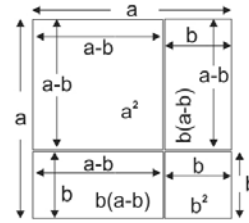
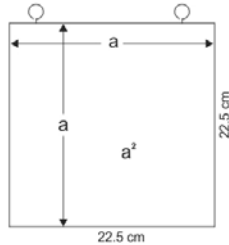


Now,
 Area of rectangle = length x breadth
 $= (a+b)(a-b)$ (2)
 Clearly Eqn. no. 1 = Eqn no. 2
 So, $a^2 - b^2 = (a+b)(a-b)$

II. Identity : $(a - b)^2 = a^2 + b^2 - 2bc$

It consists of square made out of 12 mm eva rubber of the size 22.5 x 22.5 cm. It has two hooks fixed to it and acts a base for the demo.

Also consists of 4 pieces which are cut out of 22.5x22.5 cm size 12 mm thick eva rubber as follows.



To do and observe :

Step 1 : Hang the a^2 piece to the wall (or place it on a table)

Step 2 : Now arrange the 4 pieces on a^2 base and pin them as shown in the above diagram.

Step 3 : Now area of base = a^2 (1)

Total area of the cut pieces are

$$\begin{aligned}
 &= (a-b)^2 + (a-b)b + b(a-b) + b^2 \\
 &= (a-b)^2 + ab - b^2 + ab - b^2 + b^2 \\
 &= (a-b)^2 + 2ab - b^2 \dots\dots\dots (2)
 \end{aligned}$$

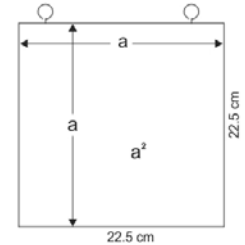
But, Eqn 1 = Eqn. 2

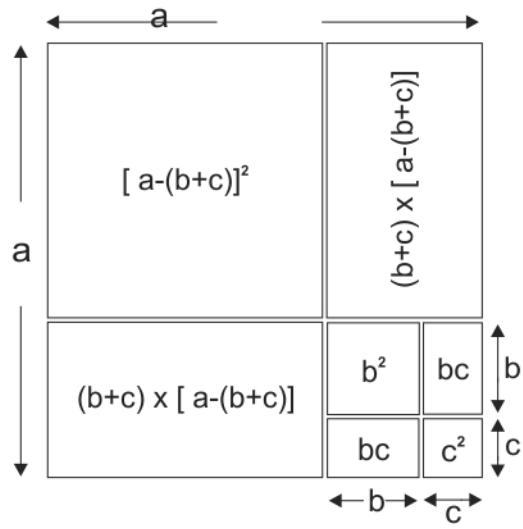
$$\begin{aligned}
 \text{So, } a^2 &= (a-b)^2 + 2ab - b^2 \\
 a^2 - 2ab + b^2 &= (a-b)^2
 \end{aligned}$$

III. Identity : $(a - b - c)^2 = a^2 + b^2 + c^2 - 2ab + 2bc - 2ac$

It consists of square made out of 12 mm eva rubber of the size 22.5 x 22.5 cm. It has two hooks fixed to it and acts a base for the demo.

Also consists of 7 squares and rectangle pieces which are cut out of 22.5x22.5 cm size 12 mm thick eva rubber as follows.





Step 1 : Arrange the seven pieces and pin them on the base a^2

$$\text{Area of base is } a^2 \dots\dots\dots (1)$$

Step 2 : Total area of the pieces is :

$$\begin{aligned}
 & [a-(b+c)]^2 + (b+c) [a-(b+c)] + (b+c) [a-(b+c)] + b^2 + \\
 & bxc + cxb + c^2 \\
 & = (a-b-c)^2 + (b+c) (a-b-c) + (b+c) (a-b-c) + b^2 + bc + bc + c^2 \\
 & = (a-b-c)^2 + ab-b^2-bc+ac-bc-c^2+ab-b^2-bc+ac-bc-c^2+b^2+c^2+2bc \\
 & = (a-b-c)^2 + 2ab - 4bc + 2bc + 2ac - b^2 - c^2 \\
 & = (a-b-c)^2 + 2ab - 2bc + 2ac - b^2 - c^2 \dots\dots\dots (2)
 \end{aligned}$$

But (1) = (2), so

$$a^2 = (a-b-c)^2 + 2ab - 2bc + 2ac - b^2 - c^2$$

$$\text{i.e. } a^2 + b^2 + c^2 - 2ab + 2bc - 2ac = (a-b-c)^2$$