MATHEMAGIC

-QUICKER THAN THE CALCULATOR-

Materials:

- Magic trick video
- 1 calculator
- 1 writing slate

How to do the Magic Trick

Goal:

Calculate the product of the given numbers before the spectator can find it using the calculator.

Trick:

1. The magician gives a calculator to the spectator.
2. The spectator writes the three-digit number on the calculator.
3. The magician indicates the three operations that the spectator must perform on the calculator (x 7, x 11, x 13).

   Note: To prevent the spectator from making a mistake, the magician can ask him to write the number on the calculator before explaining the instructions so he does not forget it.
4. On the magician's signal, the spectator announces the chosen three-digit number and performs the operations on that number using the calculator.
5. Meanwhile, the magician writes the product on a writing slate. He indicates when he is done, trying to do the calculation faster than the spectator.
6. When the spectator has finished his calculation, the magician shows him the number written on the writing slate.
7. The number on the calculator and the number on the writing slate match!

MATHEMATICAL EXPLANATION

Why This Trick Works.

The magician is able to find the final product quickly because the operations requested are particular.

Note that the product of 7 x 11 x 13 is 1 001. So, the operations that the spectator does are just another way to multiply his number by 1 001.

We can represent the situation using a first degree equation with one variable.

Let's say **X** = the value of the number chosen by the spectator.

Let's see what happens with the operations that the magician asks the spectator to do:

$$\mathbf{X} \times 7 \times 11 \times 13$$

$$= \mathbf{X} \times (7 \times 11 \times 13)$$

$$= \mathbf{X} \times 1\,001.$$

The situation can thus be represented by the following formula: 1 001 **X**. So,

$$1\,001\,\mathbf{X}$$

$$= (1\,000 + 1) \times \mathbf{X}$$

$$= (1\,000 \times \mathbf{X}) + (1 \times \mathbf{X})$$

$$= (1\,000 \times \mathbf{X}) + \mathbf{X}.$$

Also, doing the operation $\mathbf{X} \times 7 \times 11 \times 13$ is the same as doing $(\mathbf{X} \times 1\,000) + \mathbf{X}$. So, $(\mathbf{X} \times 1\,000)$ is the same as writing the number **X** followed by 3 zeros. By adding **X** to this value, we simply obtain the starting number written twice.

For example, in the video, the spectator had chosen $\mathbf{X} = 526$.

Therefore, $(\mathbf{X} \times 1\,000) + \mathbf{X} = (\mathbf{526} \times 1\,000) + \mathbf{526} = 526\,000 + 526 = 526\,526.$

The magician has no calculation to do. He simply has to write the spectator's number twice as quickly as possible to win.