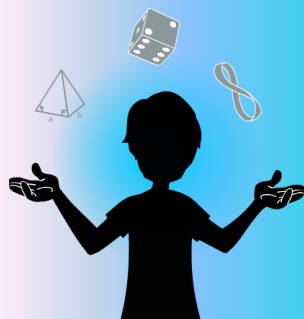


MATHEMAGIC

- HIGHLIGHTING -



AMAZINGMATHS

Materials:

- Video of the trick
- 1 full deck of cards

How to do the Magic Trick

Goal:

Find the sum of the numbers chosen by the spectators.

Trick:

1. The magician does the trick with 4 spectators. He asks the first spectator to choose a number between 10 and 19, the second spectator to choose a number between 20 and 29, the third spectator to choose a number between 30 and 39 and the fourth spectator to choose a number between 40 and 49. All these numbers are secret and must not be revealed to the magician.
2. The magician turns around and asks each spectator to take the number of cards corresponding to the digit in the tens position and the digit in the units position of the chosen number (for example, if the second spectator chose the number 23, he must take 2 cards for the tens and 3 cards for the units, so a total of 5 cards).
3. The magician takes back the remaining cards (without seeing the number of cards taken by each spectator).
4. While the magician is not looking and **counts the number of remaining cards**, the 4 spectators calculate the sum of the chosen numbers.
5. The magician is then able to predict the sum of the numbers chosen by the spectators.

To do so, the magician calculates $44 -$ (the number of remaining cards). Then, he adds a hundred to the number obtained.



MATHEMATICAL EXPLANATION



Why this trick works.

First of all, we must note that there are **54 cards** in a full deck of cards.

Let's remember that the spectators take the number of cards corresponding to the digit at the tens position and the digit at the units position.

We can notice that the first spectator's choice is limited to the numbers included between 10 and 19 inclusive. All these numbers have a characteristic in common: **they have the same digit at the tens position** (which is 1).

The second spectator's choice is limited to the numbers included between 20 and 29 inclusive. They **also have the same digit at the tens position** (which is 2).

The same principle applies to the third spectator (the digit 3) and the fourth spectator (the digit 4).

So, **the digit in the tens position of each of the numbers chosen by the spectators will always be the same, no matter the choices they made.**

From that, we know that the **total of the chosen cards for the tens position** will always be:

$$1 + 2 + 3 + 4 = 10 \text{ cards.}$$

Since the deck of cards has 54 cards, we know that there is then a possibility of 44 cards to distribute to represent the units:

$$54 - 10 = 44 \text{ cards.}$$

When the magician counts the number of remaining cards after the distribution, he knows the **total number** of cards distributed to the spectators for the units. Indeed, if the magician had not distributed any cards for the units, he would have 44 cards in his hands. However, each unit taken by the spectators removes one card from the magician's hands. That is why he counts the number of remaining cards to know the total number of units chosen by the spectators:

$$44 \text{ cards} - \text{Number of cards left after the distribution} = \text{Total number of cards distributed for the units}$$

In brief, the magician knows the total number of cards distributed for the tens (10 cards) and the total number of cards distributed for the units (see the operation above). It is possible for him to find the sum of the four numbers chosen by the spectators.

To find this sum, we simply have to add the tens' value to the units' one. We know that 10 tens equal 100 units. So, the magician simply has to add 100 to the total number of cards distributed for the units.