



AMAZINGMATHS

Materials:

- Video of the trick
- 8 tokens per team
- Deck of cards

MATHEMAGIC

-THE RIGHT WORD-

How to do the Magic Trick

1. The spectator takes one card, then cuts the rest of the deck into 3 parts as equal as possible.
2. He then chooses one of the three piles and places it on top of the card he took.
3. In his head, he spells the name of the card he chose, putting a card down on the table for each letter spelled. Then, he places the rest of the pile onto the cards he placed on the table.
4. Next, the spectator chooses another card among the two piles that were not chosen at the beginning. This second card is not secret. The spectator spells the name of this card, putting a card down for each letter spelled, then places the rest of the pile on the cards he just placed on the table.
5. The same way, the spectator spells again the name of his card. The next card in the pile is the card he had taken at the beginning!



MATHEMATICAL EXPLANATION



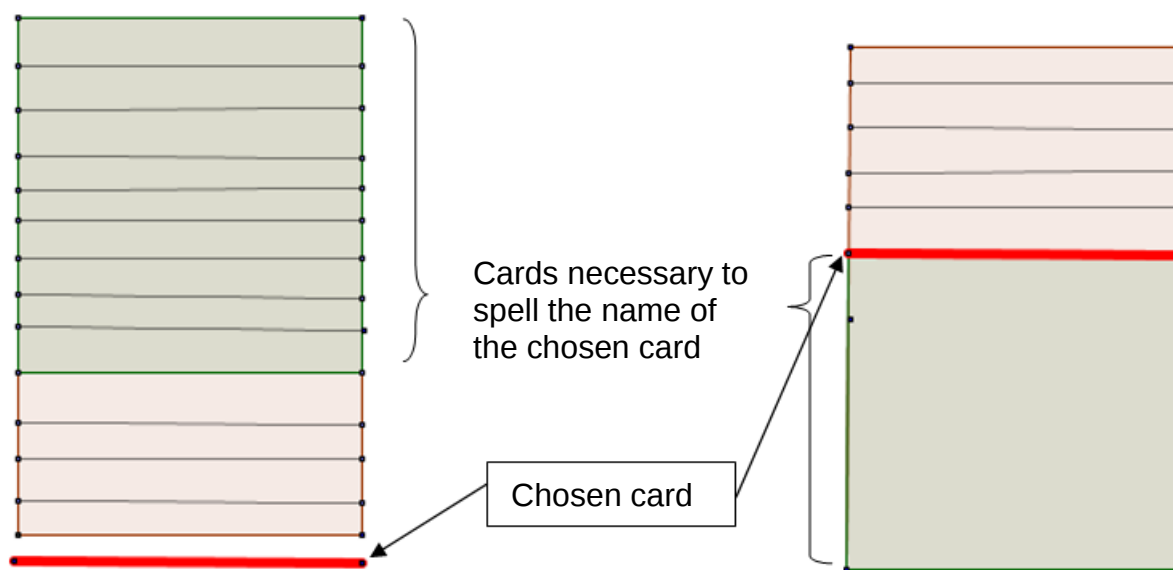
Why this trick works.

First of all, the three piles we create by cutting the deck of cards count approximately 17 cards ($52 - 1 = 51$ and $51/3 = 17$). Plus, the cards that have the least letters in their name are the ace of tiles and the ace of pikes (8 letters).

When we spell the first word, we place a certain number of cards under the chosen card (let's say X cards), then we place the rest of the pile on top. This way, we go from the first card layout to the second one, as illustrated in the following diagram:

First card layout

Second card layout



We know that we used at least 8 cards to spell the card, so the number of cards placed on top of the chosen card is smaller or equal to $17 - 8 = 9$.

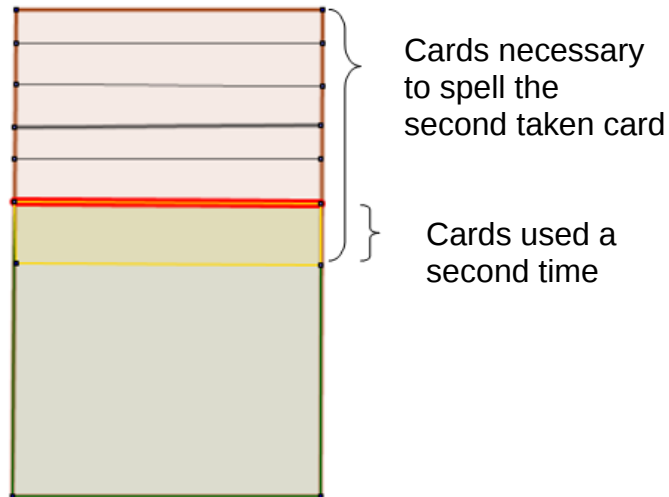
By spelling another card at random, we start by taking the cards placed on top of the pile (so on top of our chosen card) to put them on the table.

However, we know that the second card to spell has also at least 8 letters. So, we will have to use our chosen card, and probably pass it, during this second countdown. So, we will probably use some of the X cards that follow in the pile.

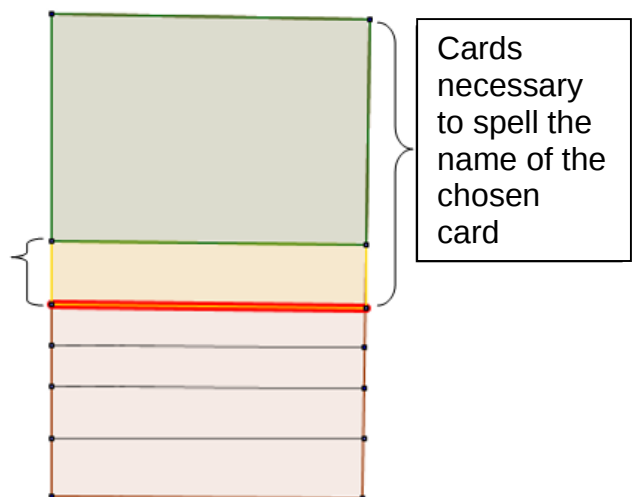
Finally, we place the rest of the X cards on top of the pile.

The card layout will change as follows:

Second card layout



Final card layout



We notice that the cards that are on top of the chosen card are exactly the X cards used to spell the card the first time. So, once we have spelled one last time the name of the chosen card, we are sure that the next card of the pile will really be the chosen card itself.

Note: The reasoning used here relies on the fact that the piles count exactly 17 cards. However, the splitting up into three piles is “approximate” in the procedure to do this trick. If the pile counts a little less than 17 cards, the trick will still work. If the pile counts a little more than 17 cards, the trick will not always work, but it will work most of the time. In fact, it will not work if the two cards used are the ace of tiles and the ace of pikes, because they are the cards with the least letters in their name. One way to avoid this problem is to ask the spectator to divide the deck into exactly three piles of 17 cards, or to remove from the deck the two aces in question. We can also leave the trick as is and discuss with the students the elements that determine the trick’s validity.