



AMAZINGMATHS

Material :

- Magic trick video
- 24 playing cards, of which 4 face cards will be the "rebellious" cards.

MATHEMAGIC

-THE REBEL CARDS-

How to do the Magic Trick

1. The magician removes 4 identical cards and asks the spectator to select 20 random cards.
2. Then, he asks to insert the 4 cards, face up, among the other 20, face down.
3. We then place the cards on the table by flipping one card out of two.
4. The spectator must now take the cards two by two and either turn them over or put them down as he chooses.
5. The spectator repeats the same manipulation, but with 4 cards.
6. We then divide the pack in two, distributing the cards into two separate stacks by placing one card on the left and one on the right until the pack has been completely divided.
7. Finally, we fold one of the packs on the other. When spreading the pack, the 4 cards of the beginning are still turned over.



MATHEMATICAL EXPLANATION



Why this trick works

This trick works because the manipulations performed cancel each other out. So, we end up with the same layout of cards than at the start: all in the same direction except the 4 selected cards (the “rebellious” cards).

Detailed Explanation

Let's observe the cards' layout, step by step.

Initial layout: all the cards are facing the same direction, except 4.

To better understand, number the position of each card. The first card on the table is in position 1 and the last one on top is in position 24.

The first manipulation turns over the cards in even positions. The cards in the odd position are face down and those in the even position are face up. However, the 4 rebellious cards are in the opposite direction: a rebellious card in even position will be face down and a rebellious card in odd position will be face up.

Card reversal manipulations have no effect on the orientation of even and odd cards. We can consider the reversal of two cards like this:

1. We exchange the order of the two cards (the card in the even position becomes odd and vice versa).
2. We turn over the two cards, keeping the new order.

So, we changed the order and direction of the TWO cards, which keeps the pattern in which the even-numbered cards face up and the odd-numbered cards face down. In the case where we turn over a rebellious card, the important thing is that it stays in the opposite direction of the other cards in the position of same parity. *To understand this manipulation, try with two cards only. Place the card from underneath face up and from the top, face down. Flip both at the same time and make sure the bottom card is always face up, no matter how many times you turn it over.*

For the same reason, the reversal of 4, 6, 8 or any number of cards at the same time does not change the structure of the orientation of the cards according to their position.

Finally, by separating the cards in two piles at the end, we separate the cards in even positions from the cards in odd positions. By closing them like a book, we turn over all the cards of one of the two parities, and we thus cancel the first manipulation. This brings us back to the same layout as at the start: all the cards in the same direction, except the 4 rebellious cards.