

Magic Tricks



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1. Magic 9 Cards

- Ask the volunteer to shuffle the cards and to select any 9 cards (face down).
- Deal the 9 cards face down into 3 piles of 3 in any order
- Ask the contestant to choose a pile.
- You and the contestant should have a look at the bottom card of that pile. This is the 'Magic Card'. Ask them to remember it.
- Put all the other cards beneath that pile, which makes sure that the magic card is the 3rd card out of the 9 card pile. What you do next will depend on the number and suit of the Magic Card. For example if it is nine of spades then do the following:

Number

- Deal each card onto the table whilst spelling the number. For example, N- deal -I - deal -N deal -E deal and then put that pile underneath the pile in your hand.

OF

- Now deal two cards and state the letters O-F and then put that pile underneath the pile in your hand.

SUIT

- Now deal 6 cards and state the letters S-P-A-D-E-S and then put that pile underneath the pile in your hand.

MAGIC

- Now deal 5 cards and state the letters M-A-G-I-C and put that pile underneath the pile in your hand.
- For the last card (letter C), turn the card over to reveal it is the nine of spades!
- This trick works for any card! Have a go!



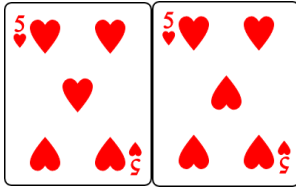
2. 10 Card trick

- Ask the volunteer to shuffle the pack
- Ask the volunteer to choose any 10 cards from the pack face down and put into a pile.
- Ask them to pick one magic card from the ten cards (remember it) and place on top of the pack of 10 cards. The magician shouldn't see the card. When practising the trick however, the magician can have a look just to check they are doing the trick correctly.
- Magician then turns their back and asks the volunteer to choose a secret magic number between 1 and 10.
- Ask the volunteer to move that many cards, one by one to the back of the 10 card pile (from the top of the pile to the bottom of the pile).
- Magician then turns round and takes the 10 card pile and looks through the cards face down. Move one card at a time to the other hand. In doing this, you are reversing the order of the cards.
- The magician then takes the top five cards of the new arrangement (face up) and moves them to the bottom of the pile. Whilst doing this, magician acts like they are trying to mentally find the card. Don't make it obvious that you are moving the cards around.
- The magician says the magic just isn't working and needs the volunteer to do more.
- Ask the volunteer to take the pile again face down and move the same number of cards as he/she did before, but with **one extra card**. Magician turns their back and doesn't watch.
- Magician then turns round and takes the cards and looking at them face down, picks the fourth card and shows them. This was the magic card!

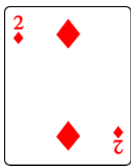


3. Rotational magic

- Before you start this trick you need to pick 22 cards out of a deck. These need to be the cards with rotational order of symmetry 1. So the cards that do not look the same when you turn them upside down.
- E.g. Pick the 5 of hearts ...



... but don't pick the 2 of diamonds (rotational order of symmetry 2)



- The cards you need are at the bottom of these instructions but try to find them all yourself first.
- Put the 22 cards in a direction that you recognise as “the right way up”. Perhaps so that the most number of the suit are pointing towards you.
- Fan the cards out in your hand face down and ask your volunteer to pick a card.
- While your volunteer is looking at their card, rotate the deck in your hand.
- Ask the volunteer to put the card back in the deck
- You can now shuffle the cards and offer the cards to your volunteer to shuffle too (in the same way as you, in a way that doesn't rotate the cards)
- You can now look through the cards and find the “upside down” one and amaze your volunteer!
- To make the trick more exciting you could claim that you are psychic. When your volunteer picks a card ask them to draw an imaginary star on the card with their eyes which you will then be able to see when you look at the cards!

The cards you need are:

Spades: Ace,3,5,6,7,8,9

Hearts: Ace,3,5,6,7,8,9

Clubs: Ace, 3,5,6,7,8,9

Diamonds: 7

4. 21 Card Trick Instructions

- Ask volunteer to shuffle the pack

Deal 1:

- Deal the cards face up into 3 columns horizontally, until you have 7 in each column. See below.



Until you have :



- Ask the contestant to choose a card and not tell you.
- Ask them to tell you which pile it is in. Tell them you can read their mind and will find out the card they are thinking!
- Collect the cards by column, and ensure the column with the card in is the **second pile** you pick up (it will be the **middle of the 3 piles** in your hand)

Deal 2:

- Now deal the 21 card pile again as before (horizontally, row by row, face up, 7 in a column)
- Ask again which pile the card is in.
- Collect the cards by column, and ensure the column with the card in is the second pile you pick up.

Deal 3:

- Now deal the 21 card pile again as before (horizontally, row by row, face up, 7 in a column)
- Ask again which pile the card is in.
- **Their card will be the card in the middle of the column!**

27 Card Trick Version

- Even more impressive! You can not only find the card your volunteer chooses, but in just three deals you can get it into any position the volunteer chooses (from 1 to 27).
- Deal as above, but with 9 cards in each column.
- Ask your volunteer to tell you a number inbetween 1 and 27.
- You are now going to repeat the steps above but instead of always putting the column they tell you in the middle, put it either in the top, middle or bottom based on the number the volunteer says and the following table

	1	3	9	
Top				0
Middle				1
Bottom				2

- First take one away from the number your volunteer gives you.
- Then work out how many 1's 3's and 9's make up their number. You are only allowed to use a maximum of 2 of each number (This is how ternary numbers are written)

e.g. The volunteer chooses the number 16. Take away one gives you 15. 15 is made up of 1 nine, 2 threes and 0 ones.

	1 st deal	2 nd deal	3 rd deal	
	1	3	9	
Top	✓			0
Middle			✓	1
Bottom		✓		2

- Using the ticks in the table above:
 - The first time you deal, make sure you put the column that your volunteer points to so that they are at the top when you deal again
 - The second time make sure the column that your volunteer points to ends up at the bottom when you deal again
 - Third time in the middle
- Then count out 16 (the number your volunteer chose) cards from the top. The 16th card should be the one that your volunteer chose.

5. 49 Card Trick

1 full deck of cards

Directions:

1. Remove THREE cards from the deck so you only have 49 cards. It does not matter which three you remove.
2. Shuffle the 49 cards.
3. Have a person select a card from the deck, look at it, remember the card, and then return in anywhere into the deck without you seeing it.
4. Have the person select their favourite number between 1-49.
5. Ask the person to watch for their card as you deal the deck out into 7 rows of 7 cards each.
6. Once done, have the person indicate which column their card is in, then pick up the piles.
7. Repeat the seven piles process again making the person indicate which pile their card is in.
8. Now, pick up the piles and then count out until you get to the number they selected and VOILA – that is the card they had selected at the beginning.

FOR PRESENTERS EYES ONLY

After the person has selected and returned a card, which they will remember, and selected a number between 1-49, you have to do a little simple math.

Take the number they have selected, subtract ONE and then divide that number by SEVEN. This trick relies on the mathematics of base 7 numbers. So, if the person selected 26 for their number, you would subtract ONE to get 25 and then divide by SEVEN to get a quotient of 3 with a remainder of 4.

The remainder (4 in our example) will be important for the first deal. The quotient (3 in our example) will be important in the second deal.

Now, deal out the 49 cards into seven rows face up. Be sure to tell the person to watch for their card so they can tell you at the end which column it is in, but not before you are done dealing out all the cards.

Lay out seven cards face up and then start over covering up the first layer with the next, also face up, until you run out of cards.

Ask them which pile their card is in. Now, being sure the pile which contains their card is in the right order is critical.

You can work on the showmanship later. The remainder in our example was 4. So, we need the pile they indicated to be in position 4 in the layers indicated to the right. Pick up their pile and turn it over.

Then, pick up four piles and turn them over on top of the pile containing their card. The last two piles you will turn over and place on the bottom of the deck.

Repeat dealing out seven piles face up with the person watching for their card. It is really important that you lay out seven piles and then start back at the beginning to cover them up in the same order.

Then, have them indicate which pile contains their card.

Now, the quotient (3 in our example) is important. Pick up their pile and turn it over. Then, pick up three piles and turn them over on top of the pile containing their card. The last three piles you will turn over and place on the bottom of the deck.

Now, count out cards from the top of the deck face down until you get to 25.

The 26th card will be the card they selected at the very beginning – VOILA!

6. Fitch Cheney Card Trick

How the trick will look:

Alice and Bob are mathematicians who perform a trick at a dinner party. Bob leaves the room and a random volunteer shuffles a standard deck of cards.

Alice chooses 5 cards at random. She places 1 of the cards face down on a table and then leaves the other 4 cards face up.

Bob returns to the room. He inspects the 4 face up cards, and in virtually no time he calls out the value of the face down card.

The cards are not marked in any way and this trick is completely mathematical. Naturally Alice and Bob had prepared to perform the trick so they had a plan of what to do. Can you figure out how they did it?

Explanation

The trick uses several mathematical principles.

Alice has to communicate the suit and the value of the hidden card to Bob. Here is how it can be done.

Signalling the suit: pigeonhole principle

The pigeonhole principle states that if you try to place more than n pigeons into n pigeonholes, then necessarily some pigeonhole will have at least 2 pigeons.

In this trick, Alice has 5 cards (“pigeons”) that can be any of the 4 suits (“pigeonholes”). By the pigeonhole principle, there is necessarily some suit that has at least 2 cards. In other words, there will always be at least 2 cards of the same suit.

Alice inspects the 5 cards to find at least 2 cards of the same suit. She places one those cards face down and then arranges a card of the same suit on the far left of the 4 face up cards.

When Bob looks at the face up cards, he knows the suit is the same as the leftmost card.

But how can Bob determine the value?

Signaling the value part 1: permutations

Suppose Bob sees the leftmost face up card is 3 ♣, which means the face down card is also ♣.

Let's say the other face up cards are 4 ♥, 5 of ♠, and 6 ♦. Alice can use the order of these cards to indicate the value of the face down card.

The 3 cards can be placed in $3! = 3 \times 2 \times 1 = 6$ different orders. Denote the lowest card as L (4 ♥), the middle card as M (5 ♠), and the highest card as H (6 ♦). Then the orders and additions can be given by the code:

LMH = +1

MLH = +2

MHL = +3

LHM = +4

HLM = +5

HML = +6

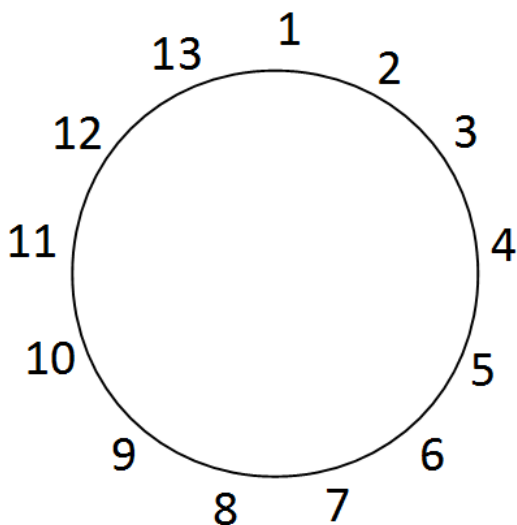
(Easy to remember – look for lowest value card and add on the position number of that card. Also give a bonus 3 points if the other two cards are in descending order)

If Bob views the order HML = +6, then he adds 6 to the 3 ♣ to determine the card is 9 ♣.

In this example Alice can signal the cards from the 4 ♣ to the 9 ♣. But what if the two cards where the 3 ♣ and the 10 ♣?

Signalling the value part 2: modulo arithmetic

Let us rank the cards so Ace = 1, Jack = 11, Queen = 12, and King = 13. Furthermore, think about the values being arranged on a clock so that we are dealing with arithmetic modulo 13.



Suppose Alice got the 3 ♣ and the 10 ♣. If she counts up from 3, then the 10 is 7 spots away, which is too large to signal.

Instead, Alice keeps the 10 ♣ face up and places the 3 ♣ face down. If she counts up from 10, then the 3 is +6 away which is possible.

On the clock you can see that the largest distance between two numbers is 6. This means the addition system is sufficient to signal between any two cards.

Signaling the value part 3: breaking ties

There is one more complication which happens if the other face up cards have the same numerical value as each other.

Rank the suits in alphabetical order Clubs (♣) < Diamonds (♦) < Hearts (♥) < Spades (♠). In other words, all the cards in the deck are ordered as follows:

Ace ♣ < Ace ♦ < Ace ♥ < Ace ♠ < 2 ♣ < 2 ♦ < 2 ♥ < 2 ♠ < ... < King ♣ < King ♦ < King ♥ < King ♠

The cards are still put in numerical order, but ties are broken by the value of the suits.

Summary

Alice can communicate to Bob the value of the face down card by:

1. Making the leftmost face up card have the same suit as the face down card. There will always be at least 2 cards of the same suit so this is possible.
2. Arranging the other 3 face up cards to indicate how much to add to the leftmost card value. Alice has to pick the face down card carefully so it is never more than 6 away from the face up card. If one choice does not work, the other choice will work as two cards are never more than 6 away in clock arithmetic.

The trick is known as Fitch Cheney's Card Trick and it's a fun application of mathematical principles that work perfectly for a standard deck of cards!