

MATHEMAGIC

- MYSTERY GRID -



AMAZINGMATHS

Materials:

- Video of the trick
- 1 mystery grid
- Sheet of paper
- Pencil

How to do the Magic Trick

Goal:

Tell the sum of the 5 numbers chosen by the spectator without even looking.

Preparation:

Beforehand, draw the mystery grid on a sheet of paper (refer to the section *Why this trick works* to see how to build a mystery grid).

Trick:

1. The magician shows on the board the mystery grid built beforehand. He then asks a spectator to come do the trick in the front.
2. The magician shows the mystery grid to the spectator, then turns around. The spectator randomly chooses a number in the grid and circles it. Once this is done, he crosses the row and the column on which the number is. From now on, he cannot choose numbers among the ones that were crossed. He chooses a second number and executes the same instructions until he finally gets 5 numbers.
3. Once the selection is made, the magician tells the result of the addition of the numbers selected by the spectator, without even looking.
4. The spectator then validates that the magician's answer is right by doing the addition himself.



MATHEMATICAL EXPLANATION



Why this trick works.

Here is the mystery grid used during the trick.

8	5	2	9	4
12	9	6	13	8
13	10	7	14	9
9	6	3	10	5
10	7	4	11	6

The mystery grid was built like an addition table, but the numbers around the grid (the grey squares) are not indicated. Let's see how an addition table works.

+	8	5	2	9	4
<u>0</u>	(<u>0</u> +8) 8	(<u>0</u> +5) 5	(<u>0</u> +2) 2	(<u>0</u> +9) 9	(<u>0</u> +4) 4
<u>4</u>	(<u>4</u> +8) 12	(<u>4</u> +5) 9	(<u>4</u> +2) 6	(<u>4</u> +9) 13	(<u>4</u> +4) 8
<u>5</u>	(<u>5</u> +8) 13	(<u>5</u> +5) 10	(<u>5</u> +2) 7	(<u>5</u> +9) 14	(<u>5</u> +4) 9
<u>1</u>	(<u>1</u> +8) 9	(<u>1</u> +5) 6	(<u>1</u> +2) 3	(<u>1</u> +9) 10	(<u>1</u> +4) 5
<u>2</u>	(<u>2</u> +8) 10	(<u>2</u> +5) 7	(<u>2</u> +2) 4	(<u>2</u> +9) 11	(<u>2</u> +4) 6

1st
2nd
3rd
4th
5th

Rows

1st 2nd 3rd 4th 5th

Columns

The number in each square is the result of the addition of the number at the top of the column with the number at the beginning of the row. For example, the number 14 is formed by the addition of the 9 (in column 4) and the 5 (in row 3).

MATHEMATICAL EXPLANATION



How the trick works.

+	8	5	2	9	4	
<u>0</u>	(<u>0</u> +8) 8	(<u>0</u> +5) 5	(<u>0</u> +2) 2	(<u>0</u> +9) 9	(<u>0</u> +4) 4	1 st
<u>4</u>	(<u>4</u> +8) 12	(<u>4</u> +5) 9	(<u>4</u> +2) 6	(<u>4</u> +9) 13	(<u>4</u> +4) 8	2 nd
<u>5</u>	(<u>5</u> +8) 13	(<u>5</u> +5) 10	(<u>5</u> +2) 7	(<u>5</u> +9) 14	(<u>5</u> +4) 9	3 rd
<u>1</u>	(<u>1</u> +8) 9	(<u>1</u> +5) 6	(<u>1</u> +2) 3	(<u>1</u> +9) 10	(<u>1</u> +4) 5	4 th
<u>2</u>	(<u>2</u> +8) 10	(<u>2</u> +5) 7	(<u>2</u> +2) 4	(<u>2</u> +9) 11	(<u>2</u> +4) 6	5 th
	1 st	2 nd	3 rd	4 th	5 th	

N.B. We notice that the numbers written in the addition table are the same than in the mystery grid.

In the trick, the sum of the numbers chosen by the spectator is always 40. The magician never has to add the numbers, because the result is always the same. The magician knows this number, because it is the sum of all the digits indicated in the grey squares.

$$8 + 5 + 2 + 9 + 4 + 0 + 4 + 5 + 1 + 2 = 40 \rightarrow \text{Addition of the grey squares}$$



At the end of the trick, the goal is to reproduce the addition of these numbers to get the sum of 40. To do so, each digit that is in **the addition of the grey squares** has to appear only once in the spectator's selection of numbers.

When the spectator chooses the number 14, it represents the sum of the 9 and the 5. The spectator must then cross the row and the column the number 14 belongs to. Because the spectator crosses the 4th column, the number 9 cannot be added to another digit anymore. The same principle applies to the 3rd row (see the image above).



MATHEMATICAL EXPLANATION



How the trick works.

The 9 and the 5 having now been used, the spectator has to continue choosing numbers in the mystery grid.

Every time the spectator chooses a new number in the grid, he selects a **new row** and a **new column**, which leads to the addition of two new numbers that are in the grey squares. So, they are removed from the possible options.

The further in the trick we are, the more limited the possibilities of selection are for the spectator. Several digits are already used, so removed from the options (columns and rows crossed).

So, the spectator's selection of 5 digits will recreate the addition of all the grey squares. Therefore, the magician knows the sum of the numbers will always be 40, because, in the end, each digit that is in the grey squares will also be in the spectator's choices.

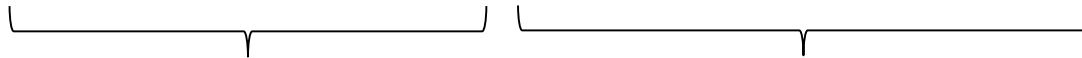
Example

If the spectator chooses the 14, the 8, the 6, the 2 and the 10, his addition is:
 $14 + 8 + 6 + 2 + 10 = 40$.

We can also see it as: $(5 + 9) + (4 + 4) + (1 + 5) + (0 + 2) + (2 + 8) = 40$

So:

$$8 + 5 + 2 + 9 + 4 + 0 + 4 + 5 + 1 + 2 = (5 + 9) + (4 + 4) + (1 + 5) + (0 + 2) + (2 + 8)$$



Addition of the grey squares

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Spectator's selection