

LIGHTS! CAMERA! MATH! TEACHER NOTES

X Marks the Spot

In this trick, a volunteer is asked to think of a number between 5 and 25 and then take that number of steps in an anticlockwise direction along a path of coins. The volunteer then takes the same number of steps in a clockwise direction. The performer turns over the last coin the volunteer lands on to reveal that it is marked with an X; the other coins are turned over to show they are not marked. The trick provides a novel illustration of the difference between clockwise, anticlockwise and simple arithmetic.

This is a very simple trick mathematically. It is simply a matter of counting the same number twice, once in each direction but, at the end, instead of going back down the tail to end up at the start (which wouldn't be much of a trick!) the count is completed by continuing around the circle.

The Human Calculator

This trick again requires the help of an audience volunteer and involves the performer correctly predicting the sum of five 5-digit numbers. The key to this trick is a purely mathematical phenomenon and no sleight of hand is needed.

Pupils will find this illusion draws on an ability to add large numbers together carefully and helps demonstrate that even apparently random numbers are governed by mathematical theory when considered together. To be able to perform this trick, children will need fast and accurate mental arithmetic to generate the magician's numbers. Pupils could also be asked to explain how this works mathematically.

The Sword Box Illusion

This is a trick that relies solely on the numbers to achieve its magical effect. Four pupils each choose a number from a selection of 16 laid out in a grid or matrix. Numbers positioned in the same row and column as the chosen number are eliminated. Ultimately, four numbers are left on the grid and these will always add up to 34. This trick helps build confidence in working with number grids and recognising the differences between rows and columns.

Pupils could try this with a grid of the numbers 2 to 17 instead of 1 to 16. They will find that the total at the end is 38. Children could also be asked what they think the result would be if the grid ran from 3 to 18. They should try to figure this out without going through the procedure.

In All Probability

This game introduces the children to the complex world of probability. Even though it seems that the odds are in their favour every time, the odds are actually two and a half to one against them. This means that if you play this game over and over, you will win most of the time. The children should be encouraged to explore why this is the case. The basic principle is that it is the cumulative probability of turning over 3 picture cards that is important.

The Magic Square

A Magic Square is simply an arrangement of numbers in a square grid so that the sum of numbers in every row, column and diagonal is the same. Experimenting with these grids helps pupils to understand the difference between rows, columns and diagonals. It also encourages children to experiment with different combinations of numbers.

In the book, it mentions that there are 7 other variations of the illustrated square that may be found by reflections and rotations through 90 degrees. Pupils could be asked to find as many of these as possible and may also wish to explore different ranges of numbers and bigger grids.

The Hologram Illusion

This trick requires the help of a volunteer who has to think of a number between 0 and 9 and then arrange a selection of numbers to make a sum. Using digital root theory, the numbers are added together to produce a total that is the same as the number chosen by the volunteer at the beginning of the trick. The Hologram Illusion highlights the difference between rows and columns, as well as the importance of being able to add numbers quickly and correctly without writing them down.

The Fraction Engine

The story of the 17 camels shows the importance of understanding fractions and how they combine together.

The eldest son was to get $\frac{1}{2}$ of the camels.
The middle son was to get $\frac{1}{3}$ of the camels.
The youngest son was to get $\frac{1}{9}$ of the camels.

To add these fractions together, the concept of the Lowest Common Denominator (LCD) has to be understood. In this case, the LCD is 18 so $\frac{1}{2} + \frac{1}{3} + \frac{1}{9}$ becomes $\frac{9}{18} + \frac{6}{18} + \frac{2}{18} = \frac{17}{18}$.

The Magic Store

This trick is all about adding sums of money together and reacting to the different choices made at each stage of the trick. The children should be encouraged to make up a set of menu cards as in the book and to perform the trick for each other. They should also explore the various paths through the cards to understand why the result is always \$21 or \$22.

The Magic of Time

This trick may be used to introduce children to some elementary algebra. At the end of the trick, the number we end up with is always a multiple of 9. Let's say that the number of objects removed is represented by the 2-digit number xy . This may be re-written as $10x + y$. The calculation in the trick may therefore be written as $(10x + y) - (x + y) = 9x$ so the answer is always a multiple of 9.

The Magic of 1089

In this trick, the spectator is asked to think of a 3-digit number and to carry out a number of manipulations and basic arithmetical operations to end up with a final number. This result has been predicted. This is an automatic mathematical trick with the result always being 1089.

The mathematical basis of this trick depends on the idea of place value. So a number e.g. 642 may be written as $600 + 40 + 2$.

Reversing the digits gives 246 or $200 + 40 + 6$.

Subtracting the smaller number from the larger number gives $400 + 0 - 4 = 396 = 4 \times 99$.

Whatever number is chosen, the result is always a multiple of 99. The possible values are 99*, 198, 297, 396, 495, 594, 693, 792 and 891.

(* If the result is 99, it should be written as 099.)

The middle digit of all these numbers is always 9 and the first and last digits of each add up to 9. Adding such a number and its reverse gives a number with a 9 in the hundreds place (i.e.900), 9+9 in the tens place (i.e.180) and 9 in the units place (i.e. 9).

$$900 + 180 + 9 = 1089.$$