

# *How Safe Is It?*

## *Discovering Three Secret Numbers in a Given One*

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### **Magic Trick Effect:**

A spectator, highly capable in arithmetic OR possessing a calculator, is asked to look at an invisible safe and its invisible combination lock. The lock has numbers from 1 to 6. The magician asks the spectator to turn the dial to one of the 6 numbers, and then turn the dial the other way to some other number, without revealing the two numbers chosen. The spectator is asked to turn the “handle” and open the safe, then put his hand in and drop 1 to 5 imaginary coins inside, close the door and spin the lock.

The magician asks the spectator to subtract the smaller combination lock number from the larger, then multiply the result by 5, then multiply that result by the sum of the 2 combination lock numbers. That result has the number of deposited coins added to it, and the last piece of arithmetic is to multiply the most recent result by 2.

The result is revealed to the magician, who will then use that value as a key to unlock the spectator’s mind.

The magician turns the lock with the same 2 numbers secretly chosen by the spectator, announces the numbers after using them, turns the handle to open the safe and reaches in. Pulling his hand out, he opens his hand and it is holding the number of coins deposited, except that they are real.

	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>
<b>1</b>	3	8	15	24	35
<b>2</b>		5	12	21	32
<b>3</b>			7	16	27
<b>4</b>				9	20
<b>5</b>					11

### **Method:**

The formula of the arithmetic above is

$$((\text{comboA} - \text{comboB}) * 5 * (\text{comboA} + \text{comboB}) + \text{coins}) * 2$$

which simplifies to

$$(\text{comboA}^2 - \text{comboB}^2) * 10 + 2 * \text{coins}$$

The magician should memorize the table above. The values in the table are the differences of the squares of the number at the top of the table (one of the combination values) and the values on the left of the table (the other combination value).

For example: 12 (in the table) =  $4^2 - 2^2$  and when multiplied by 10 will give 120. If the spectator announces his final result is 126, then the magician considers this as  $120 + 6$ . The magician ignores the zero on the end and, using 12, knows that 4 and 2 were the combination numbers chosen. The 6 is  $2 * 3$ , so there were 3 coins.

If the spectator announces the result as “120”, the magician would not think of 12, since there were no coins added if 4 and 2 were the combination numbers. The instructions were to put in from 1

to 5 coins.  $120 = 110 + 10 = 11 * 10 + 2 * 5$ . There were 5 coins, with 6 and 5 as the combination numbers.

This trick is limited to spectators who are unusually good at math and wouldn't be used with general audiences.

Oh, the production of the real coins? The magician has his hand in his pocket, fingering the correct number of coins. The other hand turns the lock and opens the safe door, followed by the hand with the calculated number of coins reaching in, then pulling out to reveal them.

### **Discussion:**

While it is tedious to memorize the chart with the number pair associations, there are some short cuts.

The long diagonal from 3 to 11 contains: a) all odd numbers b) none are skipped c) they are the sum of the matching top and left values and d) the value pair differs by only 1.

The diagonal above it from 8 to 20 has values 4 apart. If you divide one of those numbers by 2 you will get a value which is again the sum of the top and left values on the outside of the chart AND those 2 values are exactly 2 apart in each case.

The diagonal above that contains all odd numbers. If you divide them by 3 you get a number which is the sum of the top and left values, but they are 3 apart.

This may be continued.

Another feature of this trick is that it is only valid for the natural numbers from 1 to 6.

Unfortunately, if you use numbers up to 7 then there are values which occur more than once in a table. For example,  $7^2 - 5^2 = 5^2 - 1^2$ . If you go up to 8, then you also have the problem of  $8^2 - 7^2 = 4^2 - 1^2$ .

Also, since choosing the same number twice (boxcars or snake eyes with dice, for example) will always result in the value of 0, you can not distinguish between different pairs. That's why I must make a point of having the spectator choose another number for the second value.

Of course, you can create other scenarios. Invisible dice could be used, or have the spectator mentally choose 2 different boxes from a set of 6 without revealing which 2.

Contact me if you have any questions, suggestions or have another idea for the story line. Try it!