

Puzzle 6 - SOLUTION

Not Mindreading

Problem 1 *Instructions:*

1. Think of a 5-6 digit number, that has at least two different digits in it. My example is 803225.
 2. Create a second number by rearranging the digits of the previous number. My example is 320258.
 3. Subtract the smaller number from the larger number. My example is $803225 - 320258 = 482967$
 4. Cross out any non-zero digit of the difference. My example is 48296~~7~~.
 5. Announce the number you obtain by omitting the crossed out digit. My example is 48297.
- If you tell the mindreader the last number, s/he can tell what digit you've crossed out. How?

Solution 1 *The trick is based on the rule of divisibility by 9. The rule is that every number's remainder after division by 9 is the same remainder if we divide the sum of its digits by 9. For example, the sum of the digits in the number 2500041 is $2 + 5 + 4 + 1 = 12$. When we divide 12 by 9 we get a remainder 3. This means that if we divided 2500041 by 9, we get a remainder 3. In particular, if the sum of the digits is divisible by 9, so is the number.*

This trick exploits this property. When we create the second number, we use the same digits. So, we obtain two numbers that have the same sum of digits and thus the same remainder when divided by 9. This means that the third number, the difference of the first two, will certainly be divisible by 9 and so its digits add up to a number divisible by 9.

When someone announces their final number, we need to add the digits and see what number needs to be added to it to obtain something divisible by 9. (Now you see why crossing out 0 was not allowed, we wouldn't be able to distinguish it from 9.)

In my example, we hear 48297. Since $4 + 8 + 2 + 9 + 7 = 30$, we need add 6 to that to make it divisible by 9. (The next number, 15 is too large). Thus they crossed out a 6.