



CALCULATOR NUMERACY TRICK

Instructions for students:

Type in any 4-digit number
Add 17, press equals
Multiply by 18, press equals

Choose one of the digits in the display to be your secret digit. It must be a non-zero digit.

Then read all your digits apart from your secret digit.

The mathemagician will tell you your secret digit.

Instructions for the teacher ('mathemagician')

Add up the digits they read. Their secret digit is whatever you need to add on to their total to make the next multiple of 9. Zero cannot be their secret digit.

Why does it work: possible discussion questions/phrases

- 1) 'What do you think all the numbers everyone creates on their calculator have in common? Why?'

Students may say all the numbers are even, amongst other things.

If they are unsure what to say, they could compare their calculator screen with those around them and spot commonalities.

- 2) 'When we multiply by 18, we are creating numbers that are multiples of 2. Because by multiplying by 18 we are also multiplying by 2, because 2 goes into 18.'

Which other multiplication tables will all the numbers everyone creates have in common?'

1,2,3,6,9,18 – all the factors of 18



- 3) 'It's the fact the numbers are all multiples of 9 that is important. There is a special pattern in all multiples of 9 that allows this trick to work. Write out some multiples of 9 and see what you notice.'

Students might think that the digits always add up to 9. Challenge them with a large multiple of 9 such as 189, and they will see they do not always add up to 9.

With enough examples like this they should see that all digits add up to a multiple of 9.

- 4) 'So, the digits of all multiples of 9 add up to a multiple of 9. How does this explain how the trick is done?'

The correct answer is: the mathemagician is adding up all your digits apart from your secret digit.

They know that if you'd read all the digits including the secret one, your digits would add up to a multiple of 9, so they are working out what you need to add on to get to the next multiple of 9. This must be what you missed out.

Further discussion

- 1) 'How could we change the instructions in a way that the trick will still work?'

Students should note the 'plus 17' is irrelevant.

And they should note that 18 could be replaced with any multiple of 9.

- 2) 'Why do we ask you to not leave out a zero?'

In the situation where the student reads out digits that already add up to a multiple of 9, the mathemagician would not know if a zero or a 9 had been missed out.