The Magic of Number 9

1.Finding the Digital Roots by Casting “9”

What is Digital root?

If we add up the digits of a number until there is only one number left we have found what is called the digital root. In other words, the sum of the digits of a number is called its digital root.

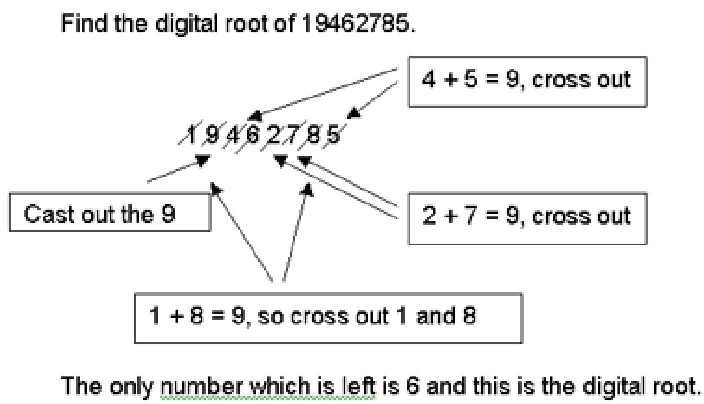
Example:

For 5674, 5 + 6 + 7 + 4 = 22 and 2 + 2 = 4

» 4 is the digital root of 5674

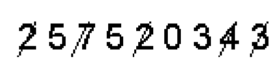
One use of digital roots is for divisibility tests (like 3 and 9). This method makes it easier to calculate the digital root.

Example:



Example:

Find the digital root of 257520643



Steps:

1. 2 + 7 = 9, cross out 2 and 7.

2.4 + 3 = 9, cross out 4, 3 and 2.

3.There are no other groups of numbers adding up to 9.

4.Add up the remaining digits, 5 + 5 + 0 + 3 = 13.

5.13 is more than 9, so 1 + 3 = 4.

6.The digital root is 4.

If there is nothing left after having cast out nines then the digital root is 9.

2. I do not like him, why does he follow me?

In the nine times table below notice that the digits of each product sum to nine. Why does this happen? Look at how the digits of the product are changing each time.

Table	Sum of the digits of each product
1 x 9 = 9	0 + 9 = 9
2 x 9 = 18	1 + 8 = 9
3 x 9 = 27	2 + 7 = 9
4 x 9 = 36	3 + 6 = 9
5 x 9 = 45	4 + 5 = 9
6 x 9 = 54	5 + 4 = 9
7 x 9 = 63	6 + 3 = 9
8 x 9 = 72	7 + 2 = 9
9 x 9 = 81	8 + 1 = 9
10 x 9 = 90	9 + 0 = 9

I would like to tell the class that due to some reason (Purani dushmani) I do not like No. 9, so to get rid of him I multiply him by 5, we get 45 which is 4 + 5 = 9 then, I look skywards, roll my eyes, and say oh oh he has come again!

Then I say ok let me multiply him by 7. The experience repeats. By this time the students have caught on and want me to multiply by 8, by 9, by 15, and so on.

3. Inverse Table

Write the multiplication table of 9 and interchange the place value of every number obtained. Observe the pattern. How fascinating it is!

Multiplication Table	Number obtained by interchanging the place value of the digit of every product	
1 x 9 = 09	90	10 x 9 = 90
2 x 9 = 18	81	9 x 9 = 81
3 x 9 = 27	72	8 x 9 = 72
4 x 9 = 36	63	7 x 9 = 63
5 x 9 = 45	54	6 x 9 = 54
6 x 9 = 54	45	5 x 9 = 45
7 x 9 = 63	36	4 x 9 = 36
8 x 9 = 72	27	3 x 9 = 27
9 x 9 = 81	18	2 x 9 = 18
10 x 9 = 90	09	1 x 9 = 09

Do you think this will work for the table 8? Try!

4. Snake eats its own tail

Think of a two digit number, say 42, then subtract the reverse of its digits, 24, from 42

⇨	(42 – 24) = 18 18 is a product of 9 and 1 + 8 = 9

Choose any two digits number and for each one reverse the digits and subtract the smaller number from the larger. Look at all the answers you get. Do they all have a common divisor? What do the digits sum to each time?

Some Examples:

				Sum of the digits
92	29	(92 – 29) = 63	9 x 7	6 + 3 = 9
14	41	(41 – 14) = 27	9 x 3	2 + 7 = 9
83	38	(83 – 28) = 45	9 x 5	4 + 5 = 9
17	71	(71 – 17) = 54	9 x 6	5 + 4 = 9

You see how fascinating and enjoying it is. In each case the difference is divisible by 9 (i.e. the common factor is 9) and the sum of the digits of the difference is always 9.

Do you think this will also work for three digit number or four-digit number. Try it out!

5. Take 9 and add any number to it.

Two Digit example	Three Digit example
⇨ 9 + 13 = 22 11 ↳ 2 + 2 = 4 1 + 3 = 4	9 + 134 = 143 ↳ 1 + 4 + 3 = 8 1 + 3 + 4 = 8
⇨ 9 + 14 = 23 ↳ 2 + 3 = 5 1 + 4 = 5	9 + 155 = 164 ↳ 1 + 6 + 4 = 11 1 + 5 + 5 = 11
⇨ 9 + 15 = 24 ↳ 2 + 4 = 6 1 + 5 = 6	9 + 185 = 194 ↳ 1 + 9 + 4 = 14 1 + 8 + 5 = 14

What you have observed:

The sum of the digits of the number added to 9 is always equal to the sum of the digits of the result.

Take any four digit number and try the trick.

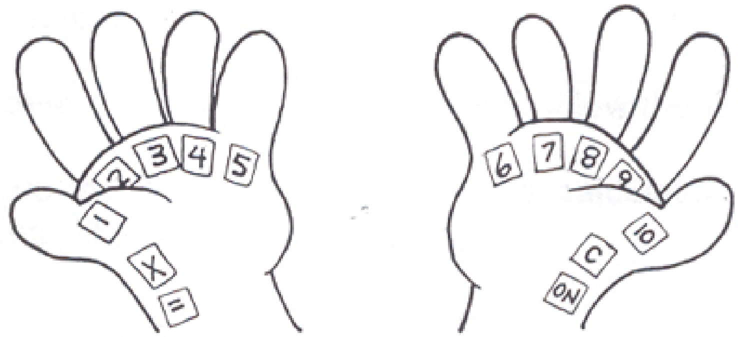
6. Hand Calculator

Your friends are amazed when you magically transform your hands into a calculator and multiply on your fingers!

Materials: Pen

Preparation

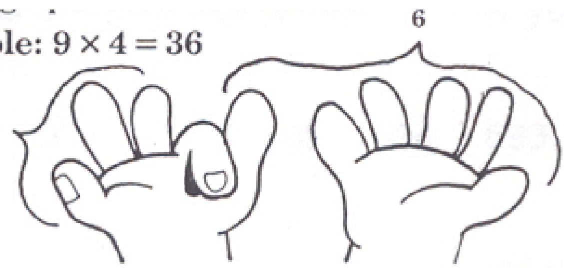
Draw these calculator keys on your palms with a ballpoint pen.



Presentation

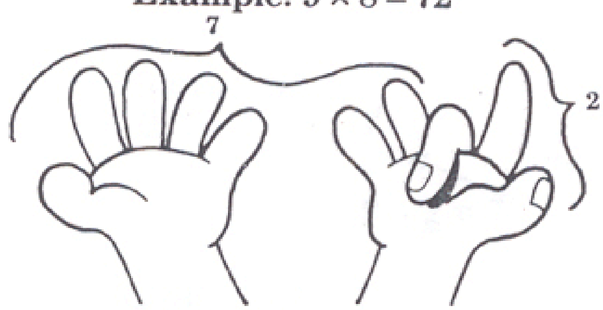
Tell your friend that she can multiply by 9 on your hands just as she would on a regular calculator. After she enters the numbers and pushes (=) , just bend over the finger that is multiplied by 9. The fingers that are standing up tell her the answer!

Example: 9 × 4 = 36



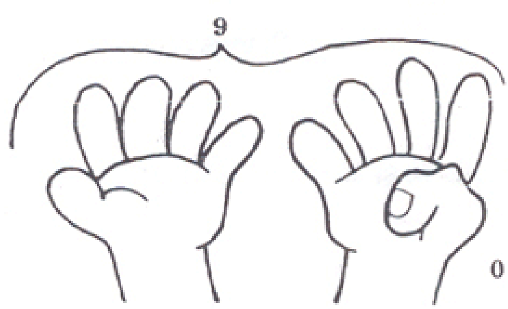
Bend over finger #4

Example: 9 × 8 = 72



Bend over finger #8

Example: 9 × 10 = 90



Bend over finger #10

9 fingers on the left and 0 fingers on the right = 9 0.

7. Subtraction Sorcery

You ask a friend to work a subtraction problem on a calculator. After she tell you one digit of the answer, you are able to divulge the entire answer!

Materials

A calculator Paper and pencil

Finally, ask her to tell you either the first digit or the last digit of the answer. You are now able to divulge the entire answer!

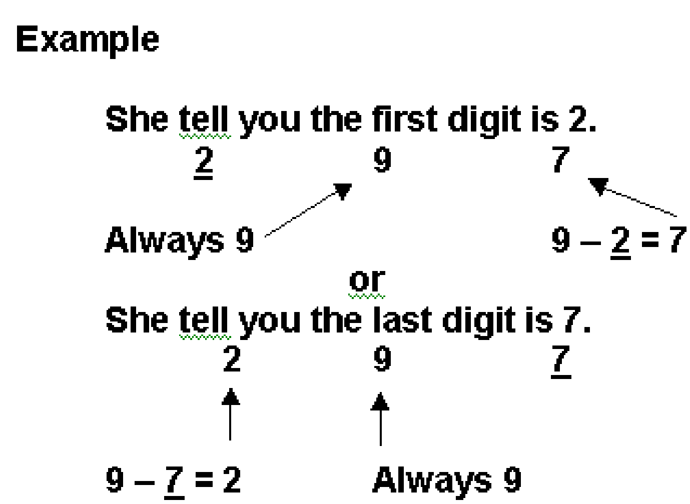
How to Do It

Here are all the possible answers when you subtract two 3-digit numbers as described.

99   198   297   396   495   594   693   792   891

(0̲99)

Notice that the middle digit is always 9 and that the sum of the first digit and the last digit is 9. So just subtract what your friend tells you from 9 to get the missing digit.



An Exception

If your friend tells you that the first digit or last digit is 9, her answer will be 99.

8. Casting out the Nines

Casting out the nines – by repeatedly subtracting 9 until a remainder of less than 9 is left, or, which amounts to the same thing, dividing by 9 and noting the remainder – can be done in an oddly simple way. The remainder when a number has been divided by 9 is the same as the sum of the digits (or, when that sum gives a number with two digits the sum of those digits). As the remainder – not the number of nines – is what you are after you can arrive at it directly. Here are two examples:

Cast the nines from 67 and find the remainder.

67	9)67(7	6 + 7 = 13
-9	63	3 + 1 = 4
58	4	
-9		
49		
-9		
40		
-9		
31		
-9		
22		
-9		
13		
-9		
4		

Cast out the nines from 44 and find the remainder.

44	9)44(4	4 + 4 = 8
-9	36	
35	8	
-9		
26		
-9		
17		
-9		
8		

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