

Chapter 2 || Digit sums, casting out 9's and 9' check method

The word digit means a single figure number: The numbers 1, 2, 3, 4, 5, 6, 7, 8, 9, 0 are all digits. Big numbers can be reduced to single digit by adding the constituents.

Digit Sums

A digit sum is the sum of all the digits of a number and is found by adding all of the digits of a number

The digit sum of 35 is $3 + 5 = 8$

The digit sum of 142 is $1 + 4 + 2 = 7$

Note : If the sum of the digits is greater than 9, then sum the digits of the result again until the result is less than 10.

The digit of 57 is $5 + 7 = 12 \rightarrow 1 + 2 = 3$

greater than 9, so need to add again

Hence the digit sum of 57 is 3.

The digit sum of 687 is $6 + 8 + 7 = 21 \rightarrow 2 + 1 = 3$

Hence the digit sum of 687 is 3.

- Keep finding the digit sum of the result until it's less than 10
- 0 and 9 are equivalent

Look and understand some more examples :

To find the digit sum of 18, for the example we just add 1 and 8, i.e. $1 + 8 = 9$ so the digit sum of 18 is 9. And the digit sum of 234 is 9 because $2 + 3 + 4 = 9$

Following table shows how to get the digit sum of the following numbers

15	6
12	3
42	6
17	8
21	3
45	9
300	3
1412	8
23	5
22	4

Sometimes two steps are needed to find a digit sum.

So for the digit sum of 29 we add $2 + 9 = 11$ but since 11 is a 2-digit number we add again $1 + 1 = 2$

So for the digit sum of 29 we can write

$$29 = 2 + 9 = 11 = 1 + 1 = 2$$

Similarity for $49 = 4 + 9 = 13 = 1 + 3 = 4$

So the digit sum of 49 is 4.

Number 14	Digit sum $1 + 4 = 5$	Single digit 5
19	$1 + 9 = 10$	1
39	$3 + 9 = 12$	3
58	$5 + 8 = 13$	4
407	$4 + 0 + 7 = 11$	2

CASTING OUT NINE

Adding 9 to a number does not affect its digit sum

So 5, 59, 95, 959 all have digit sum of 5.

For example to find out the digit sum of 4939 we can cast out nines and just add up the 3 and 4 so digit sum is 7 or using the longer method we add all digit $4 + 9 + 3 + 9 = 25 = 2 + 5 = 7$

There is another way of casting out the nines from number when you are finding its digit sum.

Casting out of 9's and digit totalling 9 comes under the Sutra when the samuccaya is the same it is zero.

So in 465 as 4 and 5 total nine, they are cast out and the digit sum is 6: when the total is the same (as 9) it is zero (can be cast out) cancelling a common factor in a fraction is another example.

Number

1326

25271

9643

23674

128541

1275

6317892

Digit sum

3

8

4

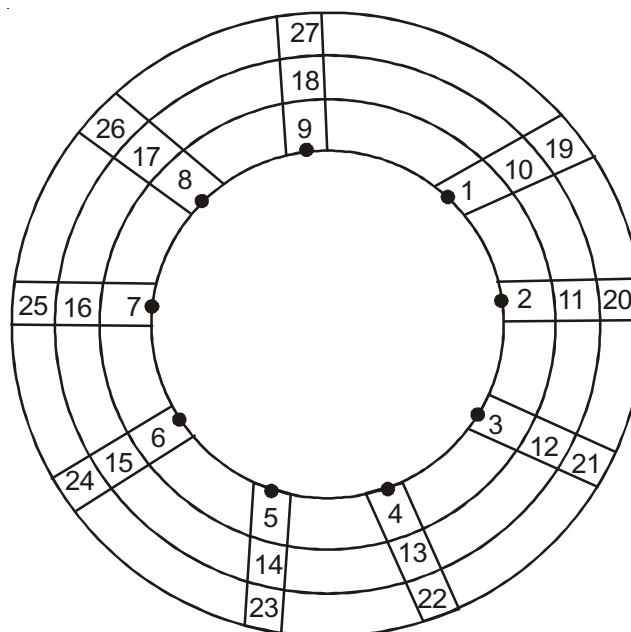
4

3

6

9 or 0

Nine Point Circle



Number at each point on the circle have the same digit sum.

By casting out 9's, finding a digit sum can be done more quickly and mentally.

9. Check Method

Digit sum can be used to check that the answers are correct.

Example: Find $23 + 21$ and check the answer using the digit sums

$$23 = \text{digit sum of } 23 \text{ is } 2 + 3 = 5$$

$$\underline{+21} = \text{digit sum of } 21 \text{ is } 2 + 1 = 3$$

$$\underline{44} = \text{digit sum of } 44 \text{ is } 4 + 4 = 8$$

If the sum has been done correctly, the digit sum of the answer should also be 8

Digit sum of $44=8$ so according to this check the answer is probably correct.

There are four steps to use digit sum to check the answers:

1. Do the sum.
2. Write down the digit sums of the numbers being added.
3. Add the digit sums.
4. Check whether the two answers are same in digit sums.

Add 278 and 119 and check the answer

$$278$$

$$\underline{+119}$$

$$\underline{397}$$

1. We get 397 for the answer
2. We find the digit sum of 278 and 119 which are, 8 and 2 respectively
3. Adding 8 and 2 gives 10, digits sum of $10=1+0=1$
4. Digit sum of 397 is

$$3 + 9 + 7 = 19 = 1 + 9 = 10 = 1 + 0 = 1$$

Which confirm the answer?

CAUTION!

Check the following sum:

$$279 \ 9$$

$$\underline{121 \ 4}$$

$$\underline{490 \ 4}$$

Here an estimation can help you to find the result more accurate if by mistake you write 400 in place of 490 then it will show the result is correct.

The check is $9 + 4 = 13 = 4$ which is same as the digit sum of the answer which confirms the answer.

However if we check the addition of the original number we will find that it is incorrect! This shows that the digit sum does not always find errors. It usually works but not always. We will be looking at another checking device i.e. 11 - check method.

Note : The difference of 9 and its multiples in the answer make errors. So, keep in mind a rough estimation.

Practice Problems

Digit sum Puzzles

1. The digit sums of a two digit number is 8 and figures are the same, what is the number?
2. The digit sum of a two digit number is 9 and the first figure is twice the second, what is it?
3. Give three two digit numbers that have a digit sum of 3.
4. A two digit number has a digit sum of 5 and the figures are the same. What is the number?
5. Use casting out 9's to find the digit sums of the numbers below.

Number	
465	
274	
3456	
7819	
86753	
4017	
59	

6. Add the following and check your answer using digit sum check

(1) $66 + 77 =$

(2) $57 + 34 =$

(3) $94 + 89 =$

(4) $304 + 233 =$

(5) $787 + 132 =$

(6) $389 + 414 =$

(7) $5131 + 5432 =$

(8) $456 + 654 =$