

## Chapter 3 || Eleven Check Method

We have already used the digit sum check that helps to show if a calculation is correct. This method works because adding the digit in a number gives the remainder of the number after division by 9.

A similar method works by using remainders of numbers after division by 11 rather than 9

### Alternate digit sum or Eleven-check Method

Suppose we want another check for  $2434 \times 23 = 55982$  it can be done in the following steps

**Step1:** Alternately add and subtract (starting from right moving towards left) the digits of each numbers as described below

Number	Alternating signs	Digit sum
2434	$-2 + 4 - 3 + 4$	3
23	$-2 + 3$	1
55982	$+5 - 5 + 9 - 8 + 2$	3

**Step 2:** Now multiply the Digit Sum to get the product  $3 \times 1 = 3$  Since the Digit Sum of the product and the two numbers is the same, the answer is correct as per 11 check method.

Two digit and Negative number in the digit sum checking the sum of addition

$$\begin{array}{r}
 4364 + 1616 \\
 \text{Left to right} \\
 4364 \\
 \underline{1916} \\
 6280
 \end{array}$$

Number	Alternating signs	Digit sum	Single digit
4364	$-4 + 3 - 6 + 4$	$-3 (11-3)$	8
1916	$-1 + 9 - 1 + 6$	$13(11+2)$	2
6280	$-6 + 2 - 8 + 0$	$-12$	10
		$11 - 12 = -1$	
		$11 - 1 = 10$	

**Step2:** Apply the following rules to get a single positive digit for the number

- Subtract the negative numbers below 11 from 11 to get its positive counterpart so  $-3 = 11 - 3 = 8$   
And  $-12 = -12 + 11 = -1 = 11 - 1 = 10$
- For the two digit number above 11, divide the number by 11 and get the remainder as the positive digit sum so  $13 \div 11$  gives remainder 2. Alternately, adding and subtracting digit of 13 starting from right can obtain this same result.

**Step 3 :** now add the Digit sums to get the sum  $8 + 2 = 10$ , the answer is correct as per 11 check method.

### Two digits in the digit sum

Check subtraction problem

$$2819174 - 839472$$

$$2819174$$

$$\underline{839472}$$

$$1979702$$

**Step 1:** Alternatively add and subtract (staring from right moving towards left) the digit of each numbers as described below

Number	Alternating signs	Digit sum	Single digit
2819174	+2-8+1-9+1-7+4	-16(-16+11= -5)	11-5=6
839472	-8+3-9+4-7+2	-15(-15+11= -4)	11-4=7
1979702	+1-9+7-9+7-0+2	-1	11-1=10

**Step 2:** Apply the following rules to get a single positive digit for the number

- The negative numbers below  $-11$  are to be first divided by 11 to get the remainder. Than subtract the remainder from 11 to get its positive counterpart. So  $-16/11$  Remainder is  $-5$  and  $-5 = 11 - 5 = 6$  similarly  $-15/11$  Remainder  $-4 = 11 - 4 = 7$ .
- The negative number  $-1 = 11 - 1 = 10$

**Step3:** Now subtract the Digit sums to get the answer  $6 - 7 = -1 = 10$ , the answer is correct as per 11- checked method.

### Practice Problems

Get the digit sum and single digit for the following numbers.

Numbers	Alternative signs	Digit sums	Single digit
567			
1536			
93823			
1978712			
849391			
82918			
5949393			
176780			

Using 11 check method check the following Addition problems:

- (1)  $37 + 47 = 84$
- (2)  $55 + 28 = 83$
- (3)  $47 + 25 = 72$
- (4)  $29 + 36 = 65$
- (5)  $526 + 125 = 651$
- (6)  $1328 + 2326 = 3654$
- (7)  $129 + 35644 = 35773$
- (8)  $3425 + 7491 + 8834 = 19750$
- (9)  $1423178 + 5467 + 123 + 34 = 1428802$
- (10)  $1314 + 5345 + 65 + 781 = 7505$

Check the following subtraction problems:

- (1)  $63 - 28 = 35$
- (2)  $813 - 345 = 468$
- (3)  $695 - 368 = 372$
- (4)  $3456 - 281 = 3175$
- (5)  $7117 - 1771 = 5346$
- (6)  $8008 - 3839 = 4165$
- (7)  $6363 - 3388 = 2795$
- (8)  $51015 - 27986 = 23029$
- (9)  $14285 - 7148 = 7137$
- (10)  $9630369 - 3690963 = 5939406$