Simplification and Approximation

What is Digit Sum?

Given a number N_1, all the digits of N_1 are added to obtain a number N_2. All the digits of N_2 are added to obtain a number N_3, and so on, till we obtain a single-digit number N. This single-digit number N is called the digit sum of the original number N_1.

Example: What is the digit sum of 123456789?

Answer: 1 + 2 + 3 + 4 + 5 + 6 + 7 + 8 + 9 = 45 --> 4 + 5 = 9. Hence, the digit sum of the number is 9

Note: In finding the digit-Sum of a number we can ignore the digit 9 or the digits that add up to 9. For example, in finding the digit-sum of the number 246819, we can ignore the digits 2, 6, 1, and 9. Hence, the digit-sum of 246819 is = 4 + 8 = 12 = 1 + 2 = 3

What is BODMAS rule?

BODMAS is an acronym and it stands for Bracket, Order, Division, Multiplication, Addition, and Subtraction. The order of operations of BODMAS is shown in the below figure.

Tips to Remember BODMAS Rule:

The rules to simplify the expression using BODMAS rule are as follows:

- First, simplify the brackets
- Solve the exponent or root terms
- Perform division or multiplication operation (from left to right)
- Perform addition or subtraction operation (from left to right)

What are the uses of the concept of the Digit Sum?

We introduce you to a very important concept of the Digit-Sum Rule of Multiplication here. This rule says that: the digit-sum of the product of two numbers is equal to the digit sum of the product of the digit sums of the two numbers.

Example: The product of 129 and 35 is 4515.

Solution: We will check this using the rule of Digit Sum rule of Multiplication.

Digit sum of 129 = 3 and digit sum 35 = 8

Product of the digit sums = 3 × 8 = 24 --> Digit-sum = 6.

Digit-sum of 4515 is = 4 + 5 + 1 + 5 = 15 = 1 + 5 = 6.

Digit-sum of the product of the digit sums = digit sum of 24 = 6

Hence, Digit sum of the product (4515) = Digit-sum of the product of the digit sums (24) = 6

A very important use of this concept in Problem solving includes:

1. Rapid checking of calculations while multiplying numbers

If you want to check the multiplication of different numbers is correct or not, you can use this method to check the same. Suppose you are taking the product of AxBxC = D. To check you need to take out the digit sum of the product number and the individual numbers. If both the value matches then the product is taken out will be correct, else not.

Note:

Although the answer of multiplication will not be correct if the digit-sum of the product of the digit-sums is not equal to digit-sum of the product, the reverse is not true i.e. the answer of multiplication **may or may not be** correct if the digit-sum of the product of the digit-sums is equal to digit-sum of the product.

2. Finding the sum of the digits of a number raised to a power

Example: The digits of the number $(4)^{30}$ are summed up continually till a single-digit number is obtained. What is that number?

Answer: $4^3 = 64$. Digit sum of 64 is = 1.

$4^{30} = 4^3 \times 4^3 \times 4^3 \ldots \times 4^3$ (10 times)

Digit sums on both sides will be the same.

--> digit sum of 4^{30} = digit sum of $1 \times 1 \times 1 \times 1 \ldots$ (10 times) = 1

1.Evaluate: $2 + 4 \div (22 + 6) \times 2$.

2. Evaluate: $\{15 \times 32 \div 2 \times 5\} \div 75$

3. Evaluate: $5 \times (2 \times 3^4) \div 6 + 7 - 8$

4. 58 x 96 x 62 =?

(a) 345246
(b) 345226
(c) 345216
(d) 345236

$\sqrt{624.98} + \sqrt{729.25} = ?$

(a) 58 (b) 56 (c) 52 (d) 61 (e) 62

180% of 25501 + 50% of 28999 = ?

(a)62400 (b) 64000 (c) 60400 (d) 64200 (e) 60600

- 2(25500)- (1/5)25500+ 14500= 60400

$171.995 \times 14.995 \div 25 = ?$

(a)103 (b) 115 (c) 110 (d) 125 (e) 118

- (170 X 15) /25 =102 approx 103

$175 \times 28 + 275 \times 27.98 = ?$

(a) 11800 (b) 12600 (c) 12800 (d) 11600 (e) 16200

- (175+275) 28 =12600

$324.995 \times 15.98 \div 4.002 + 36.88 = ?$

(a) 1300 (b) 1230 (c) 1340 (d) 1380 (e) 1390

- 325 X 4 +37= 1337 approx 1340

1164 × 128 ÷ 8.008 + 969.007 = ?

(a) 18800 (b) 19393 (c) 19593 (d) 19200 (e) 20293

- 1164 X 16 +969= 19593

69.008% of 699.98 + 32.99% of 399.999 = ?

(a) 615 (b) 645 (c) 675 (d) 715 (e) 815

- 69 % 700 + 33% 400= 615