**Chapter-1**

**Number system**

***Formulas of Number Series***

1. 1 + 2 + 3 + 4 + 5 + … + n = n(n + 1)/2
2. (12 + 22 + 32 + ..... + n2) = n ( n + 1 ) (2n + 1) / 6
3. (13 + 23 + 33 + ..... + n3) = (n(n + 1)/ 2)2
4. Sum of first n odd numbers = n2
5. Sum of first n even numbers = n (n + 1)

***Mathematical Formulas***

1. (a + b)(a - b) = (a2 - b2)
2. (a + b)2 = (a2 + b2 + 2ab)
3. (a - b)2 = (a2 + b2 - 2ab)
4. (a + b + c)2 = a2 + b2 + c2 + 2(ab + bc + ca)
5. (a3 + b3) = (a + b)(a2 - ab + b2)
6. (a3 - b3) = (a - b)(a2 + ab + b2)
7. (a3 + b3 + c3 - 3abc) = (a + b + c)(a2 + b2 + c2 - ab - bc - ac)
8. When a + b + c = 0, then a3 + b3 + c3 = 3abc
9. (a + b)n = an + (nC1)an-1b + (nC2)an-2b2 + … + (nCn-1)abn-1 + bn

***Shortcuts for number divisibility check***

1. A number is divisible by 2, if its unit's digit is any of 0, 2, 4, 6, 8.
2. A number is divisible by 3, if the sum of its digits is divisible by 3.
3. A number is divisible by 4, if the number formed by the last two digits is divisible by 4.
4. A number is divisible by 5, if its unit's digit is either 0 or 5.
5. A number is divisible by 6, if it is divisible by both 2 and 3.
6. A number is divisible by 8, if the number formed by the last three digits of the given number is divisible by 8.
7. A number is divisible by 9, if the sum of its digits is divisible by 9.
8. A number is divisible by 10, if it ends with 0.
9. A number is divisible by 11, if the difference of the sum of its digits at odd places and the sum of its digits at even places, is either 0 or a number divisible by 11.
10. A number is divisible by 12, if it is divisible by both 4 and 3.
11. A number is divisible by 14, if it is divisible by 2 as well as 7.
12. Two numbers are said to be co-primes if their H.C.F. is 1. To find if a number, say y is divisible by x, find m and n such that m \* n = x and m and n are co-prime numbers. If y is divisible by both m and n then it is divisible by x.

***CONCEPT OF UNIT PLACE***

The last digit (or unit digits) of 0, 1, 5and 6 always the same Irrespective of their powers raised on them.

Cyclic order -

Unit place Unit place

21 = 2 31 = 3

22 = 4 32 = 9

23 = 8 33 = 7

24 = 6 34 = 1

25 = 2 35 = 3

The last digit (or unit digits) even and the power is divisible by 4 then unit place is 6. The last digit (or unit digits) odd and the

power is divisible by 4 then unit place is 1.

**Example:** Find the unit in the product **6892 × 3568 × 7239 × 3624 = ?**

**Answer:** Product of unit digits = 2 × 8 × 9 × 4 = 576

= 6 (unit digit)

**Example:** Find the unit digit in the product 3897 × 2651 × 388

**Answer:** Product of unit digits = 7 × 1 × 8 = 56

Unit digit is 6

**Example:** What is the unit digit (3683)169

Sol.

**Answer:** Unit digit in (3)

And, Power of digit 169, we take last two

digit only 69, divide by 4, get the remainder

3169/4 = 31 = 3

**Example:** What is the unit digit in 778 × 493 × 641

**Answer:** 72 ×41 × 6 = 49 × 4 × 6 = 6

**Example:** On dividing a number by 56, we get 29 as remainder. On dividing the same number by 8, what will be the remainder?

**Answer:** On dividing the given number by, 56

Let us get quotient = x and remainder =8

Given number = 56x+5 = 8×7x+ 5

= 5 is Remainder