

## Concepts and Formulas

### Properties of Binomial Coefficients:

1. General Term: (r+1)th term of the binomial expansion is called general term.

$$T_{r+1} = {}^nC_r a^{n-r} b^r$$

2. Middle Term: in Binomial expansion of  $(a+b)^n$

Case-1: **n is even**

$$\text{middle term is: } \left(\frac{n+1+1}{2}\right)^{\text{th}} = \left(\frac{n}{2}+1\right)^{\text{th}}$$

Case-2: **n is odd**

$$\text{middle terms are: } \left(\frac{n+1}{2}\right)^{\text{th}} \text{ and } \left(\frac{n+1}{2}+1\right)^{\text{th}}$$

3. Constant Term: also called term that is independent of x in expansion of

$$\left(x + \frac{1}{x}\right)^{2n}$$

In this case middle term is (n+1)th term as 2n is even.

$${}^{2n}C_n x^n \left(\frac{1}{x}\right)^n = {}^{2n}C_n (\text{constant})$$

#### 4. Important results:

1.  $C_0 + C_1 + C_2 + \dots + C_n = 2^n$
2.  $C_0 + C_2 + C_4 + \dots = C_1 + C_3 + C_5 + \dots = 2^{n-1}$
3.  $C_0 - C_1 + C_2 - C_3 + \dots + (-1)^n \cdot nC_n = 0$
4.  $nC_1 + 2 \cdot nC_2 + 3 \cdot nC_3 + \dots + n \cdot nC_n = n \cdot 2^{n-1}$
5.  $C_1 - 2C_2 + 3C_3 - 4C_4 + \dots + (-1)^{n-1} C_n = 0$  for  $n > 1$
6.  $C_0^2 + C_1^2 + C_2^2 + \dots C_n^2 = [(2n)! / (n!)^2]$

## Tips and Tricks

1. By now you must have noticed that in binomial expansion results we use short hand notations of  $C(n, r) = \frac{n!}{r!(n-r)!}$

So knowing about the maths notation is important to be able to understand the question and answer it.

2. Try to write down different types of terms definition and their formulas.

3. Read binomial coefficient results carefully and also try to prove them. It will help tremendously. Believe me.

4. Write down important results from this chapter in a neat single page and revise before tests and exams.

5. Keep in mind that these concepts are very new to you, and getting the overall idea of things will take time. Just keep doing your every day work. Dots will connect eventually.

6. Practice questions from problem sections. Try to make them timed.