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Multinomial Theorem

In mathematics, the multinomial theorem describes how to expand a power of a sum in terms of powers of the terms in that sum. It is the generalization of the binomial theorem to polynomials.

Basically, we are expanding this: $(x_1 + x_2 + \cdots + x_m)^n$, and using Multinomial Theorem we can calculate the value of coefficient of any given term.

The coefficient of the term $x_1^{k_1} x_2^{k_2} \cdots x_m^{k_m}$, where $k_1 + k_2 \cdots + k_m = n$, is

$$\binom{n}{k_1, k_2, \ldots, k_m} = \frac{n!}{k_1! k_2! \cdots k_m!}$$

Resource: Wiki

Relation with Binomial Coefficient

$$\binom{n}{k_1,k_2,\ldots,k_m} = \binom{n}{k_1} \cdot \binom{n-k_1}{k_2} \cdots \binom{n-k_1-k2-\ldots - k{m-1}}{k_m}$$