

Counting

Multiplication principle

If one event can occur in m ways and another event can occur in n ways, then the two events together can occur in

$m \times n$ ways

Length 3 (1,2,3,4,5,6)

$6 \times 6 \times 6$

Factorials

$n! = n \cdot (n-1) \cdot (n-2) \cdots 3 \cdot 2 \cdot 1$

$0! = 1$

$1! = 1$

Permutations

Ways to arrange items where order matters.

$P(n) = n!$

Arrange A, B, C $\rightarrow 3! = 6$ ways

$P(n,r) = \frac{n!}{(n-r)!}$

Choose president, VP, secretary from 8 people: $P(8,3) = \frac{8!}{5!}$

repeats $\frac{n!}{n_1! n_2! \dots n_k!}$

BANANA $\rightarrow 6$ letters, repeats: A=3, N=2
 $\frac{6!}{3!2!}$

Combinations

$C(n,r) = \frac{n!}{r!(n-r)!}$

Binomial Theorem

$(a+b)^n$

$(a+b)^n = \sum_{k=0}^n \binom{n}{k} a^{n-k} b^k$

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