Binomial Theorem

1	Pascal Triangle	1 1 1 1 2 1 1 3 3 1 1 4 6 4 1 1 5 10 10 5 1

Observe Expansion

Power	Expand	Number of terms
$(a+b)^0$	1	1
$(a+b)^1$	$a+b$	2
$(a+b)^2$	$a^2+2ab+b^2$	3
$(a+b)^3$	$a^3+3a^2b+3ab^2+b^3$	4
$(a+b)^4$	$a^4+4a^3b+6a^2b^2+4ab^3+b^4$	5
$(a+b)^5$	$a^5+5a^4b+10a^3b^2+10a^2b^3+5ab^4+b^5$	6

Binomial Theorem General Formula

$$(a+b)^n =$$

$$nC_0\ a^n + nC_1\ a^{n-1}b^1 + nC_2\ a^{n-2}b^2 + \cdots + nC_r\ a^{n-r}b^r + \cdots + nC_n\ b^n$$

$$nC_0 = nC_n = 1, it\ will\ always\ be\ 1\ as\ seen\ from\ pascal\ triangle$$

$$\therefore\ a^n + nC_1\ a^{n-1}b^1 + nC_2\ a^{n-2}b^2 + \cdots + nC_r\ a^{n-r}b^r + \cdots + \ b^n$$

What is nC_r ?

$n = the\ power\ of\ expansion$

$r = which\ term\ of\ the\ pascal\ triangle\ of\ the\ power\ n$

Example: $5C_0 = 1$, $5C_1 = 5$, $5C_2 = 10$, $5C_3 = 10$, $5C_4 = 5$, $5C_5 = 1$

How to calculate nC_r?

Factorial Intro

$$1! = 1$$

$$2! = 2 * 1 = 2$$

$$3! = 3 * 2 * 1 = 6$$

$$4! = 4 * 3 * 2 * 1 = 24$$

Factorial General Formula

$$n! = n(n-1)(n-2)\ldots(1)$$

$\mathbf{nC_r}$ General Fomula

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