Binomial Theorem

- shows you have to expand binomial

$$(a+b) = 1a^1 + 1b^1$$

$$(a+b)^2 = 1a^2 + 2ab + 1b^2$$

$$(a+b)^3 = 1a^3 + 3a^2b + 3ab^2 + 1b^3$$

$$(a+b)^4 = 1a^4 + 4a^3b + 6a^2b^2 + 4ab^3 + 1b^4$$

$$(a+b)^5 = 1a^5 + 5a^4b + 10a^3b^2 + 10a^2b^3 + 5ab^4 + 1b^5$$

Coefficients

Blaise Pascal

1
1 1
1 2 1
1 3 3 1
1 4 6 4 1
1 5 10 10 5 1
1 6 15 20 15 6 1

$$(a+b)^6 = a^6 + 6a^5b^1 + 15a^4b^2 + 20a^3b^3 + 15a^2b^4 + 6ab^5 + b^6$$

6th row: if you have 6 diff hats

$_6C_0 = 1$ $\quad$ $_6C_1 = 6$ $\quad$ $_6C_2 = 15$ $\quad$ $_6C_3 = 20$

$_6C_4 = 15$ $\quad$ $_6C_5 = 6$ $\quad$ $_6C_6 = 1$

we know $\boxed{(a+b)^n = \sum_{k=0}^{n} {}_nC_k \, a^{n-k} b^k}$

Binomial Theorem.

let $a=1$

$$(1+b)^n = \sum_{k=0}^{n} {}_nC_k \, b^k = (1 + nb + {}_nC_2 b^2 + {}_nC_3 b^3$$

$$(1+b)^{\frac{1}{2}} \approx 1 + \frac{1}{2}b - \frac{1}{8}b^2$$

$$5{,}000\left(1+\frac{.04}{12}\right)^{12t} \quad 15, \quad \sum_{t=1}^{36} \frac{P}{\left(1+\frac{0.04}{12}\right)^t} = 15000$$

$$\boxed{{}_nC_k = \frac{n!}{(n-k)!\,k!}} = \frac{n(n-1)\cdots(n-k+1)}{k!}$$

$${}_nC_r = {}_nC_{n-r}$$

$${}_{\frac{1}{2}}C_1 = \frac{\frac{1}{2}}{1} = \frac{1}{2}$$

$${}_8C_5 = \frac{8!}{3!\cdot 5!} = \frac{8\cdot 7\cdot 6\cdot 5\cdot 4}{5!}$$

$${}_{\frac{1}{2}}C_2 = \frac{\frac{1}{2}\left(-\frac{1}{2}\right)}{2!}$$

$${}_{\frac{1}{2}}C_3 = \frac{\frac{1}{2}\left(-\frac{1}{2}\right)\left(-\frac{3}{2}\right)}{3!}$$