$(a+b)^2$ $\quad a \cdot a \cdot b$

$(a+b)(a+b)(a+b) \quad a^3 b^0 + 3a^2 b^1 + 3ab^2 + b^3 a^0 \quad \frac{10!}{9!\,1!} \quad \frac{10!}{8!\,2!} \quad \frac{10!}{7!\,3!}$

$$\underbrace{(a+b)(a+b)\cdots(a+b)}_{10} = 1a^{10} b^0 + \binom{10}{1} a^9 b^1 + \binom{10}{2} a^8 b^2 + \binom{10}{3} a^7 b^3 + \cdots$$

$$\cdots + \binom{10}{10} a^0 b^{10}$$

$$(a+b)^n = \binom{n}{0} a^n b^0 + \binom{n}{1} a^{n-1} b^1 + \binom{n}{2} a^{n-2} b^2 + \cdots \binom{n}{n-1} a^1 b^{n-1} + \binom{n}{n} a^0 b^n$$

$$(a+b)^n = \binom{n}{0} a^n b^0 + \binom{n}{1} a^{n-1} b^1 + \dots \quad \binom{n}{n} a^0 b^n$$

even $\left[r = \frac{n}{2} + 1 \right]$

$n = 10$

odd $\left[r = \frac{n+1}{2} \right]$

which is the highest coefficient $\rightarrow$ middle

r^{th} term? $\binom{n}{r-1} a^{n-r+1} b^{r-1}$

$\binom{10}{1} a^9 b^1$

$r = 1 \quad \binom{10}{0} a^{10} b^0$

$r = 2 \quad \binom{10}{1} a^9 b^1$

what will be the coeff. of middle term

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

$(a+b)^3 = a^3 + \boxed{3a^2b + 3ab^2} + b^3$

$a^4 \quad a^3 b \quad a^2 b^2 \quad a b^3 \quad b^4$

$$\underline{\lim_{n\to\infty}\left(1+\frac{1}{n}\right)^n} = \sum_{k=0}^{\infty}\frac{1}{k!}$$

$\underline{e} = 2.713$

$$= \binom{n}{0}1^n + \binom{n}{1}1^{n-1}\left(\frac{1}{n}\right) + \binom{n}{2}1^{n-2}\cdot\left(\frac{1}{n}\right)^2 + \dots$$

$$= \frac{1}{0!} + \frac{1}{1!} + \frac{\cancel{n^2}\left(1-\frac{1}{n}\right)}{2!\;\cancel{n^2}} + \frac{\cancel{n^3}\left(1-\frac{1}{n}\right)\left(1-\frac{2}{n}\right)}{3!\;\cancel{n^3}} + \dots$$

$$= 1 + n\cdot\left(\frac{1}{n}\right) + \frac{n(n-1)}{2!}\frac{1}{n^2} + \frac{n(n-1)(n-2)}{3!\;n^3} + \dots$$

$n \cdot n-1 \cdot (n-2)!$

$$\frac{n!}{2!\,n-2!}\left(\frac{1}{n^2}\right) = \frac{n(n-1)}{2!}\frac{1}{n^2}$$

$= e$

$$\frac{1}{0!} + \frac{1}{1!} + \frac{1}{2!} + \frac{1}{3!} + \frac{1}{4!} + \dots$$

$$= \sum_{K=0}^{\infty}\frac{1}{K!}$$

(Eulers numbers)

$$(1+1)^n = \binom{n}{0} + \binom{n}{1} + \binom{n}{2} + \dots \binom{n}{n} = 2^n$$

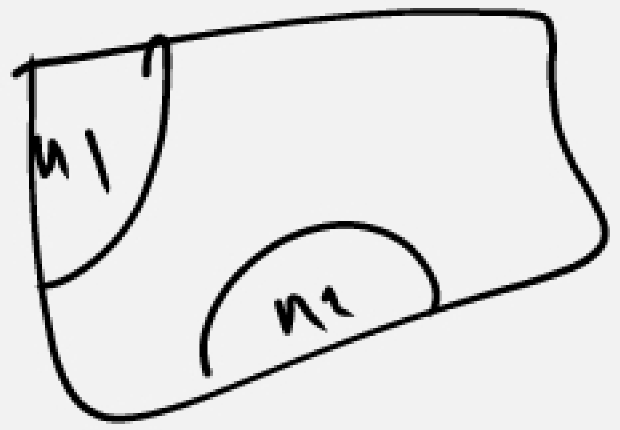
The sum of all the binomial coefficients add to $\boxed{2^n.}$ Power set

x^1

x^4

$\left(\frac{x^2}{2} - \frac{1}{x}\right)^6$: compute the 5th term $\frac{15}{4}$ $\boxed{x^0}$

$^6C_r\left(\frac{x^2}{2}\right)^{6-r}\left(\frac{1}{x}\right)^r$ p $\to$ x^{12-2r} $\left(\frac{1}{x^r}\right) \to$ power $\boxed{12-3r}$



$n.$ $\quad {}^{n}C_{n_1} \cdot {}^{(n-n_1)}C_{n_2} \cdot {}^{(n-n_1-n_2)}C_{n_3} \cdots {}^{n_r}C_{n_r}$

$n_1 \ldots n_r$ MULTINOMIAL $\quad = \dfrac{n!}{n_1!\, n_2! \ldots n_r!}\, x_1^{n_1} x_2^{n_2} + \ldots x_r^{n_r}$

$36,\ 4 \times 9$ $\quad {}^{36}C_9 \cdot {}^{27}C_9 \cdot {}^{18}C_9 \cdot {}^{9}C_9$

$n_1 + n_2 + \ldots + n_r = n$ $\quad (x_1 + \ldots x_r)^n$