Binomial Theorem Notes

$(a+b)^0 = 1$

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

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

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

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

* All exponants add up to the original exponant.

* The coefficients are determained by...

- Pascal's Triangle or... use the Combinations formula

Power	Coefficients
$n=0 \rightarrow$	1
$n=1 \rightarrow$	1 1
$n=2 \rightarrow$	1 2 1
$n=3 \rightarrow$	1 3 3 1
$n=4 \rightarrow$	1 4 6 4 1
$n=5 \rightarrow$	1 5 10 10 5 1
$n=6 \rightarrow$	1 6 15 20 15 6 1
$n=7 \rightarrow$	1 7 21 35 35 21 7 1

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

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

apply

$(x+y)^8$

$$\binom{8}{0}x^8 + \binom{8}{1}x^7y + \binom{8}{2}x^6y^2 + \binom{8}{3}x^5y^3 + \binom{8}{4}x^4y^4 + \binom{8}{5}x^3y^5 + \binom{8}{6}x^2y^6 + \binom{8}{7}xy^7 + \binom{8}{8}y^8$$

Solution next page.

$\boxed{IC-112}$ $(x+y)^8$

$$\left(\frac{8!}{(8-0)!0!}\right)x^8+\left(\frac{8!}{(8-1)!1!}\right)x^7y+\left(\frac{8!}{(8-2)!2!}\right)x^6y^2+\left(\frac{8!}{(8-3)!3!}\right)x^5y^3+$$

$$\left(\frac{8!}{(8-4)!4!}\right)x^4y^4+\left(\frac{8!}{(8-5)!5!}\right)x^3y^5+\left(\frac{8!}{(8-6)!6!}\right)x^2y^6+\left(\frac{8!}{(8-7)!7!}\right)xy^7+\left(\frac{8!}{(8-8)!8!}\right)y^8$$

$$\boxed{x^8+8x^7y+28x^6y^2+56x^5y^3+70x^4y^4+28x^2y^6+8xy^7+y^8}$$

1st 2nd 3rd 4th 5th 6th 7th 8th

Next day practice Binomial Theorem. (worksheet)

Add to notes $r=$ term# $n=$ exponent

To find the r^{th} term

- use combination formula to find the coefficient.
- determan the leading exponent

$$\boxed{(n-r)+1}$$

example: $(x+y)^7$ 4^{th} term

$n=7$ $r=4$

$${}_7C_4=\frac{7!}{(7-4)!4!}=35$$

$$(7-4)+1=4$$

$$\boxed{35x^4y^3}$$

exponants must add up to original exponant

*If it's a difference even terms are "−".