

## Pre-Calculus 12 The Binomial Theorem

$$(x+y)^n = {}^nC_0 x^n y^0 + {}^nC_1 x^{n-1} y^1 + {}^nC_2 x^{n-2} y^2 + \dots + {}^nC_{n-1} x^1 y^{n-1} + {}^nC_n x^0 y^n$$

start at 0, increase  $\nearrow$  start at n, decrease  $\nwarrow$

Ex. 1) Expand and simplify

a.)  $(2x+y)^3$

$n=3 \rightarrow 4 \text{ terms}$

$${}^3C_0 (2x)^3 y^0 + {}^3C_1 (2x)^2 y^1 + {}^3C_2 (2x)^1 y^2 + {}^3C_3 (2x)^0 y^3$$

$$1(8x^3) + 3(4x^2)y + 3(2x)y^2 + 1y^3$$

$$8x^3 + 12x^2y + 6xy^2 + y^3$$

b.)  $(4a^2+2b)^4$

$n=4 \rightarrow 5 \text{ terms}$

$${}^4C_0 (4a^2)^4 (2b)^0 + {}^4C_1 (4a^2)^3 (2b)^1 + {}^4C_2 (4a^2)^2 (2b)^2 + {}^4C_3 (4a^2)^1 (2b)^3 + {}^4C_4 (4a^2)^0 (2b)^4$$

$$1(256a^8) + 4(64a^6)(2b) + 6(16a^4)(4b^2) + 4(4a^2)(8b^3) + 1(16b^4)$$

$$256a^8 + 512a^6b + 384a^4b^2 + 128a^2b^3 + 16b^4$$

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# 5b  
6b