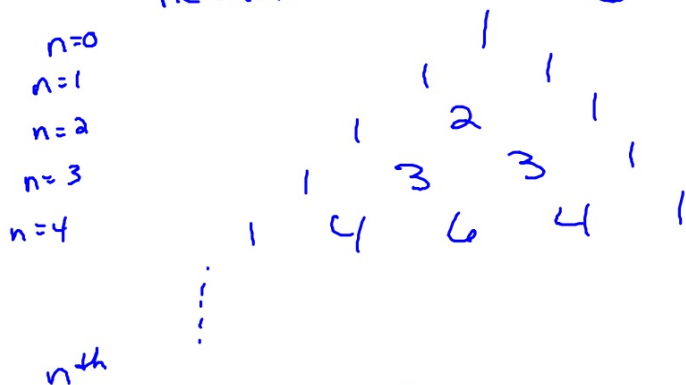


• Binomial Expansion - a review
Recall: Pascal's Triangle



For Polynomials

$$(a+b)^n = \sum_{r=0}^n \binom{n}{r} (a)^{n-r} (b)^r$$

$$\binom{n}{r} = {}^n C_r = \frac{n!}{r!(n-r)!}$$

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

Ex) Expand $(2x - 5y)^3$ $a = 2x$
 $b = -5y$

$$= \binom{3}{0} (2x)^3 (-5y)^0 + \binom{3}{1} (2x)^2 (-5y)^1 +$$

$$\binom{3}{2} (2x)^1 (-5y)^2 + \binom{3}{3} (2x)^0 (-5y)^3$$

$$= (1) 8x^3 + (3)(4x^2)(-5y) + (3)(2x)(25y^2) + (1)(-125y^3)$$

$$= 8x^3 - 60x^2y + 150xy^2 - 125y^3$$

$$\begin{array}{cccc} & & 1 & \\ & & / \quad \backslash & \\ & 1 & & 1 \\ & / \quad \backslash & & / \quad \backslash \\ 1 & 2 & 1 & \\ / \quad \backslash & & & \\ 3 & 3 & 1 & \end{array}$$

Ex] Find the x^3 term in the expansion of $(4x-1)^9$

$$\begin{array}{cccccccc} x^9 & x^8 & x^7 & x^6 & x^5 & x^4 & x^3 & x^2 \\ \binom{9}{0} & \binom{9}{1} & \binom{9}{2} & \binom{9}{3} & \binom{9}{4} & \binom{9}{5} & \binom{9}{6} & \binom{9}{7} \end{array}$$

$$\binom{9}{6} (4x)^3 (-1)^3$$

$3+6=9$

$$= (84)(64x^3)(-1)$$

$$= -5376x^3$$

$$f(x) = (x^2 + 3)^7$$

$$f'(x) = 7(x^2 + 3)^6 (2x)$$

$$= 14x(x^2 + 3)^6$$

$$= 14x \left[\binom{6}{0} (x^2)^6 (3)^0 + \dots \dots \binom{6}{2} (x^2)^2 (3)^4 \right]$$

$$= 14x \binom{6}{2} (x^2)^2 (3)^4$$

$$\text{or } \binom{6}{4}$$

$$= 14x (15)(x^4)(81) = 17010 x^5$$

