Binomial Expansion

*this is a technique for multiplying binominals

*use Pascal's triangle

coefficients

$$1 \leftarrow \text{row 0}$$
$$1 \quad 1 \quad \text{row 1}$$
$$1 \quad 2 \quad 1 \quad \text{row 2}$$
$$\rightarrow 1 \quad 3 \quad 3 \quad 1$$
$$1 \quad 4 \quad 6 \quad 4 \quad 1$$
$$1 \quad 5 \quad 10 \quad 10 \quad 5 \quad 1 \quad \text{rows}$$

The Set-Up row 3

$$(a+b)^3 = 1a^3b^0 + 3a^2b^1 + 3a^1b^2 + 1a^0b^3$$

$$= \boxed{a^3 + 3a^2b + 3ab^2 + b^3}$$
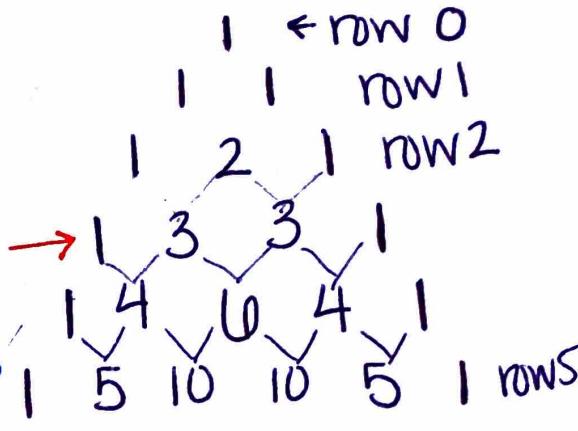
Example 1: $(x+2)^4$ ← row 4

$$= 1x^4 2^0 + 4x^3 2^1 + 6x^2 2^2 + 4x^1 2^3 + 1x^0 2^4$$
$$\qquad\qquad\quad 4 \qquad\quad 8 \qquad\quad 1$$

$$= \boxed{x^4 + 8x^3 + 24x^2 + 32x + 16}$$

Example 2: $(2x-1)^3$ ← row 3

$$= 1(2x)^3(-1)^0 + 3(2x)^2(-1)^1 + 3(2x)^1(-1)^2 + 1(2x)^0(-1)^3$$
$$\qquad\qquad\qquad\quad 4x^2 \qquad\qquad 2x \quad 1 \qquad\qquad 1$$

$$= \boxed{8x^3 - 12x^2 + 6x - 1}$$

Example 3: $(x+2y)^3$