Binomial Expansion via Pascal's Δ

Ex:

$$\overbrace{(x+3)}^{\text{Binomial}}{}^{3} = \boxed{(x+3)(x+3)}(x+3)$$
$$= (x^2+6x+9)(x+3)$$
$$= x^3+9x^2+27x+27$$

	x	$+3$
x	x^2	$3x$
$+3$	$3x$	9

	x^2	$+6x$	$+9$
x	x^3	$6x^2$	$9x$
$+3$	$3x^2$	$18x$	27

...fill out Pascal's Triangle/Binomial Expansion Wksht...

Redo $(\overset{a}{x}+\overset{b}{3})^3$ using formula from Pascal's Δ:

1
1 1
1 2 1
1 3 3 1

$$(a+b)^3 = 1\cdot a^3\cdot b^0 + 3a^2b^1 + 3a^1b^2 + 1\cancel{a^0}b^3$$
$$= a^3 + 3a^2b + 3ab^2 + b^3$$
$$(x+3)^3 = (x)^3 + 3(x)^2(3) + 3(x)(3)^2 + (3)^3$$
$$= x^3 + 9x^2 + 27x + 27$$

Ex: Expand $(2x+{-3})^5$

$2\cdot2\cdot2\cdot2\cdot2$
$4\cdot4\cdot2$
$16\cdot2$

$-3\cdot-3\cdot-3$
$+9\cdot-3$
-27
$\times 8$

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1
1 1
1 2 1
1 3 3 1
1 4 6 4 1
1 5 10 10 5 1

$$(a+b)^5 = \cancel{1}a^5\cancel{b^0} + 5a^4b^1 + 10a^3b^2 + 10a^2b^3 + 5a^1b^4 + \cancel{1}\cancel{a^0}b^5$$
$$= a^5 + 5a^4b + 10a^3b^2 + 10a^2b^3 + 5ab^4 + b^5$$
$$(2x+{-3})^5 = (2x)^5 + 5(2x)^4(-3) + 10(2x)^3(-3)^2 + 10(2x)^2(-3)^3 + 5(2x)(-3)^4 + (-3)^5$$
$$= 32x^5 - 240x^4 + 720x^3 - 1080x^2 + 810x - 243$$

Pascal's Triangle: Binomial Expansion Formulas

"count up on b"

Name: ______________________

Date: ______________ Period: _____

Geometry 1, Balboa High School

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

0th Row

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

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

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

$$(a+b)^4 = 1a^4b^0 + 4a^3b^1 + 6a^2b^2 + 4a^1b^3 + 1a^0b^4$$

$$(a+b)^5 = 1a^5b^0 + 5a^4b^1 + 10a^3b^2 + 10a^2b^3 + 5a^1b^4 + 1a^0b^5$$

$$(a+b)^6 = 1a^6b^0 + 6a^5b^1 + 15a^4b^2 + 20a^3b^3 + 15a^2b^4 + 6a^1b^5 + 1a^0b^6$$

$$(a+b)^7 = 1a^7b^0 + 7a^6b^1 + 21a^5b^2 + 35a^4b^3 + 35a^3b^4 + 21a^2b^5 + 7a^1b^6 + 1a^0b^7$$