Multiplying Polynomials

Who uses this?
Business managers can multiply polynomials when modeling total manufacturing costs.

To multiply a polynomial by a monomial, use the Distributive Property and the Properties of Exponents.

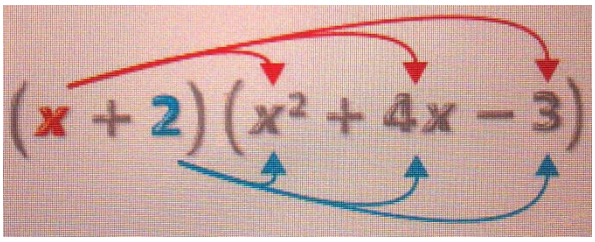
Example 1 - Multiplying a Monomial and a Polynomial

Find each product.

A. $3x^2(x^3 + 4)$

B. $ab(a^3 + 3ab^2 - b^3)$

To multiply any two polynomials, use the Distributive Property and multiply each term in the second polynomial by each term in the first.



Keep in mind that if one polynomial has *m* terms and the other has *n* terms, than the product has *mn* terms before it is simplified.

Example 2 – Multiplying Polynomials

Find each product.

A. $(x - 2)(1 + 3x - x^2)$

B. $(x^2 + 3x - 5)(x^2 - x + 1)$

Example 3 – Business Application

Mr. Silva manages a manufacturing plant. From 1990 through 2005, the number of units produced (in thousands) can be modeled by $N(x) = 0.02x^2 + 0.2x + 3$. The average cost per unit (in dollars) can be modeled by $C(x) = -0.002x^2 - 0.1x + 2$, where x is the number of years since 1990. Write a polynomial $T(x)$ that can be used to model Mr. Silva's total manufacturing costs.

You can also raise polynomials to powers.

Example 4 – Expanding a Power a Binomial

Find the product.

$(x + y)^3$

Notice the coefficients of the variables in the final product of $(x + y)^3$. These coefficients are the numbers from the third row of Pascal's triangle.

Binomial Expansion		Pascal's Triangle (Coefficients)
$(a + b)^0 =$	1	1
$(a + b)^1 =$	$a + b$	1 1
$(a + b)^2 =$	$a^2 + 2ab + b^2$	1 2 1
$(a + b)^3 =$	$a^3 + 3a^2b + 3ab^2 + b^3$	1 3 3 1
$(a + b)^4 =$	$a^4 + 4a^3b + 6a^2b^2 + 4ab^3 + b^4$	1 4 6 4 1
$(a + b)^5 =$	$a^5 + 5a^4b + 10a^3b^2 + 10a^2b^3 + 5ab^4 + b^5$	1 5 10 10 5 1

Each row of Pascal's triangle gives the coefficients of the corresponding binomial expansion. The pattern in the table can be extended to apply to the expansion of any binomial of the form $(a + b)^n$, where n is a whole number.

Binomial Expansion

For a binomial expansion of the form $(a + b)^n$, the following statements are true.

1. There are $n + 1$ terms.
2. The coefficients are the numbers from the nth row of Pascal's triangle.
3. The exponent of a is n in the first term, and the exponent decreases by 1 in each successive term.
4. The exponent of b is 0 in the first term, and the exponent increases by 1 in each successive term.
5. The sum of the exponents in any term is n.

Example 5 – Using Pascal's Triangle to Expand Binomial Expressions

Expand each expression.

A. $(y - 3)^4$

B. $(4z + 5)^3$

GET ORANIZED: In each box, write an example and find the product.