

# Study Guide

## Multiplication of Polynomials 02/29/2012

### Polynomials: Multiplication

A monomial is the product of a number and an unknown variable or unknown variables.  $6xy$  is a monomial. The sum of two or more monomials is called a polynomial. Here is an example of a polynomial:  $y^2 + 4y + 3$ .

A binomial is a polynomial with exactly two monomial terms.  $3x + 4$  is a binomial. A trinomial is a polynomial with exactly three terms.  $4xy - 3x + 6y$  is a trinomial.

Adding and subtracting polynomials includes simplifying and combining "like" terms. Like terms are monomials that have the same variable or variables for which the variable or variables have the same exponent.

Examples:

To multiply monomials and polynomials, the exponential properties must be followed. These properties apply to all real numbers with positive exponents.

Exponential Properties for Multiplication
$a^m \cdot a^n = a^{m+n}$
$(a^m)^n = a^{m \cdot n}$
$a^m \cdot a^n \cdot a^p = a^{m+n+p}$
$a^m \cdot a^n = a^{m-n}$
$a^m \cdot a^n = a^{m \cdot n}$

Exponential property #1 can be used to obtain results for problems such as:

$$(p^3 r^3)(p^2 r)(p^2 r^3) = p^{3+2+2} r^{3+1+3} = p^7 r^7$$

Exponential properties #2 and #3 can be used to obtain results such as:

$$(3p^2 r^3)^3 = (3^3)(p^{2(3)})(r^{3(3)}) = 27p^6 r^9$$

To multiply a monomial and a polynomial, multiply the monomial by each term of the polynomial. In other words, distribute the monomial.

To multiply two polynomials, each term of the first polynomial must be multiplied by each term of the second polynomial. Distribute each term of the first polynomial across the second polynomial.

$$\begin{aligned} &(3x - 4)(4x - 2) \\ &(3x)(4x) + (3x)(-2) + (-4)(4x) + (-4)(-2) \\ &12x^2 - 6x - 16x + 8 \\ &12x^2 - 22x + 8 \end{aligned}$$

Example 1: Which choice below represents the following trinomial:

- $2n^2 + 7n + 6$
- |                      |
|----------------------|
| A. $(3n + 2)(n + 2)$ |
| B. $(2n + 3)(n + 2)$ |
| C. $(2n - 3)(n - 2)$ |

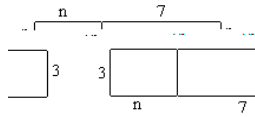
We know that when multiplying two polynomials, each term of the first polynomial must be multiplied by each term of the second polynomial. Let's look at our solutions.

A.  $(3n + 2)(n + 2) = 3n^2$  ← we can eliminate this answer

B.  $(2n + 3)(n + 2) = 2n^2 + 3n + 4n + 6 =$  \_\_\_\_\_

Answer: B

**Example 2:** Given these measurements, find the area of the rectangle.



(1)	(2)	(3)	(4)
Length = $n + 7$	$(n + 7)(n + 3)$	$(n + 7)(n + 3)$	$n^2 + 3n + 7n + 21$
Width = $n + 3$		$n^2 + 3n + 7n + 21$	$n^2 + 10n + 21$

Step 1: Area = Length x Width. Determine the length and width of the rectangle.

Step 2: Multiply the length and width to determine the area of the rectangle.

Step 3: Use FOIL to multiply the two binomials. Remember, multiply the **first** terms in each binomial, then multiply the **outer** terms, next multiply the **inner** terms, and finally multiply the **last** terms.

Step 4: The final step in solving this problem is to add the like terms.  $3n + 7n = 10n$

Answer:  $n^2 + 10n + 21$