Study Guide

Multiplication of Polynominals
02/29/2012

Polynomials: Multiplication

A <u>monomial</u> 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 <u>polynomial</u>. Here is an example of a polynomial: $y^2 + 4y + 3$.

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

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

Examples :

$\begin{Bmatrix} 2x \\ 4x \end{Bmatrix}$ like terms $\quad \begin{Bmatrix} 2x \\ -4x^2 \end{Bmatrix}$ not like terms

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

$$\boxed{\begin{array}{c} \text{Exponential Properties} \\ \text{for Multiplication} \\ (a^m)(a^n) = a^{m+n} \\ (a^m)^n = a^{(m)(n)} \\ (ab)^m = (a^m)(b^m) \end{array}}$$

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:

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

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

$$3x(x^2 + 3x - 4)$$
$$(3x)(x^2) + (3x)(3x) + (3x)(-4)$$
$$3x^3 + 9x^2 - 12x$$

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.

$$(3x - 4)(4x - 2)$$
$$(3x)(4x) + (3x)(-2) + (-4)(4x) + (-4)(-2)$$
$$12x^2 - 6x - 16x + 8$$
$$12x^2 - 22x + 8$$

Example 1: Which choice below represents the following trinomial:

$2n^2 + 7n + 6$

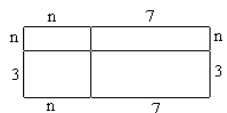| |
|---|
| A. (3n + 2) (n + 2) |
| B. (2n + 3) (n + 2) |
| C. (2n - 3)   (n - 2) |

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. $(2n+3)(n+2) = 2n^2 + 3n + 4n + 6 =$
$$2n^2 + 7n + 6$$

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 $= n+3$		$n \cdot n + n \cdot 3 + 7 \cdot n + 7 \cdot 3$	$n^2 + 10n + 21$
			$n^2 + 3n + 7n + 21$	

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: $n^2 + 10n + 21$