MA 15200 Lesson 6 Section P.4

I Polynomials

A **Monomial or Term** is a number or the product of a number and one or more variables with whole-number exponents. The number factor is called a **Coefficient** of the term. The **Degree** of the monomial (or term) is the sum of the exponents of it variables. A **Constant** has degree 0.

Ex 1: For each term, state the coefficient and the degree of the term.

a) $-14x^3y$

b) a^5

c) $\frac{\pi}{2}r^2h$

d) -5.1

A monomial or a sum of monomials is called a **Polynomial**. A polynomial with 2 terms is called a **Binomial**, and a polynomial with 3 terms is called a **Trinomial.**

Ex 2: For each polynomial, state the number of terms.

a) $4x^3 - 5x + 9x^4 - 3x^2$

b) $12x^2y - 7x^2y^2 + 8xy^2$

The **Degree of the Polynomial** is the degree of the term that has the highest degree. The **leading coefficient** of a polynomial is the coefficient of the term with the highest degree. That term is also called the **leading term**.

Ex 3: For each polynomial, state the degree, the leading coefficient, and the leading term.

a) $4x^3 - 3x^4 + 2x - 3x^2 + 3$

b) $4a - 10 + 2a^3 - 7a^2 + 5a^4$

A polynomial of one variable is written in **standard form** when the terms are written in the order of descending powers of the variable.

Ex 4: Write each polynomial is example 3 in standard form.

II Addition and Subtraction of Polynomials

Polynomials are added or subtracted by combining like terms. The answers, if possible, are usually given in standard form. (Some students find addition or subtraction easier if the polynomials are aligned vertically.)

Addition/Subtraction of Polynomials:

To add or subtract polynomials:

1. Remove parentheses using the distributive property.
2. Combine any like terms.

Ex 5: Add/Subtract these polynomials

a) $(3a^3b-7a^2b-4ab)+(5a^2b-14a^3b+8ab)=$

b) $(4x^3-4x+2x^2-6)-(2x^2-9-3x-x^3)=$

c) $4(2m^3-7m^2)+6(8m^2-m^3)-2(2m^3-3m^2)=$

d) $(4m^2n+3mn+5n^2)-(-3mn+8m^2n-n^2)+(7n^2-2mn)$

III Multiplication of Polynomials

Multiplication of Polynomials:

1. To multiply two monomials:
   Use regular 'rules of exponents'. Multiply the coefficients and multiply the variables.
2. To multiply a monomial and a polynomial (binomial or more terms):
   Use the distributive property. Multiply each term of the polynomial by the monomial.
3. To multiply two binomials:
   Use FOIL (first, outer, inner, last)
4. To multiply two general polynomials with 2 or more terms:
   Multiply each term of one polynomial by each term of the other polynomial. Then combine like terms.

***There is a good tip about the difference between addition and multiplication of monomials on page 51 of the text.**

Ex 6: Multiply and write product in simplified form.

a) $(4a^2b)\left(-\frac{1}{2}ab^4\right) =$

b) $4xy^2(3x^3 - 2x^2y + xy^2) =$

c) $(m+2)(3m-5) =$

d) $(2y + x)(5y - 2x) =$

e) $(4x+3)(x^2 - 3x + 4) =$

f) $(4a^2 - 6)(2a + 3)$

*Note: Only two polynomials (other than monomials) can be multiplied at one time. To find the following product, multiply two of the binomials, then multiply that product by the third binomial.

Ex 7: $(x-3)(x+4)(2x+1)$

Special Products:

1. Product of a Sum and Difference of two terms

$(x+y)(x-y)=x^2-y^2$ These types of binomials are called conjugates.

The Square of a Binomial

2. $(x+y)^2=x^2+2xy+y^2$

   $(1\text{st})^2+2(1\text{st})(2\text{nd})+(2\text{nd})^2$

3. $(x-y)^2=x^2-2xy+y^2$

   $(1\text{st})^2-2(1\text{st})(2\text{nd})+(2\text{nd})^2$

***See the study Tip of page 54 of the text. The mistake shown is very common with students.**

Ex 8: Find each product in simplest form.

a) $(4m+3n)^2=$

b) $(6-5w)(6+5w)=$

c) $(6-7n)^2$

d) $(6a-2b)(6a+2b)$

Ex9: The volume of a box is $V=Lwh$. Find a polynomial to represent the volume of the box below.