Algebra Section 9-2 Notes Name: _____
Multiplying and Factoring Date: _____ Block: ___

We use the **Distributive Property** to multiply a number times a sum or difference:

Ex: $5(a+3) = 5 \cdot a + 5 \cdot 3 = 5a + 15$
$(x-2)(3) = x \cdot 3 - 2 \cdot 3 = 3x - 6$

You can use the Distributive Property for multiplying powers *with the same base* when multiplying by a monomial.

Ex: $2x(3x+1) = 2x \cdot 3x + 2x \cdot 1 = 6x^2 + 2x$ (Stop because $6x^2$ and $2x$ are different degree.)

$3m(5m^2 - 4) = 3m \cdot 5m^2 + 3m \cdot (-4) = 15m^3 - 12m$ (Stop because $15m^3$ and $3m$ are unlike terms.)

Example One: Multiplying a Monomial and a Trinomial

Simplify $-3t^2(4t^4 - 7t^2 + 6)$.

$-3t^2(4t^4 - 7t^2 + 6)$
$= -3t^2 \cdot (4t^4) - 3t^2 \cdot (-7t^2) - 3t^2 \cdot (6)$
$= -12t^{2+4} + 21t^{2+2} - 18t^2$
$= -12t^6 + 21t^4 - 18t^2$

Simplify each product.

1a. $3b(8b^2 + 2b + 1)$ 1b. $-7h(4h^2 - 6h - 1)$ 1c. $2y(y^2 - 5y + 4)$

Factoring a polynomial is the *reverse* of the multiplication process.
To factor a monomial from a polynomial, first find the greatest common factor (**GCF**) of its terms.

Example Two: Finding the Greatest Common Factor (GCF)

Find the GCF of the terms of $5x^3 + 15x^2 - 10x$.

$5x^3 = 5 \cdot x \cdot x \cdot x$
$15x^2 = 3 \cdot 5 \cdot x \cdot x$ GCF is $5x$.
$10x = 2 \cdot 5 \cdot x$

Find the GCF of the terms of each polynomial.

2a. $21x^2 - 14x$ 2b. $8f^2 - 16$ 2c. $8b^3 - 4b^2 - 12b$

Factoring

To factor a polynomial *completely*, you must factor until the various monomials in the polynomial no longer have any common factors other than 1.

Example Three: Factoring Out a Monomial

Factor $6x^3 - 24x^2 + 30x$.

Step One: Find the GCF

$6x^3 = 2 \cdot 3 \cdot x \cdot x \cdot x$

$24x^2 = 2 \cdot 2 \cdot 2 \cdot 3 \cdot x \cdot x$

$30x = 2 \cdot 3 \cdot 5 \cdot x$

GCF = $2 \cdot 3 \cdot x = 6x$

Step Two: Factor out the GCF.

$6x^3 - 24x^2 + 30x$

$= 6x \cdot (x^2) + 6x \cdot (-4x) + 6x \cdot (5)$

$= 6x(x^2 - 4x + 5)$

Find the GCF and use it to factor each polynomial.

3a. $8x^2 - 12x$

3b. $5d^3 + 10d$

3c. $8m^3 - 16m^2 - 32m$

3d. $14x^3 + 7x^2 - 21$

3e. $4w^4 + 2w^3 - 6w^2$

3f. $-10h^4 - 40h^3 + 20h^2$

Homework: Pages 463-464, #4-40, every fourth problem