Math 2 **U1.3 Factoring Polynomials** (Review)

Factoring: process of "Breaking Apart" a product into its factors.

ctoring of a Polynomial: involves breaking up a polynomial into its FACTORS such that when multiplied back together, it will equal the original polynomial.

Types of Factoring:

$x^2+3x-4 \xrightarrow{\text{FACTOR}} (x+4)(x-1)$

- **"GCF":** this is used when you can ONLY factor out a monomial

  1.) Find the "largest" GCF that will go into all the coefficients (#'s attached to variables and constant (#'s without variables). Find the largest exponent all powers have in common.

  $x^2, x^5 \rightarrow x^2$

  $y^3, y, y^6 \rightarrow y$

  THIS IS THE GCF OF THE POLYNOMIAL.

  2.) Place the GCF in front of a set of ( ) and "factor it out of the original Ex: $8a^3b^2-40a^4b$

  GCF: $8a^3b \rightarrow 8a^3b(b-5a)$

- **Factor by Grouping:** used when the polynomial has 4 terms: $x^3+3x^2+4x+12$

  1.) "Group" the first 2 terms and the group last 2 terms (including any signs of its terms) by putting parentheses ( ) around each group.

  2.) Factor out the GCF of each "group".

  3.) The "leftovers" in the groups should be EXACTLY the SAME.

  4.) Your final answer (factored polynomial) will be the GCFs combined times the left overs.

- **Trinomials:** are 3-term polynomials generally in the form $ax^2 \pm bx \pm c$

  There several different ways to factor this type of polynomial: "Guess and check", "Reverse Box method", "Slide-Divide-Bottoms up", and "t-chart".

  1.) Make sure the trinomial is in STANDARD FORM.

  2.) Before factoring this type, Always check for a GCF and factor it out first! This will be in your final answer so do not forget it!

- **Special Cases:** Perfect Squares $a^2+6a+9 \rightarrow (a+3)^2$ | Difference of Squares $a^2-16 \rightarrow (a+4)(a-4)$

  Can be factored like trinomials and there are "short cuts" for both types.

x^2+81

No such creature as "Sum of Squares! Cannot be factored.

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❖ Sometimes polynomials cannot be factored. These types of polynomials are PRIME because the polynomial has only two factors; one and itself.

Ex 1: Factor out a GCF

a) $-6b^4 - 12b^2$

GCF: $-6b^2$

$-6b^2(b^2+2)$

b) $-7n^6m + 2n^6 + 3n^5$

GCF: n^5

$n^5(-7nm+2n+3)$

c) $72y^5z^2x^2 - 80y^2zx^3 + 16y^3z^2$

GCF: $8y^2z$

$8y^2z(9y^3zx^2 - 10x^3 + 2yz)$

Ex. 2: Factor by Grouping

a) $(2m^3 + 6m^2 + 3m + 9)$

$2m^2(m+3) + 3(m+3)$ must be the SAME!

$(2m^2+3)(m+3)$

b) $(5x^4 - 20x^3 + 6x - 24)$

$5x^3(x-4) + 6(x-4)$

$(5x^3+6)(x-4)$

c) $(24a^2 - 15a + 40a - 25)$

$3a(8a-5) + 5(8a-5)$

$(3a+5)(8a-5)$

d) $(27b^2 + 45b - 3b - 5)$

$9b(3b+5) - 1(3b+5)$

$(9b-1)(3b+5)$

e) $12x^3 + 10x^2 - 36x - 30$

*Always look for a GCF that goes into all first! *

$2[6x^3+5x^2-18x-15]$

$(6x^3+5x^2-18x-15)$

$x^2(6x+5) - 3(6x+5)$

$2(x^2-3)(6x+5)$

f) $45m^4 - 9m^3 + 30m^2 - 6m$

$3m[15m^3 - 3m^2 + 10m - 2]$

$(15m^3 - 3m^2 + 10m - 2)$

$3m^2(5m-1) + 2(5m-1)$

$3m(3m^2+2)(5m-1)$

TAKE OUT A SEPARATE SHEET OF PAPER TO WORK OUT THE FOLLOWING EXAMPLES

Ex. 3: Factor each trinomial or binomial completely

a) $b^2 + b - 156$	b) $2n^2 - 7n - 9$	c) $3x^2 - 8x - 60$
d) $16k^2 - 108k + 72$	e) $12p^2 + 51p - 126$	f) $96p^2 - 54$
g) $x^2 - 8x + 16$	h) $9m^2 - 24m + 16$	i) $9x^2 - 25y^2$