P5.1

Factoring Review (Cont'd)

Factoring by Grouping

Example: Factor.

$$3x^3 - 7x^2 + 15x - 35$$

$$= (3x^3 - 7x^2) + (15x - 35)$$

$$= x^2(3x - 7) + 5(3x - 7)$$

$$= \boxed{(3x - 7)(x^2 + 5)}$$

Note: $x^2y + 5y$

$$= y(x^2 + 5)$$

Note: $x^2 + 9$ is prime (does not factor)

Ex: Factor.

$$4x^3 - 3x^2 - 36x + 27$$

$$= (4x^3 - 3x^2) + (-36x + 27)$$

$$= x^2(4x - 3) - 9(4x - 3)$$

$$= (4x - 3)(x^2 - 9)$$

$$= \boxed{(4x - 3)(x + 3)(x - 3)}$$

Try: $(x+3)(x-3)$

$= x^2 - 3x + 3x - 9$

$= x^2 - 9$ No!

Try $(x+3)(x+3)$

$x^2 + 3x + 3x + 9$

$= x^2 + 6x + 9$ No!

P5.2

Factoring the Sum and Difference of 2 Cubes

Examples: $x^3 + 8$ Factor.

$= x^3 + 2^3$

$= (x+2)(x^2 - 2x + 2^2) = \boxed{(x+2)(x^2-2x+4)}$

Difference and Sum of Cubes Factorization

$a^3 + b^3 = (a+b)(a^2 - ab + b^2)$

$a^3 - b^3 = (a-b)(a^2 + ab + b^2)$

Check: $(a+b)(a^2 - ab + b^2)$

$= a(a^2 - ab + b^2) + b(a^2 - ab + b^2)$

$= a^3 - a^2b + ab^2 + ba^2 - ab^2 + b^3$

$= a^3 + b^3$ ✓

Ex: Factor. $8x^3 - 125$

$= (2x)^3 - (5)^3$

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

$= \boxed{(2x-5)(4x^2 + 10x + 25)}$

$4x^2 + 10x + 25$ and $x^2 + 9$ are irreducible quadratics (they do not factor using real number coefficients)

Perfect Cubes

$2^3 = 8$

$3^3 = 27$

$4^3 = 64$

$5^3 = 126$

$6^3 = 216$