2.3 Factoring Polynomials

1. GCF — Always
2. Grouping — 4 terms
3. Trinomial (shortcut) — $\underline{1}x^2$
4. Decomposition — trinomial — $\underline{?}x^2$
5. Differences of Squares — two terms being subtracted
6. Perfect Squares

GCF:

$5x^2 - 10x$

$= 5x(x-2)$

$18x^3y^2 - 2x^6y^4 + 8x^4y^5$

$= 2x^3y^2(9 - x^3y^2 + 4xy^3)$

Grouping:

$$\underbrace{4x^3 + 3x^2}_{x^2} + \underbrace{8xy + 6y}_{2y}$$

$$= x^2(4x+3) + 2y(4x+3)$$

$$= (4x+3)(x^2+2y)$$

$$x^2z + 2yz = z(x^2+2y)$$

Trinomial with $a=1$

$x^2+8x+15$ (×) 15, (+) 8

3, 5

$=(x+3)(x+5)$

$x^2-11x-26$ (×) −26, (+) −11

2, −13

$=(x+2)(x-13)$

Trinomial with $a = 1$

$$3x^3 - 27x^2 + 60x$$

$$= 3x(1x^2 - 9x + 20)$$

$\times$ 20

$+$ -9

$-4, -5$

$$= 3x(x - 4)(x - 5)$$

Trinomial with $a \neq 1$ (Decomposition)

$2x^2 + x - 15$

2×-15

$\times \quad -30$

$+ \quad 1$

$-5, +6$

$= 2x^2 + 6x - 5x - 15$

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

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

$$12x^2 + 29x + 14$$

$\times$ 168

$+$ 29

1, 168

2, 84

3, 56

⋮

8, 21

$$= 12x^2 + 8x + 21x + 14$$

$$= (4x + 7)(3x + 2)$$

Difference of Squares

$x^2 - 9$

$= (x-3)(x+3)$

$4x^2 - 49$

$= (2x-7)(2x+7)$

$3x^2 - 75$

$= 3(x^2 - 25)$

$= 3(x+5)(x-5)$

Perfect Squares

$x^2 + 8x + 16$

$\times 16$

$+ 8$

$4, 4$

$= (x + 4)^2$

$16x^2 - 40x + 25$

$= (4x - 5)^2$