

Polynomial Factoring

First Step: Common Factor

$$\text{Example: } x^3 - x^2 - 6x = x(x^2 - x - 6) = x(x-3)(x+2)$$

Polynomials with 2 Terms

- **Difference of Squares**

$$\begin{aligned} \text{Example: } x^2 - 4 &= (x)^2 - (2)^2 = (x+2)(x-2) \\ x^4 - 16 &= (x^2)^2 - (4)^2 = (x^2+4)(x^2-4) \end{aligned}$$

- **Difference of Cubes**

$$\text{Example: } x^3 - 8 = (x)^3 - (2)^3 = (x-2)(x^2 + 2x + 4)$$

- **Sum of Cubes**

$$\text{Example: } 8x^3 + 27 = (2x)^3 + (3)^3 = (2x+3)(4x^2 - 6x + 9)$$

Polynomials with 3 Terms

- **Quadratic**

$$\text{Example: } x^2 - 2x - 3 = (x-3)(x+1)$$

$$\text{Example: } x^4 - 2x^2 - 3 = (x^2)^2 - 2(x^2) - 3 = (x^2 - 3)(x^2 + 1)$$

Polynomials with 4 Terms

- **Grouping**

$$\begin{aligned} \text{Example: } 4x^3 + 6x^2 - 2x - 3 &= (4x^3 + 6x^2) + (-2x - 3) \\ &= 2x^2(2x + 3) - (2x + 3) \\ &= (2x^2 - 1)(2x + 3) \end{aligned}$$