Special Factoring Rules

Difference of Two Squares

Quadratics of the form $\boldsymbol{a^2 - b^2}$ are called a difference of two squares and can be factored using the formula:

$$\boldsymbol{a^2 - b^2 = (a + b)(a - b)}$$

Example 1:

Factor each quadratic completely.

a.) $\boldsymbol{x^2 - 9}$

b.) $\boldsymbol{x^2 - 16}$

c.) $\boldsymbol{2x^2 - 8}$

Since both terms divide evenly by $\mathbf{2}$, we factor out the $\mathbf{2}$:

$$2x^2 - 8 = \mathbf{2}(\boldsymbol{x^2 - 4})$$

The resulting quadratic is a difference of two squares, therefore we can factor further:

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

NOTE: a **sum** of two squares **CANNOT** be factored! It is considered to be **PRIME**.

Sum and Difference of Two Cubes:

The sum of two cubes is a polynomial of the form $\boldsymbol{a^3 + b^3}$ and can be factored using the formula:

$$\boldsymbol{a^3 + b^3 = (a + b)(a^2 - ab + b^2)}$$

The difference of two cubes is a polynomial of the form $\boldsymbol{a^3 - b^3}$ and can be factored using the formula:

$$\boldsymbol{a^3 - b^3 = (a - b)(a^2 + ab + b^2)}$$

Example 2:

Factor each polynomial.

a.) $\boldsymbol{x^3 - 8}$

$=$

b.) $\boldsymbol{x^3 + 1}$

$=$

c.) $\boldsymbol{3x^3 - 81}$

$=$

Since both terms divide evenly by $\mathbf{3}$, we factor out the $\mathbf{3}$ first:

$\boldsymbol{3x^3 - 81 = 3(\quad) = 3(\quad)(\quad)}$