

## FACTORIZING THE SUM OR DIFFERENCE OF CUBES

Up to this point we should have a good foundation in factoring polynomials using the formulas:

### Difference of Squares

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

### Perfect Square Trinomials

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

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

### Now...**The Sum/Difference of Cubes**

**Binomial**

**Trinomial**

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

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

There are two very common mistakes most often made when factoring the sum or difference of cubes. Those mistakes deal with the signs and with the trinomial.

#### Mistake

#### How to avoid the mistake

Signs

For the signs, use the acronym S.O.A.P. when writing the signs.

**S.O.A.P. (Same Opposite Always Positive)**

The middle of the Trinomial

$$a^2 + ab + b^2$$

The middle of the trinomial looks very similar to a perfect square trinomial. When writing it out, say to yourself **“Square the first term, multiply them together, square the last term.”** Say this every time you write out the trinomial and you will never include the 2 thus avoiding the mistake.

Here is that last part again. To keep from making an error with the trinomial...

Say to Yourself

Square the first term,

Multiply them together,

Square the last term.

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

Sample Problem

$$27x^3 + 125y^6$$

$$(3x)^3 + (5y^2)^3$$

$$( \quad ) ( \quad )$$

$$( \quad + \quad ) ( \quad - \quad + \quad )$$

$$(3x + 5y^2)(9x^2 - 15xy^2 + 25y^4)$$

Procedure

Look at this as something to the third power.

$$( \quad )^3 + ( \quad )^3$$

Set up a binomial and trinomial (parentheses).

$$( \quad ) ( \quad )$$

Fill in signs using S.O.A.P.

$$( \quad + \quad ) ( \quad - \quad + \quad )$$

Fill in the values for the binomial and Trinomial.

Examples

1)  $8x^3 - 27$

2)  $216a^6b^3 + 125c^3$

3)  $64x^3y^6 - 27$

$$4) x^3 + y^6 z^9$$

$$5) 54x^{3n} y^3 - 16z^{12}$$

$$6) x^6 - 1$$

$$7) x^6 - 1$$