SKILL #20

CODE: PCT.1

Sum and difference of cubes

Core Concept

Some expressions involving cubes can be factored using special patterns $(a^3 - b^3)$ and $(a^3 + b^3)$. These patterns help you break down a binomial that looks complicated into simpler polynomial factors. You'll be able to identify and factor sum and difference of cubes quickly once you recognize the form!

When to use it?

Use these formulas when:

- Both terms are perfect cubes (like $x^3, 8, 27y^3$ etc.)
- The expression has exactly two terms, joined by a $+$ (sum) or $-$ (difference)

GULDEN RULE

Remember the Formulas!

1- Sum of cubes:

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

2- Difference of Cubes:

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

Examples

MORE EXAMPLES

Example 1: Factor $x^3 - 8$

STEP 1: Check the form: Two terms, x^3 and 8 ✅

STEP 2: Identify perfect cubes:

x^3 and $8 = 2^3$ ✅

STEP 3: Find $\boldsymbol{a}$ and $\boldsymbol{b}$: $a = x, b = 2$ ✅

STEP 4: Apply the formula: $(a^3 - b^3) = (a - b)(a^2 + ab + b^2)$

STEP 5: Write Factored Form: $(x - 2)(x^2 + 2x + 4)$ ✅

Example 2: Factor $27x^3 + 64$

STEP 1: Check the form: Two terms, $27x^3$ and 64 ✅

STEP 2: Identify perfect cubes:

$27x^3 = (3x)^3$ and $64 = 4^3$ ✅

STEP 3: Find $\boldsymbol{a}$ and $\boldsymbol{b}$: $a = 3x, b = 4$ ✅

STEP 4: Apply the formula: $(a^3 + b^3) = (a + b)(a^2 - ab + b^2)$

STEP 5: Write Factored Form: $(3x + 4)(9x^2 - 12x + 16)$ ✅

Common Mistakes to Avoid

❌ Confusing sum and difference formulas

❌ Missing perfect cubes

❌ Trying to factor a sum of squares as a sum of cubes.

Quick Tips

- Memorize perfect cubes: 1, 8, 27, 64, 125, etc.
- Check the operation (sum or difference)

Additional Resources

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