SKILL #26

CODE: PN.3

Multiplying Polynomials

Core Concept

When you multiply expressions, you're combining terms using the distributive property and exponent rules. You'll often apply these three main ideas:

- Multiply coefficients (the numbers).
- Apply laws of exponents (add powers of like bases). --> SKILL #27
- Use distribution to expand expressions.

Why It Matters

These skills help you solve equations, factor expressions, and understand patterns in math, science, and engineering.

GULDEN RULE

- Multiply coefficients (numbers) and add exponents for like variables
- Use the distributive property: $a(b + c) = ab + ac$
- Combine like terms at the end
- Recognize and use special product patterns 👉🏻

Special Products:

Difference of Squares:

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

Perfect Square Trinomial:

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

Examples

Example 1: Multiplying Monomials

$$3x^2 \times 4x^3$$

STEP 1: Multiply coefficients --> $3 \times 4 = 12$

STEP 2: Apply lows of exponents to multiply x^2 *and* x^3:

$$x^2 \cdot x^3 = x^{2+3} \rightarrow x^5$$

STEP 3: Combine --> $12x^5$ ✅

Example 2: Multiplying a Monomial by a Polynomial

$$2x \cdot (x^2 + 3x + 4)$$

Use the distributive property:

$$2x \cdot x^2 + 2x \cdot 3x + 2x \cdot 4 \rightarrow 2x^3 + 6x^2 + 8x$$

Example 3: Special Product—Difference of Squares

$$(x + 7)(x - 7)$$

Use the special product rule: --> $(x + 7)(x - 7) = x^2 - 49$ ✅

Example 4: Multiplying Two Binomials (FOIL)

$$(x + 2)(x + 5)$$

First --> $x \cdot x = x^2$, Outer --> $x \cdot 5 = 5x$

Inner --> $2 \cdot x = 2x$, Last --> $2 \cdot 5 = 10$

Combine: $x^2 + 5x + 2x + 10$ --> $x^2 + 7x + 10$

Common Mistakes to Avoid

❌ Forgetting to multiply every term in one polynomial by every term in the other

❌ Not combining like terms after multiplying

❌ Mixing up signs (positive/negative)

❌ Forgetting special product patterns

Additional Resources

https://sanwaralkmali.github.io/

SKILL #27

CODE: EP.1

Laws of Exponents

Core Concept

An exponent tells you how many times to multiply a base number by itself.

The laws of exponents are rules that help you simplify expressions with exponents.

Example: $2^4 = 2 \times 2 \times 2 \times 2 = 16$ --> $2^4 = 16$

Why It Matters

- Simplify complex algebraic expressions quickly
- Work with scientific notation
- Prepare for logarithms and advanced mathematics
- Solve equations involving powers efficiently

Key Laws of Exponents

1. Product Rule: $a^m \times a^n = a^{m+n}$
2. Quotient Rule: $a^m \div a^n = a^{m-n}$
3. Power Rule: $(a^m)^n = a^{m \cdot n}$
4. Zero Exponent: $a^0 = 1\ (a \neq 0)$
5. Negative Exponent: $a^{-n} = \frac{1}{a^n}$
6. Distribute Powers: $(ab)^n = a^n \cdot b^n$, $\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}$

Examples

Example 1: $x^3 \cdot x^5$ --> $x^{3+5} = x^8$ ✅

Example 2: $\frac{x^3}{x^5}$ --> $x^{3-5} = x^{-2}$ ✅

Example 3: $(x^2)^3$ --> $x^{2 \cdot 3} = x^6$ ✅

Example 4: $(9x)^0$ --> 1 ✅

Example 5: x^{-3} --> $\frac{1}{x^3}$ ✅

Example 6: $(3x)^3$ --> $3^3 \cdot x^3 = 27x^3$ ✅

Extra Practice

Simplify: $(3x^2y)^3 \times (x^{-3}y^{-2})$

STEP 1: Use the Distribute Powers RULE

$(3x^2y)^3 \rightarrow 3^3(x^2)^3(y^3)$ --> $27x^6y^3$

STEP 2: Multiply and add exponents

$$27(x^6 \cdot x^{-3})(y^3 \cdot y^{-2})$$
$$= 27x^3y$$

⚠ Common Mistakes to Avoid

❌ Thinking $2^4 = 2 \times 4$ (Nope! It's $2 \times 2 \times 2 \times 2$)

❌ Forgetting that a zero exponent means 1

❌ Adding exponents when multiplying different bases (Only works with the same base!)

Exponents are a shortcut for repeated multiplication.

The laws of exponents make it easy to work with big numbers and simplify expressions in algebra.

Additional Resources

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