

## 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 laws 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 3: Special Product—Difference of Squares

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

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

### 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 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:  $x^2 + 5x + 2x + 10 \rightarrow x^2 + 7x + 10$

## ⚠ 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:  $2^4 = 2 \times 2 \times 2 \times 2 = 16 \rightarrow 2^4 = 16$

### 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: | $x^3 \cdot x^5 \rightarrow x^{3+5} = x^8$      | <input checked="" type="checkbox"/> |
| Example 2: | $\frac{x^3}{x^5} \rightarrow x^{3-5} = x^{-2}$ | <input checked="" type="checkbox"/> |
| Example 3: | $(x^2)^3 \rightarrow x^{2 \cdot 3} = x^6$      | <input checked="" type="checkbox"/> |
| Example 4: | $(9x)^0 \rightarrow 1$                         | <input checked="" type="checkbox"/> |
| Example 5: | $x^{-3} \rightarrow \frac{1}{x^3}$             | <input checked="" type="checkbox"/> |
| Example 6: | $(3x)^3 \rightarrow 3^3 \cdot x^3 = 27x^3$     | <input checked="" type="checkbox"/> |

### Extra Practice

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

STEP 1: Use the Distribute Powers RULE

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

STEP 2: Multiply and add exponents

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

### 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

