Simplifying Algebraic Expressions Using Exponent Rules

We can use the **Exponent Rules** to simplify algebraic expressions efficiently.

Exponents represent **repeated multiplication** of a base. When expressions involve the same base with exponents, specific rules can be applied to simplify them.

We will start with the seven most commonly used rules.

Exponent Rules

Name	Rule	Example	Description
Product Rule	$a^m \cdot a^n = a^{m+n}$	$3^2 \cdot 3^3 = a^{2+3}$	Multiply expressions with the same base by adding the exponents
Quotient Rule	$\frac{a^m}{a^n} = a^{m-n}$	$\frac{5^5}{5^3} = 5^{5-3}$	Divide expressions with the same base by subtracting the exponents
Power of a Power Rule	$(a^m)^n = a^{m \cdot n}$	$(3^2)^3 = 3^{2 \cdot 3}$	Raise a power to another power by multiplying the exponents
Power of a Product Rule	$(a \cdot b)^m = a^m \cdot b^m$	$(-3 \cdot 4)^2 = (-3)^2 \cdot 4^2$	Distribute the exponent to each factor inside the parentheses
Power of a Quotient Rule	$\left(\frac{a}{b}\right)^m = \left(\frac{a^m}{b^m}\right)$	$\left(\frac{2}{3}\right)^4 = \left(\frac{2^4}{3^4}\right)$	Apply the exponent to both the numerator and denominator
Negative Exponent Rule	$a^{-n} = \frac{1}{a^n}$	$3^{-2} = \frac{1}{3^2}$	Take the reciprocal and change the sign to positive
Zero Exponent Rule	$a^0 = 1,\ when\ a \neq 0$	$-3^0 = 1$	Any non-zero base raised to the 0 power equals 1

Remember:

- Always check that the bases are the same before applying exponent rules.
- Show all steps when simplifying to avoid mistakes with signs or operations.
- Any non-zero number raised to the power of zero equals 1!

*You may see these rules referenced as **Exponent Laws***