7.1: Multiplying and Dividing Monomials

Lesson Goals

- Explore the exponent rule for multiplying monomials.
- Explore the exponent rule for dividing monomials.

Recall that a power has a base and an exponent.

- When no exponent is present, then it is implied that the exponent is 1.

- To expand a power, we use repeated multiplication. In other words, we multiply the base by itself the number of times specified by the exponent.

- To write the expanded form in exponential form, or as a simplified power, we raise the base to the number of times it is multiplied by itself.

QUESTION: What are some different ways to express the product of powers?

Expression	Expanded Form
$3^4 \times 3^2$	$3 \times 3 \times 3 \times 3 \times 3 \times 3 = 3^6$
$j^2 \times j^6 \times j^3 \times j$	$j \times j \times j \times j \times j \times j \times j \times j \times j \times j \times j \times j = j^{12}$
$a^2 b^3 \times a^3 b^4$	$a \times a \times b \times b \times b \times a \times a \times a \times b \times b \times b \times b = a^5 \times b^7$

Important Fact

The **exponent product rule** states that when multiplying powers that have the same base, you may add their exponents to simplify the expression as a single power.

$$x^a x^b = x^{a+b}$$

Example 1

Simplify $2 \times n \times 3 \times n^4$.

$= 2 \times 3 \times n^1 \times n^4$

$6n^5$

Exponent Product Rule with Coefficients

When multiplying monomials in the same variable, multiply the coefficients and use the exponent product rule to simplify the powers.

Example 2

Simplify $(7y^8)(4y^2)$.

$7 \times y^8 \times 4 \times y^2$

$= 7 \times 4 \times y^8 \times y^2$

$= 28y^{8+2}$

$= 28y^{10}$

Example 3

Simplify $(-10x^2)(2x^4)$.

$= (-10)(2)\, x^2 \cdot x^4$

$= -20x^{2+4}$

$= -20x^6$

Dividing Monomials

QUESTION: What are some different ways to express the quotient of powers?

Expression	Expanded Form
$4^3 \div 4^2$	
$7^6 \div 7^4$	$\dfrac{7 \times 7 \times 7 \times 7 \times 7 \times 7}{7 \times 7 \times 7 \times 7} = 7 \times 7 = 7^2$
$15a^8b^3 \div 5a^7b$	$\dfrac{15 \, a \cdot a \cdot a \cdot a \cdot a \cdot a \cdot a \cdot a \cdot b \cdot b \cdot b}{5 \, a \cdot a \cdot a \cdot a \cdot a \cdot a \cdot a \cdot b}$ $= 3ab^2$

Important Fact

The **exponent quotient rule** states that when dividing powers that have the same base, you subtract their exponents to simplify the expression as a single power. (Note that the value of the base can never be equal to zero.)

$$\frac{x^a}{x^b} = x^{a-b}, x \neq 0$$

$$x - 2$$
$$-2 + x$$

Exponent Quotient Rule with Coefficients

When dividing monomials in the same variable, divide the coefficients and use the exponent quotient rule to simplify the powers.

Example 4

Simplify $4n^5 \div 2n^2$.

$$2n^3$$

Example 5

Simplify $\frac{5y^8}{10y^3}$.

$$\frac{1}{2}y^5$$

Example 6

Simplify $\left(\frac{-20x^4}{4x}\right)$.

$$= \quad \frac{-20}{4} \cdot \frac{x^4}{x^1} \quad = \quad -5x^{4-1}$$
$$= -5x^3$$

Homework:

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