

7-1 Study Guide

Multiplication Properties of Exponents

Multiply Monomials A **monomial** is a number, a variable, or the product of a number and one or more variables with nonnegative integer exponents. An expression of the form x^n is called a **power** and represents the product you obtain when x is used as a factor n times. To multiply two powers that have the same base, add the exponents.

Product of Powers	For any number a and all integers m and n , $a^m \cdot a^n = a^{m+n}$.
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Example 1: Simplify $(3x^6)(5x^2)$.

$$\begin{aligned} (3x^6)(5x^2) &= (3)(5)(x^6 \cdot x^2) && \text{Group the coefficients} \\ & && \text{and the variables} \\ &= (3 \cdot 5)(x^{6+2}) && \text{Product of Powers} \\ &= 15x^8 && \text{Simplify.} \end{aligned}$$

The product is $15x^8$.

Example 2: Simplify $(-4a^3b)(3a^2b^5)$.

$$\begin{aligned} (-4a^3b)(3a^2b^5) &= (-4)(3)(a^3 \cdot a^2)(b \cdot b^5) \\ &= -12(a^{3+2})(b^{1+5}) \\ &= -12a^5b^6 \end{aligned}$$

The product is $-12a^5b^6$.

Exercises (Set A)

Simplify each expression.

1. $y(y^5)$

2. $n^2 \cdot n^7$

3. $(-7x^2)(x^4)$

4. $x(x^2)(x^4)$

5. $m \cdot m^5$

6. $(-x^3)(-x^4)$

7. $(2a^2)(8a)$

8. $(rn)(rn^3)(n^2)$

9. $(x^2y)(4xy^3)$

10. $\frac{1}{3}(2a^3b)(6b^3)$

11. $(-4x^3)(-5x^7)$

12. $(-3j^2k^4)(2jk^6)$

13. $(5a^2bc^3)(\frac{1}{5}abc^4)$

14. $(-5xy)(4x^2)(y^4)$

15. $(10x^3yz^2)(-2xy^5z)$

7-1 Study Guide (continued)

Multiplication Properties of Exponents

Simplify Expressions An expression of the form $(x^m)^n$ is called a **power of a power** and represents the product you obtain when x^m is used as a factor n times. To find the power of a power, multiply exponents.

Power of a Power	For any number a and any integers m and p , $(a^m)^p = a^{mp}$.
Power of a Product	For any numbers a and b and any integer m , $(ab)^m = a^m b^m$.

We can combine and use these properties to simplify expressions involving monomials.

Example: Simplify $(-2ab^2)^3(a^2)^4$.

$$\begin{aligned}
 (-2ab^2)^3 (a^2)^4 &= (-2ab^2)^3 (a^8) && \text{Power of a Power} \\
 &= (-2)^3 (a^3) (b^2)^3 (a^8) && \text{Power of a Product} \\
 &= (-2)^3 (a^3)(a^8) (b^2)^3 && \text{Group the coefficients and the variables} \\
 &= (-2)^3 (a^{11}) (b^2)^3 && \text{Power of a Product} \\
 &= -8a^{11}b^6 && \text{Power of a Power}
 \end{aligned}$$

The product is $-8a^{11}b^6$.

Exercises (Set B)

Simplify each expression.

1. $(y^5)^2$
2. $(n^7)^4$
3. $(x^2)^5(x^3)$
4. $-3(ab^4)^3$
5. $(-3ab^4)^3$
6. $(4x^2b)^3$
7. $(4a^2)^2(b^3)$
8. $(4x)^2(b^3)$
9. $(x^2y^4)^5$
10. $(2a^3b^2)(b^3)^2$
11. $(-4xy)^3(-2x^2)^3$
12. $(-3j^2k^3)^2(2j^2k)^3$
13. $(25a^2b)^3\left(\frac{1}{5}abf\right)^2$
14. $(2xy)^2(-3x^2)(4y^4)$
15. $(2x^3y^2z^2)^3(x^2z)^4$
16. $(-2n^6y^5)(-6n^3y^2)(ny)^3$
17. $(-3a^3n^4)(-3a^3n)^4$
18. $-3(2x)^4(4x^5y)^2$