7-1 Study Guide and Intervention

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, $a^m \cdot a^n = a^{m+n}$.

Example 1 **Simplify $(3x^6)(5x^2)$.**

$(3x^6)(5x^2) = (3)(5)(x^6 \cdot x^2)$ Group the coefficients and the variables

$= (3 \cdot 5)(x^{6+2})$ Product of Powers

$= 15x^8$ Simplify.

The product is $15x^8$.

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

$(-4a^3b)(3a^2b^5) = (-4)(3)(a^3 \cdot a^2)(b \cdot b^5)$

$= -12(a^{3+2})(b^{1+5})$

$= -12a^5b^6$

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

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Exercises

Simplify each expression.

1. $y(y^5)$ **y^6**

2. $n^2 \cdot n^7$ **n^9**

3. $(-7x^2)(x^4)$ **$-7x^6$**

4. $x(x^2)(x^4)$ **x^7**

5. $m \cdot m^5$ **m^6**

6. $(-x^3)(-x^4)$ **x^7**

7. $(2a^2)(8a)$ **$16a^3$**

8. $(rn)(rn^3)(n^2)$ **r^2n^6**

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

10. $\frac{1}{3}(2a^3b)(6b^3)$ **$4a^3b^4$**

11. $(-4x^3)(-5x^7)$ **$20x^{10}$**

12. $(-3j^2k^4)(2jk^6)$ **$-6j^3k^{10}$**

13. $(5a^2bc^3)\left(\frac{1}{5}abc^4\right)$ **$a^3b^2c^7$**

14. $(-5xy)(4x^2)(y^4)$ **$-20x^3y^5$**

15. $(10x^3yz^2)(-2xy^5z)$ **$-20x^4y^6z^3$**

7-1 Study Guide and Intervention *(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 $(-2ab^2)^3(a^2)^4$.**

$(-2ab^2)^3(a^2)^4 = (-2ab^2)^3(a^8)$ Power of a Power

$= (-2)^3(a^3)(b^2)^3(a^8)$ Power of a Product

$= (-2)^3(a^3)(a^8)(b^2)^3$ Group the coefficients and the variables

$= (-2)^3(a^{11})(b^2)^3$ Product of Powers

$= -8a^{11}b^6$ Power of a Power

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

Exercises

Simplify each expression.

1. $(y^5)^2$
y^{10}

2. $(n^7)^4$
n^{28}

3. $(x^2)^5(x^3)$
x^{13}

4. $-3(ab^4)^3$
$-3a^3b^{12}$

5. $(-3ab^4)^3$
$-27a^3b^{12}$

6. $(4x^2b)^3$
$64x^6b^3$

7. $(4a^2)^2(b^3)$
$16a^4b^3$

8. $(4x)^2(b^3)$
$16x^2b^3$

9. $(x^2y^4)^5$
$x^{10}y^{20}$

10. $(2a^3b^2)(b^3)^2$
$2a^3b^8$

11. $(-4xy)^3(-2x^2)^3$
$512x^9y^3$

12. $(-3j^2k^3)^2(2j^2k)^3$
$72j^{10}k^9$

13. $(25a^2b)^3\left(\frac{1}{5}abf\right)^2$
$625a^8b^5f^2$

14. $(2xy)^2(-3x^2)(4y^4)$
$-48x^4y^6$

15. $(2x^3y^2z^2)^3(x^2z)^4$
$8x^{17}y^6z^{10}$

16. $(-2n^6y^5)(-6n^3y^2)(ny)^3$
$12n^{12}y^{10}$

17. $(-3a^3n^4)(-3a^3n)^4$
$-243a^{15}n^8$

18. $-3(2x)^4(4x^5y)^2$
$-768x^{14}y^2$