

ALG 1 - Unit 7 - Multiplication Properties of Exponents

Target: I can simplify expressions using exponent rules

Activity:

You can use what you learned in the previous lesson to find a shortcut for simplifying expressions with powers. Simplify the following... When you are finished simplifying, determine what pattern you see in your answers to the problems.

$$1. (3^6)^2 = 3^6 \cdot 3^6 = 3^{6+6} = \boxed{3^{12}}$$

$$2. (5^4)^3 = 5^4 \cdot 5^4 \cdot 5^4 = 5^{4+4+4} = \boxed{5^{12}}$$

$$3. (2^7)^4 = 2^7 \cdot 2^7 \cdot 2^7 \cdot 2^7 = 2^{7+7+7+7} = \boxed{2^{28}}$$

$$4. (a^3)^2 = a^3 \cdot a^3 = a^{3+3} = \boxed{a^6}$$

When you raise a power to a power, you multiply the exponents!

Property

Raising a Power to a Power

For every nonzero number a and integers m and n , $(a^m)^n = a^{mn}$.

Property

Raising a Product to a Power

For every nonzero number a and b and integer n , $(ab)^n = a^n b^n$.

Examples:

$$a) (x^5)^3 = \boxed{x^{15}}$$

$$b) (x^4)^{-2} = x^{-8} = \boxed{\frac{1}{x^8}}$$

$$c) (a^5)^3 = \boxed{a^{15}}$$

$$d) (3m)^2 = 3^2 m^2 = \boxed{9m^2}$$

$$e) (-2x^2)^2 = (-2)^2 x^{-4} = 4x^{-4} = \boxed{\frac{4}{x^4}}$$

$$f) (5x^3)^2 = 5^2 x^6 = \boxed{25x^6}$$

Review of all rules:

$$g) (a^3 b^5)^{-2} (a^{-3} b^{-5})^{-4}$$

$$= a^{-6} b^{-10} \cdot a^{12} b^{20} = \boxed{a^6 b^{10}}$$

$$e) (2bc^4)^3 (2b)^3$$

$$= 8b^3 c^{12} \cdot 8b^3 = \boxed{64b^6 c^{12}}$$

$$f) (3a^3 w^4)(3a^{-4} w^4)$$

$$= 3a^3 w^4 \cdot 81a^{-16} w^4 = 243 a^{-13} w^8 = \boxed{\frac{243 w^8}{a^{13}}}$$

Level 1:

1) $(a^2)^2 = \boxed{a^4}$

2) $(2x^3)^{-1} = 2^{-1}x^{-3} = \boxed{\frac{1}{2x^3}}$

3) $(3^2a^3)^3 = 3^6a^9 = \boxed{729a^9}$

Level 2:

4) $(2x^3y)(x^2) = \boxed{2x^5y}$

5) $(-5x^{-1}y)^3(y^3) = (-5)^3x^{-3}y^3 \cdot y^3 = \boxed{\frac{y^6}{-125x^3}}$

6) $(3x^3y^5)(2x^{-4}y^3)^3 = 3x^3y^5 \cdot 8x^{-12}y^9 = 24x^{-9}y^{14} = \boxed{\frac{24y^{14}}{x^9}}$

Error Analysis:

Error Analysis One student simplified $x^5 + x^5$ to x^{10} . A second student simplified $x^5 + x^5$ to $2x^5$. Which student is correct? Explain.

Correct

$1x^5 + 1x^5 = 2x^5$. When you are adding like terms, you add the coefficients (the # in front of the variable).
Now, $x^5 \cdot x^5 = x^{10}$. When you multiply powers with the same base, you add the exponents.

Complete each equation:

$(x^2)^3 = x^6$

$(y^{-4})^3 = y^{12}$

$(5x^{-2})^2 = 25x^{-4}$

$(n^9)^0 = 1$

$(3x^3y^0)^3 = 27x^9$

$(m^2n^3)^{-3} = \frac{1}{m^6n^9}$

HOMEWORK

Simplify each expression.

9. $(5y)^4 = \boxed{625y^4}$

10. $(4m)^5 = \boxed{1024m^5}$

11. $(7a)^2 = \boxed{49a^2}$

12. $(12g^4)^{-1} = \boxed{\frac{1}{12g^4}}$

13. $(6y^2)^2 = \boxed{36y^4}$

14. $(3n^6)^4 = \boxed{81n^{24}}$

15. $(2y^4)^{-3} = \boxed{\frac{1}{8y^{12}}}$

16. $(2p^6)^0 = \boxed{1}$

17. $(x^2)^5(x^3)^2 = x^{10} \cdot x^6 = \boxed{x^{16}}$

18. $(2xy)^3x^2 = 8x^3y^3 \cdot x^2 = \boxed{8x^5y^3}$

19. $(mg^4)^{-1}(mg^4) = m^{-1}g^{-4} \cdot mg^4 = m^0g^0 = \boxed{1}$

20. $(c^{-2})^3c^{-12} = c^{-6} \cdot c^{-12} = c^{-18} = \boxed{\frac{1}{c^{18}}}$

21. $(3b^{-2})^2(a^2b^4)^3 = 9b^{-4} \cdot a^6b^{12} = \boxed{9a^6b^8}$

22. $(2a^2c^4)^{-5}(c^{-1}a^7)^6 = 2^{-5}a^{-10}c^{-20} \cdot c^{-6}a^{42} = 2^{-5}a^{32}c^{-26} = \boxed{\frac{a^{32}}{32c^{26}}}$