2Algebra I

Lesson 7.3 Multiplication Properties of Exponents

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Last couple lessons we looked at exponents. What if we need to multiply 2 numbers that are exponential numbers? Can that be done? By the looks of the title of this lesson, the answer is yes. If we take a look at a simple multiplication problem, we can come up with a rule:

Find the product of $2^2 \cdot 2^3 = (2 \cdot 2) \cdot (2 \cdot 2 \cdot 2)$ $2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 = 2^5$ --------------------- $2 + 3 = 5$ $\therefore x^n x^m = x^{n+m}$	1. Break down the exponents 2. How many times is the base value multiplied by itself? 3. What do you see regarding the exponents?

Here are some basic rules to remember:

Rule: Multiplication may only occur with exponential numbers that have the same base; remember we can only combine like terms! $a^m \cdot a^n = a^{m+n}$ $(a^n)^m = a^{n+m}$ $(ab)^n = a^n \cdot b^n$	Example: $2^3 \cdot 5^2 = 2^3 \cdot 5^2$ $3^4 \cdot 3^5 = 3^9$ $x^2 x^3 = xx \cdot xxx = x^{2+3} = x^5$ $(x^2)^3 = x^2 x^2 x^2 = x^{2 \cdot 3} = x^6$ $(xy)^4 = (xy)(xy)(xy)(xy) = x^4 \cdot y^4$

How do we know if an exponential expression is as simplified as it can be?

1. There will be no negative exponents 2. the same base will not appear more than once 3. no powers are raised to a power 4. no products are raised to a power 5. no quotient is raised to a power 6. numerical coefficients are combined and reduced as far as they can go	1. $\frac{5}{2^{-4}} = 5 \cdot 2^4 = 5 \cdot 2^4$ 2. $\frac{2^7}{2^{-4}} = 2^7 \cdot 2^4 = 2^{11}$ 3. $(3^2)^4 = 3^{2 \cdot 4} = 3^8$ 4. $(4^2 \cdot 5^3)^2 = 4^4 \cdot 5^6$ 5. $\left(\frac{x}{3}\right)^5 = \frac{x^5}{3^5}$ 6. $\frac{6x^3}{24} = \frac{x^3}{4}$

Simplify:

$7^8 \cdot 7^4$

$m \cdot n^{-4} \cdot m^4$

$3^{-3} \cdot 5^8 \cdot 3^4 \cdot 5^2$

$x \cdot x^{-1} \cdot x^{-3} \cdot x^{-4}$

$(2.46 \times 10^5) \times 300$

$(3^4)^5$

$(4^{-2})^6$

$(a^3)^4 \cdot (a^{-2})^{-3}$

$(4p)^3$

$(-5t^2)^2$

$(x^2y^3)^4 \cdot (x^2y^4)^{-4}$

$(5^2y^7)^0$