Investigation: Properties of Exponents KEY

Use expanded form to review and generalize the properties of exponents.

Rule 1 - Product property of exponents

Write each product in expanded form, then write it in exponential form. Compare the original exponential form with the final answer in exponential form.

a. $4^3 \times 4^4$

b. $t^5 \times t^7$

c. $7^{10} \times 7^2$

$4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot 4$

$t \cdot t \cdot t \cdot t \cdot t \cdot t \cdot t \cdot t \cdot t \cdot t \cdot t \cdot t$

$7 \cdot 7 \cdot 7 \cdot 7 \cdot 7 \cdot 7 \cdot 7 \cdot 7 \cdot 7 \cdot 7 \cdot 7 \cdot 7$

$= 4^7$

$= t^{12}$

$= 7^{12}$

(note: $\bullet$ also denotes multiplication)

Generalize your results: $a^m \times a^n = \underline{\quad a^{m+n} \quad}$

Rule 2 - Quotient property of exponents

Write the numerator and denominator of each quotient in expanded form. Reduce by eliminating common factors, and then rewrite the remaining factors in exponential form.

a. $\dfrac{4^4}{4^3}$

b. $\dfrac{8^7}{8^5}$

c. $\dfrac{7^{10}}{7^2}$

$\dfrac{4 \cdot 4 \cdot 4 \cdot 4}{4 \cdot 4 \cdot 4}$

$\dfrac{t \cdot t \cdot t \cdot t \cdot t \cdot t \cdot t}{t \cdot t \cdot t \cdot t \cdot t}$

$\dfrac{7 \cdot 7 \cdot 7 \cdot 7 \cdot 7 \cdot 7 \cdot 7 \cdot 7 \cdot 7 \cdot 7}{7 \cdot 7}$

$= 4^1$

$= t^2$

$= 7^8$

Generalize your results: $\dfrac{a^m}{a^n} = \underline{\quad a^{m-n} \quad}$

Rule 3 - Power of a power property of exponents

Expand each expression, and then rewrite in exponential form.

a. $(4^3)^4$

b. $(t^3)^3$

c. $(7^5)^2$

$(4 \cdot 4 \cdot 4)(4 \cdot 4 \cdot 4)(4 \cdot 4 \cdot 4)(4 \cdot 4 \cdot 4)$

$(t \cdot t \cdot t)(t \cdot t \cdot t)(t \cdot t \cdot t)$

$(7 \cdot 7 \cdot 7 \cdot 7 \cdot 7)(7 \cdot 7 \cdot 7 \cdot 7 \cdot 7)$

$= 4^{12}$

$= t^9$

$= 7^{10}$

Generalize your results: $(a^m)^n = \underline{\quad a^{mn} \quad}$

Rule 4 - Power of a product property of exponents

Expand each expression, and then rewrite in exponential form. Do not multiply within the parentheses.

a. $(4 \times 3)^4$

b. $(t \times 8^2)^5$

c. $(7^5 \times t^3)^3$

$(4•3)(4•3)(4•3)(4•3)$

$=(4•4•4•4)(3•3•3•3•)$

$= 4^4 3^4$

$(t•8^2)(t•8^2)(t•8^2)(t•8^2)(t•8^2)$

$=(t•t•t•t•t)(8^2•8^2•8^2•8^2•8^2)$

$=t^5 8^{10}$

$(7^5•t^3)(7^5•t^3)(7^5•t^3)$

$=(7^5•7^5•7^5)(t^3•t^3•t^3)$

$=7^{15}t^9$

Generalize your results: $(a^m \times b^n)^p =$ ___ $a^{mp} b^{np}$ ____

Grading yourself:

Limited - you were able to get the working correct for Rules #1, 2 and 3, but not 4.

Adequate - you were able to get the working correct for Rules #1-3 but possibly not 4. You were able to generalize one correct rule.

Substantial - you were able to get the working correct for Rules #1-3 but possibly not 4. You were able to generalize two or three correct rules.

Excellent - you were able to get the working correct for Rules #1-4. You were able to generalize all correct rules.