Name: _____
Mrs. van der Vossen   Math 9

3.2

Exponent "LAW"s

These "laws" aka "rules" but they are more like **SHORT - CUTS**

When a value appears to **have no exponent**, it actually as an exponent equal to ONE! $5 = 5^1$

Product Rule

RULE 1: When MULTIPLYING POWERS that have the SAME BASE, __Add__ the EXPONENTS

$2^3 \times 2^2 = \underline{2 \times 2 \times 2 \times 2 \times 2} = 2^5$
(3 + 2)

$(-3)^3 (-3)^2 (-3)^2 = \underline{(-3)^7}$
(+)

$5^3 \times 5^5 = \underline{5^8}$
(+)

$m^2 \times m^3 = \underline{m^5}$
(+)

QUOTIENT RULE

RULE 2: When DIVIDING POWERS that have the SAME BASE, __SUBTRACT__ the EXPONENTS

$2^3 \div 2^2 = 2^1$ $\dfrac{2^3}{2^2} \rightarrow \dfrac{2 \times 2 \times 2}{}$
YUM   DEN

NUMBER (OR) ↓ variable

★ $x^4 \div x^1 = x^{4-1} = x^3$

cancel to one

ANYThing DIVIDED BY ISELF is equal to ONE!

divide* might be shown as a fraction

$\dfrac{(-5)^4}{(-5)^3} = \dfrac{(-5)(-5)(-5)(-5)}{(-5)(-5)(-5)} = (-5)$

$\dfrac{xxxx}{x} \rightarrow x^3$

ZERO EXPONENT RULE

RULE 3: When **ANY BASE** is raised to the

Number or variable, whole or part

power of ___ZERO___, the value of the expression is

___ONE___. *(evaluated)*

TEST ⭐

$$9^3 \div 9^3 = \frac{9 \times 9 \times 9}{9 \times 9 \times 9} = 9^0 = 1$$

NUM ÷ DEN

says None Left

$$(-3)^2 \div (-3)^2 = \frac{(-3)(-3)}{(-3)(-3)} = (-3)^0 = 1$$

$$y^5 \div y^5 = \frac{y\,y\,y\,y\,y}{y\,y\,y\,y\,y} = y^0 = 1$$

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Proved with repeated multiplication then division, because **any number DIVIDED by ITSELF equal** ONE

RULE 4: When raising a POWER to a POWER,

___MULTIPLY___ the EXPONENTS

*the **inside POWER is the BASE** that will **repeat** the amount of times that the OUTER EXPONENT says*

$$(5^2)^3 = (5 \cdot 5)(5 \cdot 5)(5 \cdot 5) = 5^{2 \times 3} = 5^6$$

3 groups • Base

$$(3^5)^2 = (3 \cdot 3 \cdot 3 \cdot 3 \cdot 3)(3 \cdot 3 \cdot 3 \cdot 3 \cdot 3) = 3^{5 \times 2} = 3^{10}$$

$$((-8)^2)^3 = ((-8)(-8))((-8)(-8))((-8)(-8)) = (-8)^{2 \times 3} = (-8)^6$$

RULE 5: When raising a Quotient (looks like a fraction but just shows DIVISION!) to a power, __BOTH__ the numerator and denominator's EXPONENTS get __MULTIPLIED__ to the outer exponent!

BASE

$$\left(\frac{1}{3}\right)^2 = \left(\frac{1}{3}\right)\left(\frac{1}{3}\right) = \frac{1^2}{3^2}$$

$$\left(\frac{2}{5^4}\right)^3 = \left(\frac{2}{5\times5\times5\times5}\right)\left(\frac{2}{5\times5\times5\times5}\right)\left(\frac{2}{5\times5\times5\times5}\right) = \frac{2^3}{5^{12}}$$

BASE

Shows multiply

RULE 6: When raising a PRODUCT (such as a coefficient and its variable $2x$) to a POWER, __MULTIPLY__ the outer EXPONENT to __BOTH__ of the inner exponents on EACH PART!

← groups

$$(\underline{5m})^2 = (\;5m\;)(\;5m\;) = 5^2 m^2 = 25m^2$$

Base BOTH

$$(x^2 y^3)^3 = (x^2 y^3)(x^2 y^3)(x^2 y^3) = x^6 y^9$$
$$(xxyyy)(xxyyy)(xx yyy)$$

coef always bef. variable.

$$(3x^2)^4 = (3xx)(3xx)(3xx)(3xx) = 3^4 x^8 = 81x^8$$

Repeated Mult.   Single Power   evaluated

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