A39: Exponent Properties & Patterns WKS

21.1 Exponential Properties & Patterns

Exponential Properties ★ $b \neq 0$ ★

NAME OF PROPERTY	ALGEBRA	EXAMPLE
ZERO EXPONENT RULE	$b^0 = 1$	$(57{,}410.4)^0 = 1$
NEGATIVE EXPONENT RULE	$b^{-n} = \frac{1}{b^n}$	$2^{-3} = \frac{1}{2^3} = \frac{1}{8}$ OR $\frac{y}{x^{-4}} = yx^4$
PRODUCT RULE	$b^n \cdot b^m = b^{n+m}$	$2^2 \cdot 2^3 = 2^{2+3} = 2^5 = 32$ $2\cdot2 \cdot 2\cdot2\cdot2 = 2^5$
QUOTIENT RULE	$\frac{b^n}{b^m} = b^{n-m}$	$\frac{2^3}{2^2} = 2^{3-2} = 2^1 = 2$ $\frac{2^3}{2^2} = \frac{2\cdot2\cdot2}{2\cdot2} = 2$
POWER RULE	$(b^n)^m = b^{n\cdot m}$	$(2^2)^3 = 2^{2\cdot3} = 2^6 = 64$ $(2^2)(2^2)(2^2) = (2\cdot2)(2\cdot2)(2\cdot2) = 2^6$
POWER OF PRODUCT RULE	$(a \cdot b)^m = a^m \cdot b^m$	$(3x)^2 = 3^2x^2 = 9x^2$ $(3x)(3x) = 9x^2$
POWER OF QUOTIENT RULE	$\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}$	$\left(\frac{4x}{3y}\right)^2 = \frac{4^2x^2}{3^2y^2} = \frac{16x^2}{9y^2}$ $\left(\frac{4x}{3y}\right)\left(\frac{4x}{3y}\right) = \frac{16x^2}{9y^2}$
RATIONAL (FRACTIONAL) EXPONENT RULE	$b^{\frac{m}{n}} = (\sqrt[n]{b})^m = \sqrt[n]{b^m}$ ↑better ↑harder	$16^{\frac{3}{2}} = (\sqrt[2]{16})^3 = 4^3 = 64$ $\sqrt[2]{16^3} = \sqrt[2]{4096} = 64$

① Zero Exponents
② Power Rule
③ Product Rule
④ Quotient Rule
⑤ Negative Exponents

} Suggested Order

$6 = 4+2$

Ex #1 $(4)(x)^0(y)^4 \cdot (2)(y)^2 = 4(1)(y)^4(2)(y)^2 = \boxed{8y^6}$

Ex #2 $(xy^2)^0 = \boxed{1}$

Ex #3 $\frac{-3xy}{-2(y)^0} = \frac{+3xy}{+2} = \boxed{\frac{3xy}{2}}$

Ex #4 $\left(a^3 b^5 (-a b^5)^{-4}\right)^4 = a^{12} b^{20} (-a b^5)^{-16}$

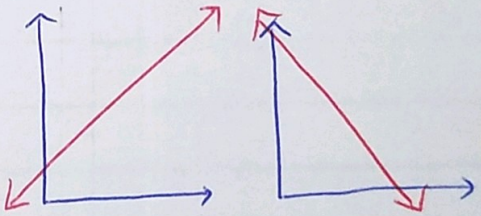
$= a^{12} b^{20} (-1)^{-16} (a)^{-16} (b)^{-80}$

$= a^{-4} b^{-60} (-1)^{-16}$

$= \frac{1}{a^4 b^{60} (-1)^{16}} = \boxed{\frac{1}{a^4 b^{60}}}$

Ex #5 $\left(\frac{(x^{-1}y^{-1})^3}{2y^{-2} \cdot x^2 y^3}\right)^2 = \frac{(x^{-1}y^{-1})^6}{2^2 y^{-4} x^4 y^6} = \frac{x^{-6}y^{-6}}{4 y^{-4} x^4 y^6}$

$= \frac{x^{-6}y^{-6}}{4x^4 y^2} = \frac{x^{-10}y^{-8}}{4} = \boxed{\frac{1}{4x^{10}y^8}}$

	RATE OF CHANGE = slope	PATTERN FOR THE Y-VALUES	WHAT THE TABLE CAN LOOK LIKE	WHAT GRAPHS CAN LOOK LIKE
LINEAR	Constant	Add same number AKA arithmetic	X: 1, 2, 3, 4, 5 Y: 4, 12, 20, 28, 36 (+8, +8, +8, +8)	
EXPONENTIAL	Increasing or decreasing	Multiply same number AKA geometric	X: 1, 2, 3, 4, 5 Y: 4, 8, 16, 32, 64 (×2, ×2, ×2, ×2)	

Ex #6 Complete the table so that it is linear.

X	5	10	15	20	25
y	1.25	1.00	0.75	0.50	0.25

Ex #7 Complete the table so that it is exponential.

X	0	1	2	3	4
y	24	12	6	3	1.5