

Unit 3.1 Laws of Exponents Notes

Law	Symbol	Words	Examples
Product of Powers	For any number a and all integers m and n , $a^m \cdot a^n = a^{m+n}$	To multiply two powers that have the same base, add the exponents.	$6^2 \cdot 6^3 = 6^5 = 7776$ $2x^4 \cdot 5x^3 = 10x^7$
Power of a Power	For any number a and all integers m and n , $(a^m)^n = a^{mn}$	To find the power of a power, multiply the exponents.	$(2^3)^4 = 2^{12} = 4096$ $(x^5)^3 = x^{15}$
Power of a Product	For any number a and all integers m and n , $(ab)^m = a^m b^m$	Every number and variable <i>within</i> the parenthesis gets raised to the power.	$(2a)^2 = 2^2 a^2 = 4a^2$ $(3y^2z)^3 = 3^3 y^6 z^3 = 27y^6z^3$
Quotient of Powers	For all integers m and n and any nonzero number a , $\frac{a^m}{a^n} = a^{m-n}$	To divide two powers with the same base, subtract the exponents.	$\frac{3^6}{3^4} = 3^2 = 9$ $\frac{x^8}{x^5} = x^{8-5} = x^3$
Power of a Quotient	For any integers m and any real numbers a and b , $b \neq 0$, $\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}$	Apply the power to all numbers and variables in the numerator and in the denominator that are contained within the parenthesis.	$\left(\frac{a^2}{b}\right)^3 = \frac{a^6}{b^3}$ $\left(\frac{2x^2}{x}\right)^4 = \frac{16x^8}{x^4} = 16x^4$
Zero Exponent	For any nonzero number a , $a^0 = 1$.	Any nonzero number raised to the zero power is 1 .	$3^0 = 1$ $x^0 = 1$ $(2x^2y^3z)^0 = 1$
Negative Exponent Property	For any nonzero number a and any integer n , $a^{-n} = \frac{1}{a^n}$ and $\frac{1}{a^{-n}} = a^n$	Any nonzero number raised to a negative power is equal to the reciprocal of the number raised to the opposite power. (When you "cross the line, change the sign".)	$2^{-1} = \frac{1}{2}$ $x^{-2} = \frac{1}{x^2}$ $\frac{1}{x^{-3}} = x^3$

Additional examples:

$$3^{-3} \quad 3^{-2} \quad 3^{-1} \quad \underline{3^0} \quad 3^1 \quad 3^2 \quad 3^3$$

$$\frac{1}{27} \quad \frac{1}{9} \quad \frac{1}{3} \quad 1 \quad 3 \quad 9 \quad 27$$

$$\frac{2x^2}{6x^4} = \frac{1}{3x^2}$$