Notes: Laws of Exponents Day 1

Base → 5^4 ← Exponent / Power

Expanded Form		
3^3	$3 \cdot 3 \cdot 3$	27
3^2	$3 \cdot 3$	9
3^1	3	3
3^0		1
3^{-1}	$1/3$	$1/3$
3^{-2}	$1/3 \cdot 1/3$	$1/9$
3^{-3}	$1/3 \cdot 1/3 \cdot 1/3$	$1/27$

Positive Exponents

$3^5 = 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 = 243$

Zero Exponent

ANYTHING TO 0 POWER = 1

Negative Exponents

Change position, Reciprocal

The rules are the same when the base is a variable:

$b^3 = b \cdot b \cdot b$ $\quad k^0 = 1$ $\quad \frac{g^{-5}}{1} = \frac{1}{g^5}$ $\quad \frac{1}{m^{-3}} = \frac{m^3}{1} = m^3$

Exponents are possessive and are only attached to what is directly infront of it

What happens when you multiply?

$(4^3)(4^5) = (4 \cdot 4 \cdot 4)(4 \cdot 4 \cdot 4 \cdot 4 \cdot 4) = 4^8$

Simplify by expansion:

65536

$(x^4)(x^2) = (x \cdot x \cdot x \cdot x)(x \cdot x) = x^6$

Simplify by expansion:

Same Base → Add Exponents

Use Product of Powers Property $a^m \bullet a^n = a^{m+n}$

$(x^3)(x^5) = x^{3+5} = x^8$

Same Base → Subtract Exponents

Use Division Property $\frac{a^m}{a^n} = a^{m-n}$

$\frac{4x^{12}}{2x^7} = \frac{4}{2} \frac{x^{12}}{x^7} = \frac{2}{1} \cdot \frac{x^5}{1} = 2x^5$

$a^4 \bullet a^5 \bullet a^{-2}$

$a^{4+5+-2} = \boxed{a^7}$

$d^2 \bullet d^{-4} \bullet d^3$

$d^{2+-4+3} = \boxed{d^1}$

$a^4 \bullet b^5 \bullet a^{-2}$

$(a^4 \cdot a^{-2}) b^5$

$\boxed{a^2 b^5}$

$x^3 \bullet x^{-5} \bullet y^{-2}$

$(x^3 \cdot x^{-5}) y^{-2}$

$x^{-2} y^{-2} = \boxed{\frac{1}{x^2 y^2}}$

$\frac{36x^{10}}{48x^8}$

$\frac{36}{48} \frac{x^{10}}{x^8}$

$\frac{3}{4} \cdot \frac{x^2}{1}$

$\boxed{\frac{3x^2}{4}}$

$\frac{-3^2 x^4}{2^{-2} x^{-3}}$

$-3^2 \cdot 2^{+2} x^4 \cdot x^{+3}$

$-9 \cdot 4 x^4 \cdot x^3$

$\boxed{-36x^7}$

$\frac{32x^{-5} y^6 z^0}{40x^{-3} y^2}$

$\frac{32}{40} \frac{x^3}{x^5} \frac{y^6}{y^2} \frac{z^0}{1}$

$\frac{4}{5} \cdot \frac{1}{x^2} \cdot \frac{y^4}{1} \cdot \frac{1}{1}$

$\boxed{\frac{4y^4}{5x^2}}$

$\frac{10 \bullet 1^0}{2^{-2}}$ $10 \cdot 1^0 \cdot 2^2 = 40$	$\frac{-6^2 \bullet x^{-4}}{1}$ $\frac{-6^2}{1} \cdot \frac{1}{x^4}$ $\frac{-36}{x^4}$	$-6^2 \bullet x^4$ $-36x^4$
$\frac{2^{-1}x^4}{3^3}$ $\frac{x^4}{1} \cdot \frac{1}{2^1 \cdot 3^3}$ $\frac{x^4}{54}$	$\frac{ab^{-3}}{c^0}$ $\frac{a}{b^3}$	$\frac{-4 \bullet 2^{-3}}{a^{-1}b^2}$ $\frac{-4a^1}{2^3 b^2} = \frac{-4a}{8b^2} = \frac{-a}{2b^2}$

Evaluate for x = 2 y = 0 w = -3 v = 1

x^y $(2)^0 = 1$	$\frac{v^w}{w^y}$ $\frac{(1)^{-3}}{(-3)^0} = \frac{1}{1}$ 1	$\frac{w^x v^x}{w^w}$ $\frac{(-3)^2(1)^2}{(-3)^{-3}} = -243$	$2wx^y$ $2(-3)(2)^0$ -6

Simplify: use only POSITIVE exponents;

$(15x^5)(\frac{1}{5}x^2y)$ $(15 \cdot \frac{1}{5})(x^5 \cdot x^2)(y)$ $3x^7y$	$x^{-3} \bullet y^{-3} \bullet x^3$ $(x^{-3} \cdot x^3)(y^{-3})$ $\frac{x^0 \cdot y^{-3}}{1} = \frac{1}{y^3}$	$(-4x^{-20})(-4^2x^2)$ $(-4^1 \cdot -4^2)(x^{-20} \cdot x^2)$ $\frac{64x^{-18}}{1} = \frac{64}{x^{18}}$
$\frac{2}{x^3} \bullet \frac{2}{x^{-3}}$ $\frac{4}{1} \cdot \frac{x^3}{x^3}$ 4	$\frac{p^6}{1} \bullet \frac{1}{p^0} \bullet \frac{6p}{1}$ $\frac{6 \cdot p^6 \cdot p^1}{p^0} = 6p^7$	$(-4)^2(x^{-2}y^4)$ $\frac{16x^{-2}y^4}{1} = \frac{16y^4}{x^2}$
$m^{-4} \bullet n^{-3} \bullet m^{-1}$ $(m^{-4} \cdot m^{-1})(n^{-3})$ $\frac{m^{-5} \cdot n^{-3}}{1} = \frac{1}{m^5n^3}$	$\frac{16x^{10}y^{-4}}{24x^3y^{-2}}$ $\frac{16}{24} \cdot \frac{x^{10}}{x^3} \cdot \frac{y^2}{y^4}$ $\frac{2}{3} \cdot \frac{x^7}{1} \cdot \frac{1}{y^2} = \frac{2x^7}{3y^2}$	$\frac{1}{2p^4} \bullet \frac{2^{-3}}{1}$ $\frac{1}{2} \cdot \frac{1}{2^3} \cdot \frac{1}{p^4} = \frac{1}{16p^4}$
$\frac{2x^{-3}y^4}{3^{-1}x^2y^{-7}}$ $\frac{2 \cdot 3^1}{1} \cdot \frac{1}{x^2x^3} \cdot \frac{y^4y^7}{1}$ $\frac{6y^{11}}{x^5}$	$(12xy^4)(-3x^{-2}y)$ $(12 \cdot -3)(x^1 \cdot x^{-2})(y^4 \cdot y^1)$ $\frac{-36x^{-1}y^5}{1}$ $\frac{-36y^5}{x}$	$\frac{x^{14}}{x^5} \bullet x^0$ x^9