Review of All Exponent Properties (The "Big" Ones)

Exponent Properties →

Zero as Exponent

1.) $a^0 = 1$

Negative Exponents

2.) $\frac{1}{a^{-n}} = a^n$ or $a^{-n} = \frac{1}{a^n}$

Product Property

3.) $a^m \cdot a^n = a^{m+n}$ (Add the exponents)

Quotient Property

4.) $\frac{a^m}{a^n} = a^{m-n}$ (Subtract exponents: Top minus Bottom)

Power to a Power

5.) $(a^m)^n = a^{m \cdot n}$ (multiply exponents)

Product to a Power

6.) $(ab)^n = a^n b^n$ (Raise everything inside ( ) to the power.)

Quotient to a Power

7.) $\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}$ or $\left(\frac{a}{b}\right)^{-n} = \frac{b^n}{a^n}$ → " SAME AS #6 "

Examples: Simplify each expression.

1.) $(2a^{-3}b^{-4})^2(-3a^4b^6)^3$

2.) $2(4x^{-2}y^3)^2(3x^4y^2)$

3.) $(3a^{-8}b^4c^3)^{-4}(6^{-1}a^2b^3c^0)^{-2}$

4.) $\frac{(3mn^{-4})^2(m^3n^4)^0}{(4m^{-6}n^3)(3m^{-3}n^4)^2}$

5.) $\frac{(2w^{-4}z^{-7})^3}{(6w^{-8}z^8)^2}$

6.) $\left(\frac{(-2a^3b^2c^{-6})^3}{(-abc)^2}\right)^{-4}$

7.) $\left(\frac{2x^3y^4x^{-5}}{3y^{-2}x^7}\right)^2 \cdot \left(\frac{3x^6y^8}{2x^{-1}y^{-3}}\right)^{-4}$

8.) $\frac{(2a^{-1}b^{-6})^{-4}(3ab^{-4})^3}{(3a^{-6}b^{-3})^2(-6a^2b^0)^{-4}}$

9.) Evaluate given a = 4 , b = – 2 , and c = – 3:

a.) $\frac{(a^3b^{-1})^3c}{2a}$

b.) $\left(\frac{14a^5b^{-1}c^3}{7a^2bc^2}\right)^{-1}$

Review of All Exponent Properties

1) $(2a^{3}b^{-4})^{2}(-3a^{4}b^{6})^{3}$

cannot multiply expression until you do the Product Raised to a Power!

$(2^{2}a^{-3\cdot2}b^{-4\cdot2})((-3)^{3}a^{4\cdot3}b^{6\cdot3})$

$(4a^{-6}b^{-8})(-27a^{12}b^{18})$

multiply both expressions and use the Product Property.

$(4\cdot-27)a^{-6+12}b^{-8+18}$

$\boxed{-108a^{6}b^{10}}$

2) $2(4x^{2}y^{3})^{2}(3x^{4}y^{2})$

cannot multiply expressions until you do the Product Raised to a Power!

$2(4^{2}x^{-2\cdot2}y^{3\cdot2})(3x^{4}y^{2})$

$2(16x^{-4}y^{6})(3x^{4}y^{2})$

Multiply expressions and use the Product Property!

$2(16)(3)x^{-4+4}y^{2+6}$

$96x^{0}y^{8}$

$\boxed{96y^{8}}$

3) $(3a^{-8}b^{4}c^{3})^{-4}(6^{-1}a^{2}b^{3}c^{0})^{-2}$

$(3^{-4}a^{-8\cdot-4}b^{4\cdot-4}c^{3\cdot-4})(6^{-1\cdot-2}a^{2\cdot-2}b^{3\cdot-2}c^{0\cdot-2})$

$c^{0}=1$

$(3^{-4}a^{32}b^{-16}c^{-12})(6^{2}a^{-4}b^{-6})$

3^{4}

$\frac{36a^{32+-4}b^{-16+-6}c^{-12}}{81}$

$\frac{36a^{28}b^{-22}c^{-12}}{81} \rightarrow \boxed{\frac{4a^{28}}{9b^{22}c^{12}}}$

becomes 1

4) $\dfrac{(3mn^{-4})^2(m^3n^4)^0}{(4m^{-6}n^3)(3m^{-3}n^4)^2}$

$\dfrac{(3mn^{-4})^2}{(4m^{-6}n^3)(3m^{-3}n^4)^2}$ ← Powered, Raised to a Power

$\dfrac{3^2 m^{1\cdot2} n^{-4\cdot2}}{(4m^{-6}n^3)(3^2 m^{-3\cdot2} n^{4\cdot2})}$

$\dfrac{9m^2n^{-8}}{(4m^{-6}n^3)(9m^{-6}n^8)}$ ← Product Property

$\dfrac{9m^2n^{-8}}{(4\cdot9)m^{-6+-6}n^{3+8}} \rightarrow \dfrac{9m^2n^{-8}}{36m^{-12}n^{11}}$ Quotient Property

$\dfrac{m^{14}}{4n^{19}} \leftarrow \dfrac{m^{14}n^{-19}}{4} \leftarrow \dfrac{1m^{2--12}n^{-8-11}}{4}$

5) $\dfrac{(2w^{-4}z^{-7})^3}{(6w^{-8}z^8)^2}$ Product to a Power

$\dfrac{2^3 w^{-4\cdot3} z^{-7\cdot3}}{6^2 w^{-8\cdot2} z^{8\cdot2}}$

$\dfrac{8w^{-12}z^{-21}}{36w^{-16}z^{16}}$ Quotient Property

$\dfrac{2w^{-12--16}z^{-21-16}}{9} \rightarrow \dfrac{2w^{4}\cdot z^{-37}}{9}$

$\dfrac{2w^4}{9z^{37}}$

6) $\left(\frac{(-2a^3b^2c^{-6})^3}{(-abc)^2}\right)^{-4}$ Product to a Power

$\left(\frac{(-2)^3 a^{3\cdot3} b^{2\cdot3} c^{-6\cdot3}}{(-1)^2 a^2 b^2 c^2}\right)^{-4}$

$\left(\frac{-8a^9 b^6 c^{-18}}{a^2 b^2 c^2}\right)^{-4}$ Quotient Property

$\left(-8a^{9-2} b^{6-2} c^{-18-2}\right)^{-4}$

$\left(-8a^7 b^4 c^{-20}\right)^{-4}$ Product to a Power

$(-8)^{-4} a^{7\cdot-4} b^{4\cdot-4} c^{-20\cdot-4}$

$\frac{a^{-28} b^{-16} c^{80}}{(-8)^4} \rightarrow \frac{c^{80}}{4096 a^{28} b^{16}}$