Integral Exponents

Summary of Exponent Rules

for any integers m and n		Examples
Exponent of 1	$a^1 = a$	
Exponent of 0	$a^0 = 1, a \neq 0$,	
Product Rule	$\left(a^m\right)\left(a^n\right) = a^{m+n}$	
Quotient Rule	$\frac{a^m}{a^n} = a^{m-n}, a \neq 0$	
Power Rules	$\left(a^m\right)^n = a^{mn}$ $(ab)^m = \left(a^m\right)\left(b^m\right)$ $\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}, b \neq 0$	
Negative Exponents	$a^{-n} = \frac{1}{a^n}, a \neq 0$ $\frac{1}{a^{-n}} = a^n$ $\left(\frac{a}{b}\right)^{-n} = \left(\frac{b}{a}\right)^n$	
Rational Exponents	$\sqrt[n]{a} = a^{\frac{1}{n}}$ $\sqrt[n]{a^m} = a^{\frac{m}{n}}$	

Simplifying Integral Exponents

1. Simplify. **Simply using positive exponents.**

a) $(5^8)(5^{-3})$ $(5^8)(5^{-3})$

b) $(0.8^{-2})(0.8)^{-4}$ $(0.8^{-2})(0.8)^{-4}$

c) $\frac{(2x)^5}{(2x)^{-3}}$ $\frac{(2x)^5}{(2x)^{-3}}$

Your Turn:

a) $(2^{-3})(2)^5$ **b)** $\frac{7^{-5}}{7^3}$ c) $\frac{(-3.5)^4}{(-3.5)^{-3}}$

2. Simplify to a power with a single, positive exponent; evaluate where possible.

a) $\left(4^3\right)^{-2}$

b) $\left[\left(a^{-2}\right)\left(a^0\right)\right]^{-1}$

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

d) $\left[\left(\frac{3}{4}\right)^{-2}\left(\frac{3}{4}\right)^4\right]^{-2}$

Your Turn:

a) $\left[\left(0.6^3\right)\left(0.6\right)^{-3}\right]^{-5}$

b) $\left(\frac{x^6}{x^4}\right)^{-2}$

c) $\left[\frac{\left(y^2\right)^0}{y^3}\right]^{-3}$

3. A culture bacteria in a lab contains 2000 bacterium cells. The number of cells doubles every day. This relationship can be modeled by the equation $\mathbf{N = 2000(2)^t}$, where **N** is the estimated number of bacteria cells and ***t*** is the time in days. How many cells were present after two days?

   There will be _____ bacterium cells after 2 days of growth.

   How many cells were present after one week? How many cells were present 2 days ago?

4. A mountain pine beetle population can triple every year. If the population in Jasper National Park is 10,000 the formula for the population would be $\mathbf{P=10{,}000(\ \ )^n}$, n being the # of years.

   How many beetles will there be 2 years from now?

   How many beetles were there 4 years ago?

5. There are ~ 117 billion grasshoppers in an area of 39,000 km^2. How many are there per square kilometer? Use exponents to solve.