Multiplying and Dividing with Exponents

Multiplication Rule: Product of Powers
Multiply powers with the same base by adding the exponents.
Examples: $a^m \cdot a^n = a^{m+n}$ $3^5 \cdot 3^3 = 3^{5+3}$ or 3^8

Watch Out: when multiplying powers, do not multiply the bases. For example, it is not 9^8 for the example above.

Division Rule: Quotient of Powers
Divide powers with the same base by subtracting the exponents.
Examples: $a^m \div a^n = a^{m-n}$ $3^5 \div 3^3 = 3^{5-3}$ or 3^2

Watch Out: when dividing powers, the denominator cannot be 0.

Find the product or quotient. Express using positive exponents.

1) $y^4 \cdot y^1$

2) $\dfrac{4^{11}}{4^5}$

$y \cdot y \cdot y \cdot y \cdot y$

y^5

$\dfrac{4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot 4}{4 \cdot 4 \cdot 4 \cdot 4 \cdot 4}$

4^6

Product Rule

y^{4+1}

y^5

Quotient Rule

4^{11-5}

4^6

Find the product or quotient. Express using positive exponents.

3) $m^{-8} \cdot m^{2}$

m^{-8+2}

$m^{-6} \leftarrow$ negative exponent

$\dfrac{1}{m^{6}}$ positive exponent

4) $\dfrac{3^{-2}}{3^{5}}$

3^{-2-5}

3^{-7}

$\dfrac{1}{3^{7}}$

Integer Rule

$-2+{}^-5={}^-7$

Find the product or quotient. Express using positive exponents.

5) $3xy^{-2} \cdot 4y^5$

$3 \cdot 4 \cdot x \cdot y^{-2} \cdot y^5$

$12xy^3$

$-2+5=3$

Find the product or quotient. Express using positive exponents.

6) $-5n^{10} \cdot 3n^6p^4$

$-5 \cdot 3 \cdot n^{10} \cdot n^6 \cdot p^4$

$-15 n^{10+6} p^4$

$-15 n^{16} p^4$

The table shows the approximate heights of some clouds. About how many times as high are some high clouds compared to some low clouds?

Clouds	Height in meters
low	2^{10}
middle	2^{11}
high	2^{13}

$$\frac{high}{low} = \frac{2^{13}}{2^{10}}$$

$$2^{13-10} = 2^3 = 2 \cdot 2 \cdot 2 = 8 \text{ times}$$