Exponents and Scientific Notation

1. Use the example of the first row of the chart below, Multiplication of Like Bases, to fill in the rest of the chart. This chart assumes that a and b are real numbers, and $a \neq 0$. m and n represent integers.

Properties of Exponents

Description	Example	Expanded Form	Property
Multiplication of Like Bases	$a^3 \cdot a^5$	$a^3 \cdot a^5 = (a \cdot a \cdot a)(a \cdot a \cdot a \cdot a \cdot a) = a^{3+5} = a^7$	$a^n \cdot a^m = a^{n+m}$
Division of Like Bases	$\frac{a^6}{a^2}$	$\frac{a^6}{a^2} =$	$\frac{a^n}{a^m} =$
Power Rule	$(a^2)^3$	$(a^2)^3 =$	$(a^n)^m =$
Power of a Product	$(ab)^3$	$(ab)^3 =$	$(ab)^n =$
Power of a Quotient	$\left(\frac{b}{a}\right)^3$	$\left(\frac{b}{a}\right)^3 =$	$\left(\frac{b}{a}\right)^n =$

Definition: For any real number a, $a \neq 0$, $a^0 = 1$. We are going to use this definition to come up with a rule for negative exponents.

$a^{-n} = a^{0-n} = \frac{a^0}{a^n} = \frac{1}{a^n}$ so $a^{-n} = \frac{1}{a^n}$.

2. Use the rules and definitions above to simplify the following, leaving your answers with positive exponents only.

5^{-2} $\left(\frac{2}{3}\right)^{-1}$ $(-2)^{-3}$ -2^{-3} $(10ab)^0$

$10ab^0$ $y^3 \cdot y^7$ $\frac{x^{11}}{x^4}$ $(3z^2)^4$ 7^2q^{-3}

$\dfrac{r}{r^{-1}}$ $\qquad$ $\dfrac{p^2q}{p^5q^{-1}}$ $\qquad$ $\dfrac{25x^2y^{12}}{10x^5y^7}$ $\qquad$ $(-6a^{-2}b^3c)^{-2}$

$(mn^3)^2(5m^{-2}n^2)$ $\qquad$ $\left(\dfrac{a}{b^2}\right)^2(3a^2b^3)$ $\qquad$ $3xy^5\left(\dfrac{2x^4y}{6x^5y^3}\right)^{-2}$

A number expressed in the form $a \times 10^n$, where $1 \leq a < 10$ and n is an integer, is said to be in **scientific notation**.

3. Write each of the following in "proper" scientific notation.

103 $\qquad$ 0.00037 $\qquad$ 0.0435×10^{-5} $\qquad$ 682×10^4

4. Perform the indicated operation and leave your answer in scientific notation.

$(6.5 \times 10^3)(5.2 \times 10^{-8})$ $\qquad$ $\dfrac{3 \times 10^{13}}{1.5 \times 10^5}$ $\qquad$ $\dfrac{1.32 \times 10^{-2}}{1.2 \times 10^{-15}}$