Properties of Exponents

Suppose a and b are any real numbers, and suppose m and n are any integers. Recall the set of integers is the set $\{..., -3, -2, -1, 0, 1, 2, 3, ...\}$

Product rule: $a^m a^n = a^{m+n}$

Power of a power rule: $(a^m)^n = a^{mn}$

Power of a product rule: $(ab)^m = a^m b^m$

Negative exponent rule: $a^{-m} = \dfrac{1}{a^m}$

Quotient rule: $\dfrac{a^m}{a^n} = a^{m-n}$

Power of a quotient rule: $\left(\dfrac{a}{b}\right)^m = \dfrac{a^m}{b^m}$

Identity property for exponents: $a^1 = a$

Zero exponent rule: $a^0 = 1$

Rule for Negative exponents and fractions

If a and b are nonzero real numbers and m and n are integers, then

$$\left(\frac{a}{b}\right)^{-m} = \left(\frac{b}{a}\right)^{m} \quad \text{and} \quad \frac{a^{-m}}{b^{-n}} = \frac{b^n}{a^m}$$

Definition 1. *A number is in* ***scientific notation*** *if it is written as the product of a number between 1 and 10 and an integer power of 10. A number in scientific notation has the form*

$$n \times 10^r$$

where $1 \leq n < 10$ *and* $r =$ *an integer.*

Example: Write 475,000 in scientific notation.
We need to ask ourselves how many decimal places would we need to move the decimal on 475,000 to write it as a number between 1 (or equal to 1) and 10 (but not equal to 10)? That number of places is the exponent on ten (when we write 475,000 in scientific notation), so $475,000 = 4.75 \times 10^5$. A number that is less than 1 will have a negative exponent when written in scientific notation.