

# Exponents & Scientific Notation

## Laws of Exponents

Multiplying Powers with the Same Base	Keep the base and ADD the exponents	$a^m \cdot a^n = a^{m+n}$	$3^3 \cdot 3^4 = 3^7$
Dividing Powers with the Same Base	Keep the base and SUBTRACT the exponents	$\frac{a^m}{a^n} = a^{m-n}$	$\frac{6^8}{6^5} = 6^3$
Power to a Power	MULTIPLY the exponents	$(a^m)^n = a^{mn}$	$(4^3)^5 = 4^{15}$
Negative Exponents	Take the reciprocal and turn the exponent positive	$a^{-m} = \frac{1}{a^m}$	$2^{-4} = \frac{1}{2^4}$
Zero Exponent	Always equals 1	$a^0 = 1$	$7^0 = 1$

## Scientific Notation

A way to write very large and very small numbers using a decimal and power of 10.

Scientific notation looks like a decimal with one digit in front of the decimal point multiplied by a power of 10. The exponent on the 10 represents the number of **PLACE VALUES** moved to arrive at the decimal. If the number is greater than 1, it is a positive power of 10. If the number is between 0 and 1, the power is negative.

Examples:

$$12,000,000 \rightarrow 1.2 \times 10^7$$
$$0.000037 \rightarrow 3.7 \times 10^{-5}$$

Returning to Standard Form:

If the power of 10 is **positive**, move the decimal to the **right** the number of places as the exponent to make a very large number. If the power is **negative**, move the decimal to the **left** the number of places as the exponent to make a very small number.

Examples:

$$4.27 \times 10^8 \rightarrow 427,000,000$$
$$2.3 \times 10^{-3} \rightarrow .0023$$

## Operations with Scientific Notation

### Adding and Subtracting:

You must have the **same power of 10**. If not, you must change one of the powers to match. To make the power **greater**, move the decimal to the **left**. To make the power **smaller**, move the decimal to the **right**. Then line up your decimals and add or subtract. Keep the powers the SAME. Make sure your answer is in proper Scientific Notation when you are done.

### Examples:

$$3.2 \times 10^5 + 1.7 \times 10^4$$

Change  $1.7 \times 10^4$  to  $.17 \times 10^5$

$$\begin{array}{r} 3.20 \times 10^5 \\ + .17 \times 10^5 \\ \hline 3.37 \times 10^5 \end{array}$$

### Multiplying and Dividing:

Use the Exponent Laws for multiplying and dividing powers of the same base! When **multiplying, add** the exponents. When **dividing, subtract** the exponents. Multiply or divide the decimals normally. Make sure your answer is in proper Scientific Notation when you are done.

### Examples:

$$\begin{aligned} &(2.5 \times 10^4)(1.3 \times 10^3) \\ &2.5 \times 1.3 = 3.25 \\ &3.25 \times 10^7 \end{aligned}$$

$$\begin{array}{r} \frac{8.4 \times 10^8}{1.2 \times 10^3} \\ 8.4 \div 1.2 = 7 \\ 7 \times 10^5 \end{array}$$