Welcome to the ASTR 105G Lab!

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*All Class Notes are available at*
http://astronomy.nmsu.edu/mccleary/astr105.html
Lab #1: Tools for Success
a/k/a “The Math Lab”

Welcome to basic astronomy. Before we start, are there any questions?

Yeah, like, what makes astronomy different from astrology?

Lots and lots of math.

Astronomy 101.
Don’t Panic 😊
The Metric System

In astronomy (and in life) we encounter things that cover many different size scales:

- The width of a human hair
- The distance to Boston
- The length of the Milky Way

The metric system provides a standard way of describing all of these...
Width of a human hair:
0.00015 m = 150 µm

Distance to Boston:
4,000,000 m = 4000 km

Length of Milky Way:
950,000,000,000,000,000,000,000 m = 950,000,000,000,000,000,000,000 km
In astronomy, we also use other distance scales:

- The Astronomical Unit (AU): distance between Earth and Sun
- The Light Year: distance light travels in one year
In the metric system, we can easily convert from one scale to another:

The distance to the Moon is 384,000,000 m. What is it in kilometers?

1 km = 1000 m

384,000,000 m = 384,000 km
Because unit conversions can be tricky, we can express units as a series of factors.

For example, what is 73 mph in m/s?

\[
73 \text{ miles/hour} = \left( \frac{1 \text{ km}}{0.621 \text{ mile}} \right) \left( \frac{1000 \text{ m}}{1 \text{ km}} \right) \left( \frac{1 \text{ hour}}{3600 \text{ s}} \right) = 33 \text{ m/s}
\]

WRITE THIS OUT EVERY TIME until you are comfortable with unit conversions.
CHECK YOUR FREAKING UNITS

Before submitting an answer, ask yourself:

1) Did I write the units?
2) Do the units make sense?
Exponents are really just a shorthand way of expressing a number:

\[ 5^4 = 5 \times 5 \times 5 \times 5 = 625 \]

And the “square” of a number is just that number multiplied by itself:

\[ 3^2 = 3 \times 3 = 9 \]
Scientific Notation: Because Scientists are Lazy

Scientific Notation is another timesaver, this time a way of writing a number with lots of zeros:

\[ 950,000,000,000,000,000 \text{ km} = 9.5 \times 10^{17} \text{ km} \]

\[ 0.00015 \text{ m} = 150 \mu\text{m} = 1.5 \times 10^{-4} \text{ m} \]
All we have to do to express a long number in scientific notation is count how many times we move the decimal point to the first non-zero number, and write "x 10\(^{-}\)".

If we move the decimal point to the left, the blank is a positive number. If we move the decimal point to the right, it's a negative number.