College Bound Math Problems #22
week of April 20, 2015

Systems of Units and How they Relate to Exponents

We have the French revolutionaries to thank for the metric system and its use of exponents with base ten. Among the length units, there are a billion (10^9) nanometers in a meter and a thousand (10^3) kilometers in a megameter. That's a direct result of the fact that each unit is 10 times as big as the one before it. The names of the length units that are big enough for the human eye to see easily yet not too far for healthy human legs to walk easily are: the millimeter, centimeter, decimeter, meter, dekameter, hectometer and kilometer. (How many centimeters are there in a hectometer?)

British length units have a colorful history but are not so easy to deal with, as they do not proceed from one size to the next by factors of ten. Instead, we learn that 12 inches make a foot and 3 feet make a yard. Rods, chains, and furlongs have also seen considerable use. There are 5.5 yards in a rod, 4 rods to a chain and 10 chains to a furlong. Finally, a mile is 8 furlongs. You can still find horse race distances specified in furlongs. Notice that these numbers range from 3 to 12, so none of them is very far from 10.

On the land now called the USA, the British and their descendants had a big impact, and so we have been spending quite a few decades here struggling over the move to the more sensible decimal units. However, in the world scientific community, measurements of all kinds rely on powers of 10 and the international system of units is not called the IS (as English would have it) but the SI, for Système International d'Unités (which is French).

1. Go to http://en.wikipedia.org/wiki/Metric_prefix and look at the list of "Metric prefixes in everyday use" in the upper right corner. Write down the ones you know (you can include ones used in the first paragraph above). For each, state what power of 10 it represents and give a whole word for which it's the prefix.

2. Go to http://en.wikipedia.org/wiki/International_System_of_Units. Read the caption of the figure in the upper right corner. Also read the first paragraph of the page and the three-paragraph introduction to the "History" section. From all that information, make a 2-column table. Use column headings "Quantity" and "Unit." In the left column put the basic quantities (e.g., _time_) in their historical order. To the right of each quantity, put its corresponding SI base unit (e.g., _second_).

3. Look at the table at http://en.wikipedia.org/wiki/English_units#Dry_goods How many pecks are there in a bushel? How many cups in a gallon? Is this system of measurement units exponential in nature? If so, what is the base of the system? (Note: It is not ten.) Explain to your mentor.