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

Systems of Units and How they Relate to Exponents

0. The question at the end of the first paragraph: 100 centimeters make a meter and there are 100 meters in a hectometer, so there are 100 x 100 = 10,000 or **10^4** centimeters in a hectometer.

1. Surely(?) all students have seen the prefix "kilo-" somewhere, whether in kilogram, kilowatt or kilometer (think 10K race). Also pretty common are "centi-" in centimeter and "milli-" in milligram. Then there is the prefix "nano-" in nanometer a word that is gaining in use because it is approximately the scale of the fairly recent undertaking called nanotechnology. Non-existent only a few decades ago (or referring only to things that did not yet exist) are words that reflect the advance of digital memory (gigabytes in laptops, petabytes in the cloud) and computational speed (teraflops, etc)

2.

Quantity	Unit
length	meter (or metre)
mass	kilogram
time	second
electric current	ampere
temperature	kelvin
luminous intensity	candela
amount of substance	mole

Ties: length & mass; temperature & luminous intensity

3. There are 4 pecks in a bushel.

There are 16 cups in a gallon.

Yes, there is definitely an exponential aspect to the relationships among these units for measuring dry volumes. Every unit in the system is related to every other one by a power of 2, ranging from 2^1 = 2 up to 2^{15} = 16,384 and including every power in between; e.g., there are 2^7 cups in a bushel. This is pretty remarkable when you consider the mess that evolved in the units of distance and weight.

What the system lacks is the kind of prefix structure that problem #1 is about and that allows people to understand immediately what a new word like "megabyte" means (provided they've heard of a kilo*byte* and a *mega*ton).