Really Big Numbers Common Core Connections

Standards for Mathematical Practice

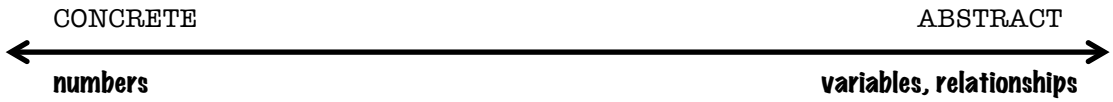
Math Teachers' Circles (hereafter MTCs) always engage in

1. Mak[ing] sense of problems and persevere in solving them.

We further almost always:

3. Construct viable arguments and critique the reasoning of others.

This particular session pushes participants to move from everyday magnitudes of numbers (up to, say, a million), to *Really Big Numbers*. It's easy to think along the lines of a continuum with CONCRETE on one end and ABSTRACT on the other and to assign "numbers" to the CONCRETE side and "variables" (and the like) to the ABSTRACT side.



The numbers we work with in this activity are so large that they represent a significant step into abstraction. We engage substantively different tools and processes when we compare these *Really Big Numbers*. As such, this activity also addresses:

2. Reason abstractly and quantitatively.

Numbers (of things, for instance) can be very concrete, yet the idea of "number" as well as extremely large and extremely small quantities are so unfamiliar to daily life that they may as well be abstractions. Hence, the continuum as shown above is problematic.

Standards for Mathematical Content

The nature of the activity is such that *Numbers and Operations in Base Ten* (NBT) is supported at many grade levels depending on how far into the text we go. Especially, however:

4.NBT.1: Recognize that in a multi-digit whole number, a digit in one place represents ten times what it represents in the place to its right.

4.NBT.2: Read and write multi-digit whole numbers using base-ten numerals, number names, and expanded form. Compare two multi-digit numbers based on meanings of the digits in each place, using >, =, and < symbols to record the results of comparisons.

4.NBT.3: Use place value understanding to round multi-digit whole numbers to any place.

5.NBT.1: Recognize that in a multi-digit number, a digit in one place represents 10 times as much as it represents in the place to its right and 1/10 of what it represents in the place to its left.

5.NBT.2: Explain patterns in the number of zeros of the product when multiplying a number by powers of 10, and explain patterns in the placement of the decimal point when a decimal is multiplied or divided by a power of 10. Use whole-number exponents to denote powers of 10.

8.EE.3: Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other. *For example, estimate the population of the United States as* 3×10^8 *and the population of the world as* 7×10^9*, and determine that the world population is more than 20 times larger.*

8.EE.4: Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities (e.g., use millimeters per year for seafloor spreading). Interpret scientific notation that has been generated by technology.