John Napier, Father of Logarithms

Scottish Mathematician, Born: Merchiston Castle, near Edinburgh, 1550.
Died: Merchiston Castle, April 4, 1617

John Napier was born into aristocracy and as a young lad, traveled throughout Europe. Napier was considered a bit "odd", inventing, but not building, war machines and believing in astrology and divination. In 1594, Napier thought about a new way of calculating. It occurred to him that all numbers could be written as powers of some base, and multiplying the numbers would be the equivalent of adding the powers. Thus multiplying could be replaced by adding, dividing could be replaced by subtracting, powers could be replaced by multiplying and roots could be replaced by dividing.

Napier spent twenty years working out tables for these exponents which he called "logarithms" (proportional numbers). We still use this name today. He published his tables in 1614, and the effect then, on science and mathematics, was similar to the effect computers have had on modern day calculating.

Here is an example of what logarithms could do for arithmetic questions:

Question Type	Question	Using Exponents	Using Logarithms	Answer
Multiplication	**2 345 x 17 958**	$\mathbf{10^{3.37014} \times 10^{4.25458} = 10^{3.37014 + 4.25426} = 10^{7.6244} = 42\ 111\ 431}$	Log (2 345 x 17 958) = Log (2 345) + log (17 958) =3. 37014 + 4. 25458 = 7. 6244. Anti-log (7. 6244) = 42 111 431	42 111 510
Dividing	**35 276 ÷ 23.57**	$\mathbf{10^{4.54748} \div 10^{1.372360} = 10^{4.54748 - 1.372360} = 10^{3.17512} = 1\ 496.\ 649}$	Log (35 276 ÷ 23.57) = Log (35 276) – log (23.57) =4. 54748 – 1. 372360 =3.17512. Anti-log (3.17512) = 1 496. 649	1 496. 648
Powers	$\mathbf{47.23^{8}}$	$\mathbf{(10^{1.674218})^{8} = 10^{1.674218 \times 8} = 10^{13.393744} = 2.47596214 \times 10^{13}}$	**Log(47.23^{8}) = 8 x Log(47.23) = 8 x 1.674218 = 13.393744. Anti-Log(13.393744) = 2. 47596214**	$\mathbf{2.4795966 \times 10^{13}}$
Finding Roots	$\sqrt[12]{2} =$	$\sqrt[12]{2} = \sqrt[12]{10^{0.301030}} = 10^{\frac{0.301030}{12}} = 10^{0.250858333} = 1.059463095$	$Log\left(\sqrt[12]{2}\right) = \frac{\log(2)}{12} = \frac{0.301030}{12} = 0.250858333$ Anti-Log(0.250858333) = 1. 059463095	**1.059463094**

Using log (2 345) + log (17 958) = 7.624400814, we get $\mathbf{10^{7.624400814}}$ = 42 111 510, so the more decimal places you keep, the more accurate are your answers. This is the same for all four examples.

Taking this to the next level, the mathematician William Oughtred (English, 1575 – 1660), invented the slide rule by taking two rulers that had been marked by logarithmic scales. By sliding the two rulers, one "added" the

logarithms and could read off the answer. This device, called the "slide rule", became the most important tool in the arsenal of all Mathematicians and Scientists for the next 360 or so years. I went through University in the sixties with a table of logs, powers and roots, and my trusty slide rule from 1965 to 1970.

During the 1970 – 1971 teaching year, I purchased my first calculator that could add, subtract, multiply and divide plus store and recall one number at a time, in memory for about $70. It did not have a square root button, so I used Newton's Method for square roots that I had written a computer program in Fortran for in 1968. I could divide and put results into and out of the memory on my calculator and could find a square root to about 5 or 6 decimal places within 30 seconds. I was so proud of myself! Of course, the next year, a calculator with the square root key in place could be purchased for $50. By then, I stupidly, gave away my slide rule. I wish I still had it, so I could keep it with my abacus and other memorabilia that I have. Yesterday (July 21, 2009) I was watching the movie "Apollo 13" on the television, that dramatically showed the 1970 voyage to the moon, that had to be aborted. During the harrowing work at Houston NASA centre to help the astronauts get back, the film zoomed into an Engineer checking calculations on his slide rule!! A year later, they were obsolete, but they had had about a 360 year run.

As an addition, Napier also invented the decimal point and our present system of decimal representation. Oughtred invented the multiplication sign (x) and the present abbreviations of cos, sin and tan, for sine, cosine, and tangent.

If you want a slide rule, but do not want to purchase one on Ebay, then go to the following website and download a pdf. You then print out on paper, a model that can be turned into a working slide rule.

http://axum.tripod.com/sliderule.pdf