Johann Karl Friedrich Gauss – One of the Top Three

German Mathematician, born April 30, 1777, died February 23, 1855

Son of a gardener, was a prodigy capble of great feats of memory and mental calculations. At the age of three, he corrected his father's calculations for a payroll sheet. At the age of ten, his teacher J. G. Burtner, felt his class was a bit rowdy and asked them to takeout their slates and find the sum of the first one hundred numbers. Guass looked at the problem $1 + 2 + 3 + 4 + \ldots + 97 + 98 + 99 + 100$, and soon realized that he could form pairs 1 + 100, 2 + 99, 3 + 98, 4 + 97, etc that all had the sum of 101. Since there were 50 pairs, the answer must be 101 x 50 or 5 050.

By his early teens, Gauss had worked out two methods to find square roots to as many as 50 decimal places, and was finding errors in logarithm tables. At 14, his teachers began to learn from him. He entered University of Gottinegen in 1795. While still in his teens he worked out the method of least squares and used it to find the orbit of Ceres while in his early twenties.

Also at University, he demonstrated a method for constructing an equilateral polygon of 17 sides using only a straight edge and a compass. He then extended this to show that only some number of sides could be done this way, for instance a 7-sided polygon could not. This was the first case of a geometric construction being proved impossible.

Gauss soon was labeled the greatest mathematician of his time, and now, along with Archimedes and Newton considered to be one of the three top mathematicians in history. Gauss did important work on the Theory of Numbers, and in Non-Euclidean Geometry. In 1799, Gauss proved the Fundamental Theorem of Algebra that every algebraic equation has a root in the form of a + bi, where "a" and "b" are real numbers, and "i" is the square root of -1, the imaginary number. If the equation was of degree "n", it had exactly "n" roots in the complex number system. He went on to show how these "complex" numbers could be plotted on a plane. This earned him his doctorate. In 1801, he followed this work up with the Fundamental Theorem of Arithmetic, that every natural number could be written as a product of primes in one and only one way.

Also during his University years he gave the first approximation for $\pi(n)$, the number of prime numbers less than "n". We bumped into this when talking about internet security on Friday, April 24th. Gauss proposed the following: $\pi(n) \approx \frac{n}{\ln(n)}$ where ln(n) is the natural logarithm of "n".

One of the great debates in mathematics surrounds Gauss. In 1817, at the age of forty, he did a lot of preliminary work in the Non-Euclidean Geometry, but did not publish it, as he withheld a lot of his work until he was absolutely sure it would be received positively. In 1832, Gauss learned that his friend's son, the Hungarian mathematician Janos Bolyai, published work in this field. Gauss, when asked for praise by the father, replied that he would "have to praise himself", for he had done it 14 years earlier! At the same time, a Russian mathematician Nikolai Lobachevski, had published, in Russian, his version of Non-Euclidean Geometry in 1829. So, who should get credit, Gauss, first, but unpublished, Lobachevski, the first to publish or Bolyai, who published independently. I vote for Lobachevski, but the jury is still out.

Gauss also did work in trigonometry, new surveying techniques, monetary investments, terrestrial magnetism and so on. There is a scientific word "DeGaussing" that is named after him. In working with surveying it is reported that Gauss handled more than one million pieces of numeric data by himself. Gauss died on Feb 23, 1855, two months short of his seventy-eighth birthday. His investments paid off as his estate was equal to two hundred times his annual income!

I have used Isaac Asimov's Biographical Encyclopedia of Science and Technology and Stephen Hawkins, Godd Created the Integers to put together this little blog.