

## CARL FRIEDRICH GAUSS (1777-1855)–Chronology

1777- September 30- Gauss born in Brunswick, main city of the Duchy of Brunswick-Wolfenbüttel. His father was a former small farmer turned urban laborer, his mother from a family of stonemasons.

1791- Introduced to the Duke of Brunswick, who awards him an annual stipend (scholarship); Gauss would receive financial support from the Duke until 1806.

1792-1795- Secondary studies at the Gymnasium Carolineum (Brunswick). Reads enough mathematics on his own (Newton, Euler, Lagrange) that he can begin to engage in original research.

1795-1798- Studies at the recently established U. of Göttingen, chosen for its good library and science orientation. Befriends Wolfgang Bolyai (philosophy student), learns independently. In the fall of 1798, he leaves without a diploma and returns to Brunswick.

1796-1801- keeps a mathematical diary, 146 entries; the first entry is on the heptadecagon. Thinks about the distribution of prime numbers (among many other topics), works on *Disquisitiones*.

1799- Submits (at the Duke's request) a doctoral dissertation to the U. of Helmstedt, containing a proof of the Fundamental Theorem of Algebra.

1801-Publication (in Leipzig) of *Disquisitiones Arithmeticae*, the foundational work of algebraic number theory. There are seven sections: the first three are a general introduction to the arithmetic of congruences; section 4 deals with quadratic reciprocity. Section 5 is the core of the work, dealing with the theory of binary quadratic forms over the integers, followed by a section with applications. Section 7 is on cyclotomy (division of the circle, or roots of unity).

1798-1807- Lives in Brunswick; contact with astronomers Zach and Olbers. During this period, G. develops an interest in mathematical and observational astronomy, and the idea of working as an astronomer, rather than a math professor. An early success was the prediction of the position of the asteroid Ceres, first observed in January 1801. Gauss's orbit forecast (September) was very different from others, and was confirmed by observations in December. Corresponds with Bessel (5 yrs. younger).

1805- Marriage to Johanna Osthoff. She would die after giving birth to their second child in 1809 (the boy died a few months later); on the same year, Gauss marries Minna Waldeck, daughter of a law professor at Göttingen.

1806-Napoleon occupies the western German states; the Duchy of Brunswick is dissolved, and incorporated into Napoleon's Kingdom of Westphalia.

1807- Accepts position at Göttingen, (on Olbers' recommendation), where he would be in charge of the new observatory, with no teaching duties.

1809- Treatise on celestial mechanics- *Theoria motus*, dealing with the problem of computing the orbital parameters of a conic section from a minimum of observations, based on Kepler's laws.

1812-c.1818- work on elliptic integrals, the arithmetic-geometric mean, and hypergeometric functions- most of it unpublished, or published posthumously.

1818-1832- personally directs the geodetic survey of the Kingdom of Hanover. This leads to two publications in theoretical geodesy, *Determination of the latitude difference between Göttingen and Altona* (1828), which includes a development of the theory of least-squares fitting of data (linear regression), and *Investigations on the foundation of higher geodesy* (1843), based on the conformal mapping of an ellipsoid to a sphere. The geodesy work also rekindles an interest in the foundations of the geometry, from a practical standpoint (trigonometric calculations if physical space is not Euclidean, but, say, hyperbolic.)

1823-Copenhagen Prize Essay- general conformality criterion for mapping between two arbitrary surfaces, using the Cauchy-Riemann equations.

1828- *General investigations on curved surfaces*, Gauss's main work on differential geometry. Introduces the 'Gaussian curvature' and the program of investigating intrinsic differential geometry.

1828, 1832- Two papers on the law of biquadratic reciprocity.

1829- Two short papers in mathematical physics: one on a 'principle of least constraint' in mechanics, another on the equilibrium shape of a fluid touching the walls of a container (capillarity).

1831- Death of Gauss's second wife Minna, who had been sick and unhappy for the previous 10 years. Gauss had two surviving children from his first marriage (Joseph and Minna), and three from his second (Eugen, Wilhelm and Therese). Eugen and Wilhelm had a difficult relationship with their father, and eventually emigrated to North America. Therese stayed with Gauss, and kept house for him until his death. Minna died in 1840, age 33.

1831- Wilhelm Weber joins the Göttingen faculty as professor of physics; this marks the beginning of Gauss's systematic research in physics, especially potential theory.

1832- Investigations on terrestrial magnetism, encouraged by Weber and Alexander v. Humboldt. The goal was to map out the magnetic field of the earth, including local and temporal variations. This led to three foundational papers on geomagnetism (1832, 1839, 1840), to the establishment of a magnetic observatory (1833) and to the publication of the first geomagnetic atlas, compiled by Gauss and Weber.

1838- First functioning electromagnetic telegraph, developed by Gauss and Weber, is built in Göttingen, connecting the Astronomical Observatory (Gauss) and Weber's lab (distance: 5,000 ft.)

1837-1838 William IV, the Hanover king of England, dies and the crown passes to Victoria, ending the dynastic link between Hanover and England. Ernst Augustus becomes king of Hanover, and sets aside the liberal constitution granted four years earlier. Seven Göttingen professors, including the brothers Grimm (philologists), Weber, and Ewald (Gauss's son-in-law) refuse to sign an oath of allegiance to the new constitution, and are dismissed. Weber quickly gets a position in Leipzig; this was a serious loss for Gauss.

1854- Riemann delivers his inaugural lecture at Göttingen, on the hypotheses that lie at the foundations of geometry- a topic picked by Gauss.

1855- Gauss dies (heart failure), February 23. His brain has been incorporated in the anatomical collection of the University of Göttingen.

