Charles Picard

French mathematician **Charles Émile Picard** (July 24, 1856 – December 11, 1941) applied mathematical principles of analysis to the study of elasticity, heat, and electricity. He furthered the work of G.F.B. Riemann in relating the study of integrals to algebraic geometry and using methods of successive approximations, he showed the existence of solutions of ordinary differential equations. As a student at the Lycée Napoléon, Picard hated geometry, claiming he "… learned it by heart to avoid being punished." It wasn't until after completing his secondary studies that he read an algebra book and became fascinated with mathematics. He was born in Paris, where his father was the manager of a silk factory. The latter died during the siege of Paris at the time of the Franco-Prussian War. It was the first of many personal tragedies for Picard. His two sons and a daughter were all killed in WWI and his grandsons were wounded in WWII and captured by the Germans.

Picard's mother, a daughter of a medical doctor was determined that her son receive a good education and to ensure this she went to work to support him. After secondary school, Picard took entrance examinations for both the École Polytechnique, which prepared mostly engineers, and the École Normale Supérieure, which was the best place to go if one wished to pursue a purely scientific career. A visit to the chemist and microbiologist Louis Pasteur convinced Picard to choose the École Normale. He finished first in his university examination in 1877 and remained at the École for a year as an assistant. In 1878, he was appointed a lecturer at the University of Paris and the next year became professor at Toulouse. He returned to the École Normale in 1881 as lecturer in mechanics and astronomy. The same year he was nominated for membership in the mathematics section of the

Académie des Sciences. Despite having already proved two important theorems now named for him, Picard was considered too young to gain admission to the academy and had to wait eight more years to achieve the honor.

Picard's youth got in his way again in 1885 when he was appointed to the chair of differential calculus at the Sorbonne in Paris. He had to accept the position of his own assistant to get around the University rule that one had to be at least thirty to hold a chair. Two years later, he exchanged his chair for that of analysis and higher algebra so that he might have research students. Picard made major contributions to the fields of algebraic geometry, group theory and analysis. His masterpiece was the three-volume *Traité d'analyse*, published between 1891 and 1896. He co-authored the two volumes *Théorie des fonctions algébriques de deux variables indépendantes* (1897, 1906) with George Simart. He also published many of Charles Hermite's works. Picard's wife was Marie Hermite, the daughter of Charles Hermite.

Jacques Hadamard praised Picard for the "perfection of his teaching." During WWI, the role of the pure sciences was to produce first-class engineers. Between the years 1894 and 1937, Picard trained more than 10,000 engineers at the École Centrale des Arts et Manufactures. He was a bit concerned that after the war, young mathematicians would opt to work in applied rather than pure mathematics. Picard was awarded the *Poncelet Prize* in 1886 and the Grand Prix des Sciences Mathématiques in 1888. He became the permanent secretary of the Paris Academy of Sciences from 1917 until his death. In 1932 Picard received the Grande Croix de la Légion d'Honneur and in 1937 the Mittag-Leffler Gold Medal.

If the derivative of a single-valued complex function exists at all points of a region, it is said to be *analytic* in the region and is called an analytic function. A function that is analytic everywhere in the finite plane is called an *entire* function or an *integral* function. The functions e^z, sin z and cos z are

entire functions. At age 23, Picard showed that an entire function can omit no more than one finite value without being reduced to a constant function, and if there exist at least two values, each of which is taken on only a finite number of times, the function is a polynomial. Otherwise the function takes on every value, other than the exceptional one, an infinite number of times. His beautiful proof of what is known as Picard's Big Theorem used his father-in-law's theory of modular functions and took only five lines. If the function is *meromorphic*, that is a function analytic everywhere in a finite plane except at a finite number of poles, infinity being an admissible value, at most two values can be omitted without the function reducing to a constant. Although Picard's Little Theorem, that an integral function of a complex variable takes on every finite value, with one possible exception, was proved earlier, it is a corollary of his big theorem.

Quotation of the Day: "If Newton and Leibniz had thought that continuous functions do not necessarily have a derivative – and this is the general case – the differential calculus would never have been created." – Émile Picard