NIKOLAI IVANOVICH LOBACHEVSKY

Nikolai Ivanovich Lobachevsky (December 1, 1792 – February 24, 1856), called the "Copernicus of Geometry," revolutionized the subject by helping to create a whole new branch, non-Euclidean geometry. His father died when Nikolai was seven and his mother moved her very poor family from Nizhny Novgorod to the city of Kazan at the edge of Siberia. Nikolai attended the Gymnasium, financed by a government scholarship, and in 1807 entered Kazan State University, which had been founded in 1804, as a result of reforms by Czar Alexander I. Lobachevsky originally intended to study medicine, but, influenced by distinguished professors whom the university had attracted from Germany, he took a broad scientific course involving mathematics and physics. In 1811 he received a Master's degree in physics and mathematics. At the age of twenty-one, Lobachevsky became a member of the teaching staff.

By 1827 Lobachevsky had been appointed Rector of the university, a post he would hold for the next 19 years. Under Lobachevsky's leadership a new library was built as well as an astronomical observatory, new medical facilities, and physics, chemistry and anatomy laboratories. In addition to his heavy administrative duties and his research he continued to teach a variety of course in mechanics, hydrodynamics, integration, differential equations, the calculus of variations, and mathematical physics. In 1832 he married Lady Varvara Alexivna Moisieva, who came from a wealthy family. At the time of the marriage he was forty years old and she was just a young girl. The union produced seven children. In 1846 the government removed him from his positions with the university. His last years were saddened by his blindness and his lack of recognition and appreciation in the mathematical communities of Europe. He died in 1856 not knowing of the fame and recognition his work would

receive.

Some historians of mathematics speculate that Martin Bartels, who had taught Carl Friedrich Gauss and regularly corresponded with him, inspired his pupil Lobachevsky's interest in the "parallel postulate problem." Whatever caused Lobachevsky to take the revolutionary view that in denying Euclid's fifth postulate he was creating a new and valid geometry; in 1823 he drew up an outline of geometry, apparently for use in a course. In it he declared, "no rigorous proof of the truth of this [the parallel postulate] had ever been discovered." This would seem to indicate he still allowed for the possibility that a proof might be found. But in an 1826 paper, he presented many characteristic theorems of what would be his new geometry.

Sometime between 1826 and 1829, Lobachevsky became convinced that Euclid's fifth postulate could not be proved on the basis of the other postulates. In 1829 he published "On the Principles of Geometry" in the *Kazan Messenger,* marking the official birth of non-Euclidean geometry. With his paper, he became the first mathematician to take the revolutionary step of publishing a geometry built on an assumption in direct conflict with the Parallel Postulate. He was certain his geometry was valid, but as it seemed contrary to common sense (at least of the time), he called it "imaginary geometry." During the years from 1835 to 1855, Lobachevsky wrote three full accounts of the new geometry. The clearest statement of his geometry was found in the book *Geometric Investigations on the Theory of Parallels,* originally published in German in 1840, and in translation in 1891 and 1914. A statement of his completed work appeared in *Pangéométrie*, published in Russian and French in 1855.

János Bolyai and Carl Friedrich Gauss, the other co-discoverers of non-Euclidean geometry, were

unaware of Lobachevsky's work because Russian journals and Russian texts were neither well known nor read in the mathematical centers of Western Europe. Gauss finally learned of Lobachevsky's work when *Geometrical Investigations on the Theory of Parallels* appeared. He praised Lobachevsky's work and recommended that the Russian be elected to the Göttingen Scientific Society, but he never corresponded with Lobachevsky nor commented on his work publicly. If János Bolyai was disappointed, in 1832, when Gauss announced that he had made the exact same discoveries, only earlier, the Hungarian was crushed when he learned in 1848 that Lobachevsky had also discovered the new geometry and had published his results many years earlier.

Although Lobachevsky would seem to have the best claim to priority in the creation of non-Euclidean geometry, the mathematical world honors all three of the men for its introduction. The "imaginary geometry" of Lobachevsky has since been more appropriately named "hyperbolic geometry." Support for the new geometries was slow in developing and it wasn't until at least a decade after Lobachevsky's death that prominent mathematicians such as Eugenio Beltrami, Karl Weierstrass, Felix Klein, Sophus Lie, and Henri Poincaré took up the cause of non-Euclidean geometry and not only made it acceptable in mathematical circles, but showed it was as consistent as Euclidean geometry and had many important applications. Lobachevsky's geometry provided relativity theory with a natural mathematical foundation.

Quotation of the Day: "In geometry I find certain imperfections which I hold to be the reason why this science, apart from the transition into analytics, can as yet make no advance

from that state in which it has come to us from Euclid." – Nikolai Ivanovich Lobachevsky