system which would combine strength with political liberty— we shall find it difficult to overrate the importance of his contri­bution to the solution of the most complex political problem of modern times.

The chief authority on Stein is the biography by G. H. Pertz (6 vols., 1849-1855), but few English readers will find the need of going beyond the admirable *Life of Stein*, by Sir John Seeley (3 vols., Cambridge, 1878), which contains a full bibliography. These works are corrected at a few points by Max Lehmann’s *Leben Steins* (Leipzig, 1902-1903). For side-lights on his career and character, see H. F. K., Baron vom Stein, *Lebenserinnerungen* (Hagen, 1901); C. T. Perthes, *Politische Zustände und Personen in Deutschland zur Zeil der französischen Herrschaft* (2 vols., Gotha, 1862); *Denkwürdigkeiten des Staatskanzlers Fürsten von Hardenberg,* ed. by L. von Ranke (5 vols., Leipzig, 1877); Varnhagen von Ense, *Denkwürdigkeiten* (6 vols., Mannheim, 1837-1842; English ed., London, 1847); A. Stern, *Abhandlungen und Aktenstücke aus der preussischen Reformzeit 1807-1815* (Leipzig, 1885); Μ. Philippson, *Geschichte des preussischen Staatswesens 1786-1813* (2 vols., Leipzig,

1880) ; Μ. Lehmann, *Knesebeck und Schön* (Leipzig, 1875); J. P. Hassel, *Geschichte der preussischen Politik, 1807-1815* (Leipzig,

1881) ; the Vicomte Jean d’Ussel, *Études sur Vannée 1813; la défec­tion de la Prusse* (Paris, 1907). (J. Hl. R.)

**STEINER, JAKOB** (1796-1863), Swiss mathematician, was born on the 18th of March 1796 at the village of Utzendorf (canton Bern). At eighteen he became a pupil of Heinrich Pestalozzi, and afterwards studied at Heidelberg. Thence he went to Berlin, earning a livelihood there, as in Heidelberg, by giving private lessons. Here he became acquainted with A. L. Crelle, who, encouraged by his ability and by that of N. H. Abel, then also staying at Berlin, founded his famous *Journal* (1826). After Steiner’s publication (1832) of his *Systematische Entwickelungen* he received, through Jacobi’s exertions, who was then professor at Königsberg, an honorary degree of that university; and through the influence of G. J. Jacobi and of the brothers Alexander and Wilhelm von Humboldt a new chair of geometry was founded for him at Berlin (1834). This he occupied till his death, which took place in Bern on the 1st of April 1863.

Steiner’s mathematical work was confined to geometry. This he treated synthetically, to the total exclusion of analysis, which he hated, and he is said to have considered it a disgrace to synthetical geometry if equal or higher results were obtained by analytical methods. In his own field he surpassed all his contemporaries. His investigations are distinguished by their great generality, by the fertility of his resources, and by such a rigour in his proofs that he has been considered the greatest geometrical genius since the time of Apollonius.

Tn hïs *Systematische Entwickelung der Abhängigkeit geometrischer Gestalten von einander* he laid the foundation of modern synthetic geometry. He introduces. what are now called the geometrical forms (the row, flat pencil, &c.), and establishes between their elements a one-one correspondence, or, as he calls it, makes them projective. He next gives by aid of these projective rows and pencils a new generation of conics and ruled quadric surfaces, “ which leads quicker and more directly than former methods into the inner nature of conics and reveals to us the organic connexion of their innumerable properties and mysteries.” In this work also, of which unfortunately only one volume appeared instead of the projected five, we see for the first time the principle of duality introduced from the very beginning as an immediate outflow of the most fundamental properties of the plane, the line and the point.

In a second little volume, *Die geometrischen Constructionen ausgeführt mittelst der geraden Linie und eines festen Kreises* (1833), republished in 1895 by Öttingen, he shows, what had been already suggested by J. V. Poncelet, how all problems of the second order can be solved by aid of the straight-edge alone without the use of compasses, as soon as one circle is given on the drawing-paper. He also wrote *Vorlesungen über synthetische Geometrie,* published posthumously at Leipzig by C. F. Geiser and H. Schroeter in 1867; a third edition by R. Sturm was published in 1887-1898.

The rest of Steiner’s writings are found in numerous papers mostly published in *Crelle's Journal,* the first volume of which contains his first four papers. The most important are those relating to algebraical curves and surfaces, especially the short paper *Allgemeine Eigenschaf ten algebraischer Curven.* This contains only results, and there is no indication of the method by which they were obtained, so that, according to L. O. Hesse, "they are, like P. Fermat’s theorems, riddles to the present and future generations.” Eminent analysts succeeded in proving some of the theorems, but it was reserved to L. Cremona to prove them all, and that by a uniform synthetic method, in his book on algebraical curves. Other important investigations relate to maxima and minima. Starting from simple elementary propositions, Steiner advances to the solution of problems which analytically require the calculus of variation, but which at the time altogether surpassed the powers of that calculus. Connected with this is the paper *Vorn Krümmungsschwerpuncte ebener Curven,* which contains numerous properties of pedals and roulettes, especially of their areas.

Steiner’s papers were collected and published in two volumes *(Gesammelte Werke,* 1881-1882) by the Berlin Academy.

See C. F. Geiser’s pamphlet *Zur Erinnerung an J. Steiner* (Zurich, 1874).

**STEINMETZ, KARL FRIEDRICH VON** (1796-1877), Prussian general field-marshal, was born at Eisenach on the 27th of December 1796 and educated at the cadet school of Stolp in Pomerania from 1807 to 1811, in the midst of the misery and poverty caused by the French occupation. At the outbreak of the War of Liberation he and his elder brother made their way through the French posts to Breslau, where, in spite of their poverty, they were at once appointed to the army, the elder as ensign on probation, the younger to the substantive rank of second lieutenant. After a vain attempt to obtain a transfer to the Blücher Hussars, for which regiment he had conceived an intense boyish admiration when it was quartered at Stolp, he was ordered to report himself to York, who treated him and the other officers sent from Breslau with coldness, until young Steinmetz asked “ when he was to return to the king who had sent him ?” The brothers took part in the hardest fighting of the campaign of 1813, the elder being killed at Leipzig and the younger being more than once wounded. The short halt on the Rhine he utilized in improving his military and general education. In the battles in France he won the second class of the Iron Cross. After the peace he entered Paris but once, fearing to infringe upon the ten ducats that he saved monthly from his pay to send to his mother. For the same reason he held aloof from the pleasures of his more fortunate comrades. His avoidance of youthful excesses enabled him to overcome his earlier bad health and to acquire a physical vigour which he kept to the end of his long career as a soldier. His character as well as his physique was strengthened by his Spartan way of life, but his temper was naturally embittered by the circumstances which imposed this self-restraint. His poverty and want of influence were the more obvious as he was, shortly after the wars, assigned to the 2nd Foot Guards, stationed in Berlin. He rigorously devoted himself to study and to the routine duties of his profession. From 1820 to 1824 he studied with distinction at the General War Academy, and was at the end of the course appointed to the topographical section of the general staff. General von Müffling reported pf him that he was arrogant and that he resented “ encouragement” —which he probably regarded as patronage—but that his ability would enable him to out­distance his comrades. Steinmetz was too poor to mount himself on the small allowance granted to general staff officers, and had to remain with his regiment in consequence. But shortly after this his marriage to his cousin Julie, the daughter of Lieutenant-General K. F. F. von Steinmetz (1768-1837), not only tempered his fierce and resentful state of mind, but in a measure improved his material prospects, for his father-in-law was generous to the young couple, and his appointment as captain at the Guard Landwehr dépôt at Potsdam, near where the general lived, brought them into daily contact. His brigade commander too, General von Röder, was an excellent soldier, and Steinmetz often spoke in later days of the thorough training he received at his hands. After this from about 1830 his regimental work and his promotion went on without incident for several years in various garrisons, until in 1839 he became major and battalion commander. In this position he had many official differences with his immediate superiors, for he urged a strenuous war train­ing for the troops, in season and out of season, too vigorously for his more conservative comrades, but off parade his relations with all, thanks chiefly to the social gifts of his wife, were of the most pleasant character. In 1848 he was in command of a guard hattalion during the disturbances in Berlin, but was not engaged, and soon found more active employment in the Danish