

Kirkman, Thomas Penyngton | Encyclopedia.com

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(*b.* Bolton, England, 31 March 1806; *d.* Croft, near Warrington, England, 3 February 1895)

mathematics.

Raised in an unscholastic mercantile family, Kirkman had to struggle for a decent education, and even so he received no instruction in mathematics at any level. He earned an arts degree at Dublin University in 1833 (M.A., 1850), and was ordained into the [Church of England](#), becoming rector at Croft, Lancashire. Nominally, this was his life's work, for there the Reverend Mr. Kirkman tended his parish and defended his creed by sermon and pamphlet for more than fifty years. But he also taught himself mathematics with a thoroughness and insight that propelled him swiftly to the frontiers of current research and earned him the admiration and friendship of Cayley, De Morgan, and [William Rowan Hamilton](#). He was elected to the [Royal Society](#) in 1857. Kirkman was a good linguist and an individualistic writer, if perhaps overly fond of neologisms and stylistic gimmickry. He delighted in versifying problems and in devising mnemonics for troublesome formulas—in fact he wrote a whole book on this topic.

Kirkman's interests extended to the controversies of the times, and he was fierce in his opposition to the new materialistic trends. [Herbert Spencer](#)'s philosophy aroused his especial contumely, and his satiric paraphrase of Spencer's definition of evolution is a notable example of a Kirkmannerism. Spencer, he wrote, was really defining the concept as "a change from a nohowish untalkaboutable all-likeness, to a somehowish and in-general-talkaboutable not-all-likeness, by continuous somethingelseifications and sticktogetherations."

His mathematical work contributed to five topics then in infancy: topology, group theory, hypercomplex numbers, combinatorics, and knots. He also wrote lengthily on a very old topic: polyhedra (or, as he insisted, on calling them, *polyedra*). Hamilton's discovery of quaternions stimulated Kirkman to one of the earliest attempts to extend the notion further, and he named his new numbers *pluquaternions*. It is, however, in combinatorics that Kirkman's name is now best known, and his Fifteen Schoolgirls Problem and its variations became and remained famous. (Essentially, it concerns ways of rearranging a sevenfold 5×3 array of distinct objects, with the restriction that the triples are individually unique and collectively comprehensive.) Many other problems of this nature were first enunciated and solved by Kirkman.

BIBLIOGRAPHY

Fifty-nine of Kirkman's chief papers are listed in the Royal society *Catalogue of Scientific Papers*. Three of note are "On Pluquaternions and Homoid Products of n Squares," in *Philosophical Magazine*, **33** (1848), 447-459, 494-509; "Application of the Theory of Polyedra to the Enumeration and Registration of Results," in *Proceedings of the Royal Society*, **12** (1862-1863), 341-380; and "The Complete Theory of Groups, Being the Solution of the Mathematical Prize Question of the [French Academy](#) for 1860," in *Memoirs and Proceedings of the Manchester Literary and Philosophical Society*, **4** (1865), 171-172.

His Fifteen Schoolgirls Problem was first posed in the *Lady's and Gentleman's Diary* (1850), p. 48, and it is thoroughly discussed in W. W. R. Ball, *Mathematical Recreations and Essays*, revised by H. S. M. Coxeter, 11th ed. (London, 1939).

Only recently has the generalized problem (for $6n + 3$ girls) been solved: "Solution of Kirkman's Schoolgirl Problem," in D. K. Ray-Chaudhuri and R. M. Wilson, *Combinatorics*, Vol. XIX of *Proceedings of Symposia in Pure Mathematics* (Providence, R. I., 1971).

Some miscellaneous publications of Kirkman's are cited in *Memoirs and Proceedings of the Literary and Philosophical Society*, **9** (1894-1895), 241-243, preceded by a short memoir on the author. A fuller account of the man and his work is Alexander Macfarlane, *Lectures on Ten British Mathematicians of the Nineteenth Century* ([New York](#), 1916), pp. 122-133.

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