

catorie to the Giddie Multitude,' in which there is a reference to 'Justice Shallowe' and 'his cousin Mr. Weathercocke.'

[Grosart's Reprint of the Flea, 1877; Arber's Transcript of the Stationers' Register; Gray's Index to Hazlitt.] E. I. C.

WOODHOUSE, ROBERT DE (d. 1345?), treasurer of the exchequer. [See WOODHOUSE.]

WOODHOUSE, ROBERT (1773-1827), mathematician, born at Norwich on 28 April 1773, was the son of Robert Woodhouse, a linendraper and freeholder in the town, by his wife, the daughter of J. Alderson, a nonconformist minister of Lowestoft, who was the grandfather of Sir Edward Hall Alderson [q.v.] and of Mrs. Amelia Opie [q.v.]. He was educated at the grammar school at North Walsham, and was admitted to Caius College, Cambridge, on 20 May 1790, graduating B.A. in 1795 as senior wrangler, and M.A. in 1798. In 1795 he was also first Smith's prizeman. He held a scholarship at Caius College from 1790 to 1798, and a fellowship from 1798 to 1823, and after graduating devoted himself to the study and teaching of mathematics. On 16 Dec. 1802 he was elected a fellow of the Royal Society.

Woodhouse is entitled to distinction in the history of mathematics in England for the important share he had during his earlier years as a teacher at Cambridge in bringing to the notice of his countrymen the development in mathematical analysis which had taken place on the continent. He was the first in England to explain and advocate the notation and methods of the calculus. In 1803 he published 'The Principles of Analytical Calculation' (Cambridge, 4to). [In this work he reviewed the methods of infinitesimals, limits, and expansions, and severely criticised the principles adopted by Lagrange in his theory of functions, regarding them as logically insufficient. By thus exposing the unsoundness of some of the continental methods he rendered his general support of the system far more weighty than if he had appeared to embrace it as a blind partisan. 'The Principles of Analytical Calculation' was followed in 1809 by 'Elements of Trigonometry' (Cambridge, 8vo; 5th edit. 1827, 8vo), a work which, according to George Peacock (1791-1858) [q.v.], 'more than any other contributed to revolutionise the mathematical studies of this country.' In his former work he had appealed, somewhat fruitlessly, to the teacher, but in his 'Trigonometry' he more successfully addressed the student and prepared the way for the introduction of the differential calculus. In 1810 appeared 'A

Treatise on Isoperimetrical Problems and the Calculus of Variations' (Cambridge, 8vo), in which he traced the course of continental research from the earliest isolated problems of the Bernoullis to the development of Lagrange's comprehensive theory. In 1812 he published a 'Treatise on Astronomy' (Cambridge, 8vo), which was intended as the first volume of a more extended work. A second volume followed in 1818 on the theory of gravitation, somewhat improperly entitled 'Physical Astronomy.' In this treatise he endeavoured to lay before the student the results of continental research since the time of Newton.

In 1820 Woodhouse was elected to succeed Isaac Milner [q.v.] as Lucasian professor of mathematics; and in 1822, on the death of Samuel Vince [q.v.], he was removed to the Plumian professorship of astronomy and experimental philosophy. On the completion of the observatory at Cambridge he was appointed its superintendent; but, though he possessed a genuine love of practical astronomy, he was hardly able to carry out his duties owing to the failure of his health. He died at Cambridge on 28 Dec. (or, according to some authorities, 23 Dec.) 1827, and was buried in the chapel at Caius College. In 1823 he married Harriet, daughter of William Wilkins, an architect of Norwich, and sister of the architect William Wilkins [q.v.]. By her he left a son Robert.

Woodhouse is entitled to the entire credit of introducing the calculus into England, but it is doubtful whether he alone, in spite of his logical power and his caustic wit, would have succeeded in converting his contemporaries. Much of his success was due to the earnest support of his three disciples, George Peacock, Herschel, and Charles Babbage [q.v.], who in 1812 founded the Cambridge Analytical Society.

[Penny Cyclopædia, 1843; Gent. Mag. 1815 i. 18-22, 1828 i. 274; Nichols's Lit. Illustr. vi. 43-4, vii. 627; Allibone's Dict. of Engl. Lit.; Venn's Biogr. Hist. of Gonville and Caius College, 1898, ii. 119; Toddhunter's William Whewell, 1876; Ball's Hist. of Mathematics at Cambridge, 1889, pp. 117-23; Edinburgh Review, November 1810, March 1819; Quarterly Review, November 1810, July 1819; English Cyclopædia.]

E. I. C.

WOODHOUSE, THOMAS (d. 1573), Roman catholic martyr, was a native of Lincolnshire. He was ordained priest shortly before the death of Mary in 1558, and was presented to a parsonage in Lincolnshire. In 1560 he resigned his living on account of the changes introduced in the English church, and, retiring to Wales, became tutor

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✓ **WOODHOUSE, ROBERT** (b. Norwich, England, 28 April 1773; d. Cambridge, England, 28 [23?] December 1827), *mathematics*.

Woodhouse was a critic and reformer. The son of Robert Woodhouse, a linen draper, and of the daughter of J. Alderson, a nonconformist minister. Woodhouse attended the grammar school at North Walsham. In 1790 he was admitted to Caius College, Cambridge, and four years later graduated with the B.A., as senior wrangler and first Smith's prizeman. In 1798 he received the M.A. from the university, and was successively fellow (1798–1823), Lucasian professor of mathematics (1820–1822), and Plumian professor of astronomy and experimental philosophy (1822–1827). Woodhouse also served as the first superintendent of the astronomical observatory at Cambridge. In 1802 he was elected a fellow of the Royal Society. He married Harriet Wilkens in 1823; they had one son, Robert.

Woodhouse was primarily interested in what was then called the metaphysics of mathematics; that is, he was concerned with questions such as the proper theoretical foundations of the calculus, the role of geometric and analytic methods, the importance of notation, and the nature of imaginary numbers. Many of these questions are discussed in his *Principles of Analytical Calculation* (1803), a polemic aimed primarily at the fellows and professors at Cambridge. [In this work Woodhouse defended analytic methods, the differential notation, and a theory of calculus based, like that of Lagrange, on series expansions.] It does not appear to have had much influence in the introduction of continental methods at Cambridge. His elementary text on trigonometry (1809), however, was widely used. George Peacock, who himself played a decisive role in the reform of mathematical studies at Cambridge, considered this work to be of major importance in achieving this goal. It was not polemical, but used analytic methods and the differential notation throughout.

✓ Woodhouse's other writings include a history of the calculus of variations (1810), a treatise on astronomy (1812), and a work on the theory of gravitation, somewhat misnamed *Physical Astronomy* (1818). In all these works Woodhouse presented the results of continental research from the time of Newton up to his own time.

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II. SECONDARY LITERATURE. The fullest account of Woodhouse's life and work is in Augustus DeMorgan, "Robert Woodhouse," in *Penny Cyclopaedia*, XXVII (London, 1843), 526–527. Woodhouse's influence is considered in Elaine Koppelman, *Calculus of Operations: French Influence in British Mathematics in the First Half of the Nineteenth Century* (Ph.D. diss., Johns Hopkins University, 1969).

ELAINE KOPPELMAN

WOODWARD, JOHN (b. Derbyshire, England, 1 May 1665; d. London, England, 25 April 1728), *geology, mineralogy, botany*.

Woodward was said to have been the son of a man of good family from Gloucestershire. He was educated at a country school, where he became proficient in Latin and Greek. About 1680, at the age of sixteen, he was apprenticed to a linen draper in London, but he abandoned this occupation to pursue a further course of study. A few years later he became acquainted with Peter Barwick, physician in ordinary to Charles II. Barwick was impressed by Woodward's ability and about 1684 took him into his household to study medicine; Woodward remained there about four years. During this period, while on a visit to Sherborne, in Gloucestershire, he studied botany in the surrounding country. While on these excursions he learned for the first time that rocks may contain fossil animal remains—they are particularly common in the Jurassic rocks in that neighborhood. These fossils greatly interested Woodward, and he resolved to investigate their occurrence in other parts of the country. This he undoubtedly did, although no detailed account of the course of his investigation has survived. Later in Oxford he made the acquaintance of two well-known naturalists, Robert Plot, keeper of the Ashmolean Museum, and his assistant, Edward Lhwyd, who also were interested in fossils. On this occasion he

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