Review

Author(s): X. Y. Z.

Review by: X. Y. Z.

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"of" and $\times$ after a $\div$ sign. Ex. (1) worked out on p. 170 is wrong, the method is not good, and such sums are futile.

Under the heading "Application of Ratio Methods," the authors give a very sound exposition of what I have always known as the "abbreviated unitary method."

Although percentage error is given, it is in its proper place, *after* absolute error : hardly enough work is given on this important section.

There is a very fine set of Miscellaneous Problems at the end of the second part, and the Revision Papers are good and numerous.

Mathematical Problem Papers for Secondary Schools. By Dr. DAVISON. Pp. 175. Price 2s. (Bell.)

An excellent collection of 200 Papers, each consisting of eight exercises, with an appendix of fifty standard riders in Geometry. Many of the exercises come from public examination papers, but there are a goodly number of the better class that are original. There is a slight leaning, however, to the problem type rather than the exercise type. On the whole, should be exceedingly useful.

Elementary Geometry, Theoretical and Practical. Vol. I. By W. E. PATERSON and E. O. TAYLOR. Pp. 155. Price 1s. 6d. (Clarendon Press.)

This volume deals with the properties of triangles and quadrilaterals, with a brief reference to Proportion and similar triangles. The method is a good one. Each proposition is considered, more or less, as a rider on previous propositions, and is led up to in a chatty manner before its enunciation is stated ; in other words, in exactly the manner which an experienced teacher would proceed when using, say, Todhunter's *Euclid*. A very good point is the frequent recapitulation of what has gone before, enabling the student to fix in his memory "what tools he has in his box," for rider work. This method of producing problem power is still further elaborated by giving hints only, but sufficient hints, for the proofs of later propositions.

I hardly like the concealed algebraic nature of the proofs of Euc. II. 12, 13, although, and because, they are founded on Euc. II. 4, enunciated as "The square on the sum of two lines, etc." If an algebraic proof is given, it should be frankly algebraic. I do not think many examiners would accept

$$(AB + BC)^2 = AB^2 + 2AB \cdot BC + BC^2.$$

The same may be said, and with greater reason, about the authors' definition of Parallel Straight Lines, as those drawn in the same direction. The idea of parallelism is fundamental before the concept of direction can be arrived at by the boy. Also no mention is made of "the same plane." J. M. CHILD.

Essays on the Life and Work of Newton. By AUGUSTUS DE MORGAN. Edited, with Notes and Appendices, by Philip E. B. Jourdain. Pp. xiv + 198. Cloth, 5s. net. 1914. (Chicago and London: The Open Court Publishing Company.)

Augustus De Morgan's biographical sketch entitled "Newton" appeared in *The Cabinet Portrait Gallery of British Worthies* in 1846, and is the first essay printed in this volume. It was, after Baile's *Life of Flamsteed* of 1835, the first English work in which the weak side of Newton's character was made known. Justice to Leibniz, to Flamsteed, even to Whiston, called for this exposure ; and the belief that it was necessary did not lower the biographer's estimate of Newton's scientific greatness, and of the simplicity and purity of his moral character. Francis Baile's discovery of the correspondence between the Rev. John Flamsteed, the first Astronomer Royal, and Abraham Sharp, as well as between Newton, Halley, and Flamsteed, on the publication of Flamsteed's catalogue of stars, had thrown a new light on the character of Newton. It appeared that the practical astronomer had been treated ungenerously by Newton, who failed to observe the conditions of publication agreed to by all parties ; and afterwards, when remonstrated with, omitted the name of Flamsteed in places where it had formerly stood in the earlier editions of the *Principia*.

It was not only mathematical discovery and controversy that De Morgan treated in the just, broad-minded, and high-minded way that is characteristic of him. He disclaimed any particular interest in those religious beliefs of Newton which he discussed so thoroughly ; still, he seems to have felt more interest in the

question, from its own nature, than he was himself aware of. He said, "Whatever Newton's opinions were, they were the result of a love of truth, and of a cautious and deliberate search after it." That Newton was a firm believer in Christianity as a revelation from God is very certain, but whether he held the opinions of the majority of Christians on the points which distinguish Trinitarians from Arians, Socinians, and Humanitarians, is the question of controversy.

The second of De Morgan's Essays printed in this volume concerns the great controversy about the invention of the fluxional or infinitesimal calculus, in which Newton and Leibniz were the principals. The Essay printed is from the *Companion to the Almanac* of 1852, and is now extremely rare. It is of great interest and importance, both on account of the fairness and vigour which De Morgan always showed in the defence of Leibniz against the imputations of Newton and the Royal Society, and because it first introduced the English public to Gerhardt's important discovery of Leibniz's manuscripts, showing his gradual discovery of the calculus in 1673-1677. This Essay also contains a summary of much of De Morgan's historical work on the controversy. Where it seems advisable, notes have been added to the second Essay, giving an account of De Morgan's and others' work on the subject.

To this second Essay the editor has added an appendix, the chief aim of which is to give the sources at which may be found the original manuscripts written by Newton and Leibniz when they were discovering their respective calculuses. This has not been done hitherto, and it is all the more necessary that it should be done, as modern authors, such as Moritz Cantor in his *Vorlesungen über Geschichte der Mathematik*, neglect the fact that any early manuscripts of Newton's on fluxions are extant, or that some have been published—by Rigaud, for example—and that some still remain unpublished.

In 1855 appeared Sir David Brewster's *Memoirs of the Life, Writings, and Discoveries of Sir Isaac Newton*, and De Morgan, in a critique of this work in the *North British Review*, showed clearly that Sir David had fallen into hero-worship. Here the faults of Newton are pointed out with an unwavering finger, and the merits of Leibniz are recognised and his character defended against Brewster more at length than in De Morgan's biography of Newton. This review is printed as the third of De Morgan's Essays on Newton. The editor has added two appendices to this third Essay: the first is part of a biography of Leibniz which De Morgan wrote, and which illustrates a laudatory reference to that great man in the third Essay; the second is an extract from a later work of De Morgan's, and deals with Newton's character and the relation to it of the Royal Society down to De Morgan's own times.

Numerous notes of either a bibliographical, explanatory, or critical nature have been added to all the Essays, but all that is not De Morgan's is put in square brackets. Such notes have become necessary, and it is hoped that the present ones will reply to all the calls of necessity and will make the book both useful and complete. Very little has to be criticised in De Morgan's history or conclusions. Like everything he wrote, these Essays of his are marked by scrupulous care, sanity of judgment, and wide reading; and one hardly knows which to admire most: the breadth or the height of his mind.

The frontispiece is from an engraving by E. Scriven of Vanderbank's portrait of Newton in the possession of the Royal Society of London. An engraving from this picture accompanied the original of De Morgan's biographical sketch; but the present frontispiece is from a much finer engraving prefixed to the biography of Newton in the first volume of *The Gallery of Portraits: with Memoirs of 1833*.

X.Y.Z.

QUERIES.

(92) When Lagrange uses *quantité de mouvement*, does he mean momentum or energy?

(93) Who first wrote M for $\frac{W}{g}$? Was it Euler?