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A MATHEMATICIAN'S MISCELLANY

By J. E. LITTLEWOOD

Methuen & Co., London. 1953. 5½" × 8". pp. 136. English price, 15s.

If one apprehends a miscellany, following Webster, as "a mass or mixture of various things; a medley", one certainly finds it in this book. That it is so indubitably such a miscellany is at once apparent if one merely glances at the table of contents, which includes the following: *Mathematics with Minimum Raw Material*; *The Mathematical Tripod*; *Cross Purposes*, *Unconscious Assumptions*, *Howlers and Misprints*; *The Zoo*; *Ballistics*; *The Probability Theorem*; *From Fermat's Last Theorem to the Abolition of Capital Punishment*; *A Mathematical Education*; *Ramanujan's Collected Papers*; *Three Reviews*; *Newton and the Attraction of a Sphere*; *Large Numbers*; *The Discovery of Neptune*; *Lion and Man*.

The author claims he will have matter to interest both the amateur and the professional mathematician (not the "amateur" as conceived by Coolidge), and he has enclosed between asterisks those portions which the amateur might safely skip. The earlier chapters make quite entertaining and interesting reading, but the "miscellany" is such that the kaleidoscopic changes as we read on leave us bewildered as to just what it is that a mathematician considers will interest other mathematicians, for whom of course the book is written. The definition of mathematics as "Mathematics is what mathematicians do" would be well exemplified in this book. Littlewood's first choice for a problem in "genuine" mathematics requiring the minimum of raw material is the following: "Three ladies, *A*, *B*, *C*, in a railway carriage all have dirty faces and are all laughing. It suddenly flashes on *A*: why doesn't *B* realize *C* is laughing at her?—Heavens! I must be laughable." Readers of this journal can refer to *A.M.T.*, H. M. Finucan, Vol. 7 No. 3, November 1951, Note No. 160, for a detailed discussion of this problem. The author then deals with a further dozen or so puzzles, including the problem of weighing pennies, which he no more than mentions, referring us to the *Math. Gaz.* (C. A. B. Smith, XXXI, 1947), the absence of which the Australian reader can remedy by referring again to *A.M.T.*, Vol. 4 No. 2, July 1948, p. 62, under the heading "Problems Bureau".

Then we find in various places (the book has unfortunately no index), The Schroder-Bernstein Theorem, Kakeya's Problem, Crum's Problem, Picard's Theorem, The Young-Hausdorff Inequality, Fermat's Last Theorem, The Rifleman's Problem, Dedekind's Section, Bessicovitch's two problems, many of which are beyond the understanding of the amateur and will surely be difficult enough for the professional.

We come upon at odd places such brief and cogent statements as:

- p. 23 "The legend that every cipher is breakable is of course absurd."
- p. 35 "A heavy warning used to be given that pictures are not rigorous. Some pictures are not rigorous, but I should say most are, and I use them whenever possible myself. An obviously legitimate case is to use a graph to define an awkward function."
- p. 39 "The literary convention that numbers less than 10 should be given in words is often highly unsuitable in mathematics."
- p. 44 "As someone said, each of the positive integers was one of his (Ramanujan's) personal friends." The "someone" now turns out to be Littlewood himself.
- p. 55 "You do not make an illegitimate conception legitimate by putting it in inverted commas."
- p. 74 (Footnote). "I wasted time (at Cambridge) on optics and astronomy (not worth knowing) and then practically discarded them." The "Cambridge astronomy" must be meant, for Littlewood devotes the concluding chapters of his book to astronomical matters, say one-seventh of the book.
- p. 72 "I will say, however, that for me the thing to avoid, for doing creative work is

above all Cambridge life, with the constant bright conversation of the clever, the wrong sort of mental stimulus."

- p. 73 (Footnote). "I do not take off marks in examinations for slovenliness as such, and always protest against examiners' bleatings that numerical work was slovenly and inaccurate."
- p. 88 "He (Ramanujan) was not interested in rigour, which for that matter is not of first rate importance in analysis beyond the undergrad stage."

The chapter on Fermat's Last Theorem now raised by Littlewood to the sublime status of being known by its abbreviation, F.L.T., is followed by an interesting chapter for the student of Education. Littlewood traces his school and university career in some detail, and if one has read Hardy's "Case Against The Tripos" (*Math. Gaz.*, No. 300, Vol. XXXII, July 1948, reprinted from *Math. Gaz.*, March 1926), one gains a truer insight into Hardy's forthright and convincing presidential address of a quarter of a century ago. It becomes clear to us on reading Littlewood's book that the man of whom Hardy wrote the following was indeed Littlewood himself, although Hardy nowhere specifically says so. The circumstances of the story, even the phraseology used, are such that one cannot avoid this conclusion.

"I remember asking another friend, who was Senior Wrangler some years later, and has since earned a very high reputation by research of the most up-to-date and highbrow kind, how the Tripos impressed him in his undergraduate days, and his reply was approximately as follows. He had learnt a little about modern mathematics while he was still at school, and he understood perfectly while he was an undergraduate, as I certainly did not, that the mathematics he was studying was not quite the real thing. But, he continued, he regarded himself as playing a game. It was not exactly the game he would have chosen, but it was the game which the regulations prescribed, and it seemed to him that, if you were going to play the game at all, you might as well accept the situation and play it with all your force. He believed, and remember, if you think him arrogant, that his judgment was entirely correct—that he could play that game at least as well as any of his rivals. He therefore decided deliberately to postpone his mathematical education, and to devote two years to the acquisition of a complete mastery of all the Tripos technique, resuming his studies later with the Senior Wranglership to his credit and, he hoped, without serious prejudice to his career. I can only add—lost as I am in hopeless admiration of a young man so firmly master of his fate—that every detail of these precocious calculations has been abundantly justified by the event."

This is the man, we are convinced, whose book we are reviewing.

The chapter on large numbers tells us that the record prime is $180p^2 + 1$ where p is the previous record prime $2^{127} - 1$. This was referred to in *A.M.T.* (H. M. Finucan, Vol. 9 Nos. 2-3, September 1953, Note No. 189). Littlewood tells us as stop press news that D. H. Lehmer had found a prime greater than 2^{1000} . In this present issue of *A.M.T.*, mention is made of the later discovery of the primality of $2^{2203} - 1$ and $2^{2281} - 1$.

The book is free from typographical errors. There is a diffuseness in some passages which may puzzle the amateurs. For example it took this reviewer some minutes to absorb clearly the statement "In what I am going to say, I am far from imputing stupidity to people certainly less stupid than myself" (p. 118). And again, "... this would be used in a printed paper if only to save expense, but the picture in a lecture" (p. 35). "It is valid in n dimensions and the beginner will give what follows, but in $X_1, X_2, \dots, X_n; X'_1, X'_2, \dots, X'_n$ " (p. 30). One wonders what A. P. Herbert would concoct if he were to comment on the use of such words as verbality, pictoriality, reduacity, centrality, ballistician, which certainly jar the ear, however apt their connotation.

The book is quite unlike either Hardy's *Mathematician's Apology* or Sawyer's *Mathematician's Delight*. It is a book in a class by itself, of which one might say, as O. Henry did, it may be recognised by its similarity to itself.

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