Book review

Mathematical Delights

By Ross Honsberger, published by the Mathematical Association of America, 2004

ISBN 088385-334-5, softcover, x + 252 pages, US$?????

Reviewed by **Ed Barbeau**, *University of Toronto*

There was a time when Ross Honsberger of the University of Waterloo performed a mathematical concert at each annual meeting of the Ontario Association for Mathematics Education. Eager mathematics teachers would pack a large auditorium for a polished and witty exposition of about ten of Honsberger's favourite problems and their solutions, selected for their elegance and capacity to surprise and delight. Those who show up at the annual marking bee for the Waterloo contests still can enjoy such a treat.

These problems found their way into a succession of books published by the Mathematical Association of America. No fewer than eleven of the first twenty-eight volumes of the Dolciani Mathematical Exposition Series, including the inaugural four and this one, are from his hand. That is a lot of beautiful mathematics!

While his earlier books consisted of longer essays on individual problems, this is a miscellaneous collection of problems from a variety of sources briefly treated. Demanding at most the background of a second-year undergraduate, the author aims to "put on display little gems that are to be found at the elementary level". The first part of the book, *Gleanings*, contains problems and solutions drawn from contests like the Putnam, journals like *Mathematics Magazine* and *The College Mathematics Journal*, and published collections of problems. The second part, *Miscellaneous Topics*, focuses on the work of particular correspondents (Liong-shin Hahn, Achilleas Sinefakopoulos and George Evagelopoulos) and problems from particular sources (New Mexico Mathematics Contest of 2002, and *The Book of Prime Number Records* by Paulo Ribenboim). Finally, just to make sure the reader is not content to be a spectator, Honsberger poses 27 challenges, with solutions provided in a separate section.

The problems are attractive for different reasons. Sometimes the result itself surprises (as Honsberger often asked in his lectures, "how does someone think of such things?"), while the solution is often straightforward and sometimes even tedious. At other times, there is an unusual strategy leading to a straightforward *dénouement*. But the most staisfying solutions are clever, unexpected and brief. In part, the book celebrates the human ingenuity that generated the problems and solutions, the latter occasionally during a competition.

For example, the 1980 IMO problem to show that $(a^2+b^2)/(ab+1)$ is square whenever a and b are integers for which $ab+1$ divides a^2+b^2 was a notoriously challenging one for which a Bulgarian student gave a prizewinning solution during the competition. There are a number of intriguing results about the sizes of circles inside an arbelos (a region bounded by three tangent semicircles with a common diameter). From *The College Mathematics Journal* comes two short constructions for the tangent of an ellipse from an exterior point. Sometimes a serious research problem can lead to an almost trivial instance with the right perspective, witness this question of M.V. Subbarao of the University of Alberta: *Are there* $r \geq 2$ *distinct odd primes* $p_1, p_2, \cdots, p_r$ *and an integer* a *for which* $(p_1+a)(p_2+a)\cdots(p_r+a)-1$ *is divisible by* $(p_1+a-1)(p_2+a-1)\cdots(p_r+a-1)$? A \$100 award went to C. Offord and R. Wentz for an almost trivial example where $r=2$ and the primes are twins.

As you would expect, the problems are drawn from the standard competition areas of number theory, combinatorics, algebra and geometry. The reader will find them of varying appeal, but the geometry problems are the most fun. There are two indices for names and terms, each item keyed to the section rather than the page containing it.