Ordinary differential equations, by I.G. Petrovskii. Translated from the Russian by R.A. Silverman, Prentice-Hall, Inc., Englewood Cliffs, N.J. x + 232 pages. $7.95.

There is what sometimes seems to be an infinite (and monotone increasing) number of texts in elementary differential equations. Many of these contain considerably more material than can be covered in the customary one-semester course, and it is suggested that they may also be used for a second course. Such a second course would ordinarily not require more mathematical sophistication than the first course, and would concentrate on further techniques for obtaining exact or approximate solutions.

Another possibility for a second course (or a first course for a student who has avoided the standard first course) is a deeper study of the qualitative theory of ordinary differential equations, but this possibility has not been explored by many textbooks. In fact, only four recent books, those by Birkhoff and Rota, Hochstadt, Pontrjagin, and the one by Petrovskii reviewed here, seem to the reviewer to be possible texts for such a course. As these four books all have a different emphasis and coverage, it would be futile to compare them; each has many good features and some weaknesses, and would be a possible text for a second course.

The book by Petrovskii concentrates on existence theory and the structure of solutions. There is also a discussion of autonomous systems and critical points. The exposition is excellent throughout, with careful and clear explanations. The book is not meant for second year students with only a year of calculus behind them. A knowledge of linear algebra and an understanding of uniform convergence are essential, and some knowledge of such topics as metric spaces, analytic functions, and topology of the plane would be useful for the student. There are some interesting (and difficult) exercises, but no routine problems.

Petrovskii's book is probably suitable as a text only for very good students. The average student will find it too hard, and will be discouraged by his inability to solve the problems. However, for a student able to cope with it, this is a superb book. It seems to be becoming fashionable to feed bright young students large doses of algebra and topology, but to ration their intake of analytic techniques. Such a diet is ill-advised, in the reviewer's opinion, and the reading of Petrovskii's book is an excellent prescription to help balance the education of the budding young mathematician.

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