# Preface for Revised Potential Theory

Potential theory had its beginning about 300 years ago as a result of two events, the realization by Sir Isaac Newton of the applicability of the inverse square law to extraterrestrial bodies and George Green's postulation of a function that could serve to represent a solution of a differential equation as an integral. During the nineteenth and twentieth centuries many of the great mathematicians contributed to the subject, Gauss, Poincaré, Lebesgue, to name a few. Following World War II there was heightened interest in the subject, notably in France. The purpose of my 1969 book on potential theory was to gather and reference what seemed to be a folklore of facts about potential theory such as, for example, "The point at infinity is a regular boundary point …" A soft analysis approach to the writing of the 1969 book just scratched the surface. The inclusion of the exercises should help the young mathematician to acquire the skills to contribute to potential theory.

A stated goal in the Preface of the first edition of this book was to make the content more pragmatic and less esoteric. The first edition of this book added content pertaining to elliptic partial differential equations subject to first-order differential boundary conditions in response to the surge in activity among probabilists to characterize the most general boundary conditions for diffusion processes. To further that goal, exercises have been added. Most of the exercises are of a kind that a student might encounter in an advance calculus course. I recall having solved some of the exercises in a second-year Physics course taught by Prof. Ernst Ising who proclaimed in class "I will teach you all the calculus you need to know."

Since every lecturer has his/her idea of what should constitute a course in potential theory, I can only suggest what I think might be a possible introduction to the subject, leaving it to the student to become familiar with the important theorems not covered in my suggestion. This suggestion includes: Sects. 2.1–2.9; with emphasis on mastering integration with respect to spherical coordinates; Sects. 3.1–3.6; Sects. 4.1–4.4; Sects. 5.1–5.4; Sects. 9.1–9.5;Sects. 11.1–11.8; and, Sects. 13.1–13.7.

I am grateful for the encouragement of this revision by Dr. Sixt of Springer, UK and to Catherine Waite for guiding me through the publishing process. I would welcome suggestions for further exercises or comments via email at lester.helms@comcast.net or l-helms@illinois.edu.

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