Student Solution Manual for Foundation Mathematics for the Physical Sciences

Student Solution Manual

This *Student Solution Manual* provides complete solutions to all the odd-numbered problems in *Foundation Mathematics for the Physical Sciences*. It takes students through each problem step by step, so they can clearly see how the solution is reached, and understand any mistakes in their own working. Students will learn by example how to arrive at the correct answer and improve their problem-solving skills.

K. F. RILEY read mathematics at the University of Cambridge and proceeded to a Ph.D. there in theoretical and experimental nuclear physics. He became a Research Associate in elementary particle physics at Brookhaven, and then, having taken up a lectureship at the Cavendish Laboratory, Cambridge, continued this research at the Rutherford Laboratory and Stanford; in particular he was involved in the experimental discovery of a number of the early baryonic resonances. As well as having been Senior Tutor at Clare College, where he has taught physics and mathematics for over 40 years, he has served on many committees concerned with the teaching and examining of these subjects at all levels of tertiary and undergraduate education. He is also one of the authors of *200 Puzzling Physics Problems* (Cambridge University Press, 2001).

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Preface

For reasons that are explained in the preface to *Foundation Mathematics for the Physical Sciences* (*FMPS*), the text of the third edition of *Mathematical Methods for Physics and Engineering* (*MMPE*) (Cambridge: Cambridge University Press, 2006) by Riley, Hobson and Bence, after a number of additions and omissions, has been republished as two somewhat overlapping texts. *Essential Mathematical Methods for the Physical Sciences* contains most of the more advanced material, and specifically develops mathematical *methods* that can be applied throughout the physical sciences; *FMPS* is an augmented version of the more introductory material, principally concerned with mathematical *tools* rather than methods. The full text of *MMPE*, including all of the more specialised and advanced topics, is still available under its original title.

As in the third edition of *MMPE*, the penultimate subsection of each chapter of *FMPS* consists of a significant number of problems, nearly all of which are based on topics drawn from several sections of that chapter. Also as in the third edition, hints or outline answers are given in the final subsection, but only to the odd-numbered problems, leaving all even-numbered problems free to be set as unaided homework.

This book is the solutions manual for the problems in *FMPS*. For the two hundred and thirty plus *odd-numbered* problems it contains, complete solutions are available, to both students and their teachers, in the form of this manual; these are in addition to the hints or outline answers given in the main text. For each problem, the original question is reproduced and then followed by a fully worked solution. For those original problems that make internal reference to the main text or to other (even-numbered) problems not included in this solutions manual, the questions have been reworded, usually by including additional information, so that the questions can stand alone. Some further minor rewording has been included to improve the page layout.

In many cases the solution given is even fuller than one that might be expected of a good student who has understood the material. This is because we have aimed to make the solutions instructional as well as utilitarian. To this end, we have included comments that are intended to show how the plan for the solution is formulated and have provided the justifications for particular intermediate steps (something not always done, even by the best of students). We have also tried to write each individual substituted formula in the form that best indicates how it was obtained, before simplifying it at the next or a subsequent stage. Where several lines of algebraic manipulation or calculus are needed to obtain a final result, they are normally included in full; this should enable the student to determine whether an incorrect answer is due to a misunderstanding of principles or to a technical error.

Preface

As noted above, the original questions are reproduced in full, or in a suitably modified stand-alone form, at the start of each problem. Reference to the main text is not needed provided that standard formulae are known (and a set of tables is available for a few of the probability problems). This means that, although it is not its prime purpose, this manual could be used as a test or quiz book by a student who has learned, or thinks that they have learned, the material covered in the main text.