

Cambridge University Press

0521679737 - Student Solutions Manual for Mathematical Methods for Physics and Engineering,
Third Edition

K. F. Riley and M. P. Hobson

Frontmatter

[More information](#)

Student Solutions Manual for *Mathematical Methods for Physics and Engineering*, third edition

Mathematical Methods for Physics and Engineering, third edition, is a highly acclaimed undergraduate textbook that teaches all the mathematics needed for an undergraduate course in any of the physical sciences. As well as lucid descriptions of the topics and many worked examples, it contains over 800 exercises. New stand-alone chapters give a systematic account of the 'special functions' of physical science, cover an extended range of practical applications of complex variables, and give an introduction to quantum operators.

This solutions manual accompanies the third edition of *Mathematical Methods for Physics and Engineering*. It contains complete worked solutions to over 400 exercises in the main textbook, the odd-numbered exercises that are provided with hints and answers. The even-numbered exercises have no hints, answers or worked solutions and are intended for unaided homework problems; full solutions are available to instructors on a password-protected website, www.cambridge.org/9780521679718.

KEN 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*.

MICHAEL HOBSON read natural sciences at the University of Cambridge, specialising in theoretical physics, and remained at the Cavendish Laboratory to complete a Ph.D. in the physics of star-formation. As a research fellow at Trinity Hall, Cambridge and subsequently an advanced fellow of the Particle Physics and Astronomy Research Council, he developed an interest in cosmology, and in particular in the study of fluctuations in the cosmic microwave background. He was involved in the first detection of these fluctuations using a ground-based interferometer. He is currently a University Reader at the Cavendish Laboratory, his research interests include both theoretical and observational aspects of cosmology, and he is the principal author of *General Relativity: An Introduction for Physicists*. He is also a Director of Studies in Natural Sciences at Trinity Hall and enjoys an active role in the teaching of undergraduate physics and mathematics.

Cambridge University Press

0521679737 - Student Solutions Manual for Mathematical Methods for Physics and Engineering,
Third Edition

K. F. Riley and M. P. Hobson

Frontmatter

[More information](#)

Student Solutions Manual for
**Mathematical Methods
for Physics and Engineering**

Third Edition

K. F. RILEY and M. P. HOBSON



Cambridge University Press
0521679737 - Student Solutions Manual for Mathematical Methods for Physics and Engineering,
Third Edition
K. F. Riley and M. P. Hobson
Frontmatter
[More information](#)

CAMBRIDGE UNIVERSITY PRESS
Cambridge, New York, Melbourne, Madrid, Cape Town, Singapore, São Paulo

Cambridge University Press
The Edinburgh Building, Cambridge CB2 2RU, UK

Published in the United States of America by Cambridge University Press, New York

www.cambridge.org
Information on this title: www.cambridge.org/9780521861533

© K. F. Riley and M. P. Hobson 2006

This publication is in copyright. Subject to statutory exception
and to the provisions of relevant collective licensing agreements,
no reproduction of any part may take place without
the written permission of Cambridge University Press.

First published 2006

Printed in the United Kingdom at the University Press, Cambridge

A catalogue record for this publication is available from the British Library

Library of Congress Cataloguing in Publication data

ISBN-13 978-0-521-67973-2 paperback
ISBN-10 0-521-67973-7 paperback

Cambridge University Press has no responsibility for the persistence or accuracy of URLs for
external or third-party internet websites referred to in this publication, and does not guarantee that
any content on such websites is, or will remain, accurate or appropriate.

Contents

<i>Preface</i>	<i>page ix</i>
1 Preliminary algebra	1
2 Preliminary calculus	17
3 Complex numbers and hyperbolic functions	39
4 Series and limits	55
5 Partial differentiation	71
6 Multiple integrals	90
7 Vector algebra	104
8 Matrices and vector spaces	119
9 Normal modes	145
10 Vector calculus	156
11 Line, surface and volume integrals	176

CONTENTS

12	Fourier series	193
13	Integral transforms	211
14	First-order ODEs	228
15	Higher-order ODEs	246
16	Series solutions of ODEs	269
17	Eigenfunction methods for ODEs	283
18	Special functions	296
19	Quantum operators	313
20	PDEs: general and particular solutions	319
21	PDEs: separation of variables and other methods	335
22	Calculus of variations	353
23	Integral equations	374
24	Complex variables	386
25	Applications of complex variables	400
26	Tensors	420
27	Numerical methods	440
28	Group theory	461
29	Representation theory	480

Cambridge University Press
0521679737 - Student Solutions Manual for Mathematical Methods for Physics and Engineering,
Third Edition
K. F. Riley and M. P. Hobson
Frontmatter
[More information](#)

CONTENTS

30	Probability	494
31	Statistics	519

Cambridge University Press

0521679737 - Student Solutions Manual for Mathematical Methods for Physics and Engineering,
Third Edition

K. F. Riley and M. P. Hobson

Frontmatter

[More information](#)

Preface

The second edition of *Mathematical Methods for Physics and Engineering* carried more than twice as many exercises, based on its various chapters, as did the first. In the Preface we discussed the general question of how such exercises should be treated but, in the end, decided to provide hints and outline answers to all problems, as in the first edition. This decision was an uneasy one as, on the one hand, it did not allow the exercises to be set as totally unaided homework that could be used for assessment purposes, but, on the other, it did not give a full explanation of how to tackle a problem when a student needed explicit guidance or a model answer.

In order to allow both of these educationally desirable goals to be achieved, we have, in the third edition, completely changed the way this matter is handled. All of the exercises from the second edition, plus a number of additional ones testing the newly added material, have been included in penultimate subsections of the appropriate, sometimes reorganised, chapters. Hints and outline answers are given, as previously, in the final subsections, *but only to the odd-numbered exercises*. This leaves all even-numbered exercises free to be set as unaided homework, as described below.

For the four hundred plus *odd-numbered* exercises, complete solutions are available, to both students and their teachers, in the form of *this* manual; these are in addition to the hints and outline answers given in the main text. For each exercise, the original question is reproduced and then followed by a fully worked solution. For those original exercises that make internal reference to the text or to other (even-numbered) exercises 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

Cambridge University Press

0521679737 - Student Solutions Manual for Mathematical Methods for Physics and Engineering,
Third Edition

K. F. Riley and M. P. Hobson

Frontmatter

[More information](#)PREFACE

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.

The remaining four hundred or so *even-numbered* exercises have no hints or answers (outlined or detailed) available for general access. They can therefore be used by instructors as a basis for setting unaided homework. Full solutions to these exercises, in the same general format as those appearing in this manual (though they may contain references to the main text or to other exercises), are available without charge to accredited teachers as downloadable pdf files on the password-protected website <http://www.cambridge.org/9780521679718>. Teachers wishing to have access to the website should contact solutions@cambridge.org for registration details.

As noted above, the original questions are reproduced in full, or in a suitably modified stand-alone form, at the start of each exercise. 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 statistical and numerical exercises). 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 he or she has learned, the material covered in the main text.

In all new publications, errors and typographical mistakes are virtually unavoidable, and we would be grateful to any reader who brings instances to our attention. Finally, we are extremely grateful to Dave Green for his considerable and continuing advice concerning typesetting in L^AT_EX.

Ken Riley, Michael Hobson,
Cambridge, 2006