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Preface

This Instructor's Manual contains the solutions to all the end-of-chapter problems (but not the appendices) from *Classical Dynamics of Particles and Systems*, Fifth Edition, by Stephen T. Thornton and Jerry B. Marion. It is intended for use only by instructors using *Classical Dynamics* as a textbook, and it is not available to students in any form. A Student Solutions Manual containing solutions to about 25% of the end-of-chapter problems is available for sale to students. The problem numbers of those solutions in the Student Solutions Manual are listed on the next page.

As a result of surveys received from users, I continue to add more worked out examples in the text and add additional problems. There are now 509 problems, a significant number over the 4th edition.

The instructor will find a large array of problems ranging in difficulty from the simple "plug and chug" to the type worthy of the Ph.D. qualifying examinations in classical mechanics. A few of the problems are quite challenging. Many of them require numerical methods. Having this solutions manual should provide a greater appreciation of what the authors intended to accomplish by the statement of the problem in those cases where the problem statement is not completely clear. Please inform me when either the problem statement or solutions can be improved. Specific help is encouraged. The instructor will also be able to pick and choose different levels of difficulty when assigning homework problems. And since students may occasionally need hints to work some problems, this manual will allow the instructor to take a quick peek to see how the students can be helped.

It is absolutely forbidden for the students to have access to this manual. Please do not give students solutions from this manual. Posting these solutions on the Internet will result in widespread distribution of the solutions and will ultimately result in the decrease of the usefulness of the text.

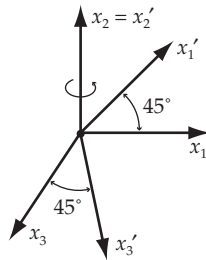
The author would like to acknowledge the assistance of Tran ngoc Khanh (5th edition), Warren Griffith (4th edition), and Brian Giambattista (3rd edition), who checked the solutions of previous versions, went over user comments, and worked out solutions for new problems. Without their help, this manual would not be possible. The author would appreciate receiving reports of suggested improvements and suspected errors. Comments can be sent by email to stt@virginia.edu, the more detailed the better.

Stephen T. Thornton
Charlottesville, Virginia

CHAPTER 1

Matrices, Vectors, and Vector Calculus

1-1.



Axes x'_1 and x'_3 lie in the x_1x_3 plane.

The transformation equations are:

$$x'_1 = x_1 \cos 45^\circ - x_3 \cos 45^\circ$$

$$x'_2 = x_2$$

$$x'_3 = x_3 \cos 45^\circ + x_1 \cos 45^\circ$$

$$x'_1 = \frac{1}{\sqrt{2}}x_1 - \frac{1}{\sqrt{2}}x_3$$

$$x'_2 = x_2$$

$$x'_3 = \frac{1}{\sqrt{2}}x_1 + \frac{1}{\sqrt{2}}x_3$$

So the transformation matrix is:

$$\begin{pmatrix} \frac{1}{\sqrt{2}} & 0 & -\frac{1}{\sqrt{2}} \\ 0 & 1 & 0 \\ \frac{1}{\sqrt{2}} & 0 & \frac{1}{\sqrt{2}} \end{pmatrix}$$