Worked Examples from Introductory Physics
Vol. I: Basic Mechanics

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To the Student.

Physics is learned through problem-solving. There is no other way.

Problem–solving can be very hard to learn, and students often confuse it with the algebra with which one *finishes up* a problem. But the level of mathematics and calculator skills required in a general physics course is not very great. Any student who has difficulty solving the equations we derive in working these problems really needs to re–take some math courses! Physics is all about *finding* the right equations to solve. The rest of it ought to be easy.

My two purposes in composing this book are: (1) To summarize the principles that are absolutely essential in first–year physics. This is the material which a student *must* be familiar with before going in to take an exam. (2) To provide a set of example problems with the most complete, clearest solutions that I know how to give.

I hope I've done something useful in writing this. Of course, nowadays most physics textbooks give lots of example problems (many more than they did in years past) and even some sections on problem–solving skills, and there are study–guide–type books one can buy which have *many* worked examples in physics. But typically these books don't have enough discussion as to how to set up the problem and why one uses the particular principles to solve them; usually I find that there aren't enough *words* included between the equations that are written down. Students seem to think so too. Part of the reason for my producing this notebook is the reaction of many students to earlier example notebooks I have written up: "You put lots of words between all the equations!"

At present, most of the problems are taken from the popular calculus–based textbooks by Halliday, Resnick and Walker and by Serway. I have copied down the problems nearly verbatim from these books, except possibly to change a number here and there. There's a reason for this: Students will take their exams from individual professors who will state their problems in their own way, and they just have to get used to the professors' styles and answer the questions as their teachers have posed them. Style should not get in the way of *physics*.

Organization of the Book:

The chapters cover material *roughly* in the order that it is presented in your physics course, though there may be some differences. The chapters do *not* correspond to the same chapters in your textbook. Each chapter begins with a summary of the basic principles, where I give the most important equations that we will need in solving the problems. I

have called this *The Important Stuff* because... well, you get the idea. In general I give no derivations of the equations though learning the derivations is an important part of an education in physics. I refer you to your textbook for those.

After that, I give worked examples. The emphasis here is to show how we try to clarify the situation presented in the problem (often with a picture), to show what principles and equations from the chapter are applicable to the situation, and finally to show how to use those equation to solve for the desired quantities.

I have not been especially careful about numerical accuracy in solving these problems; oftentimes my results will have more or fewer significant figures than they should, if one takes the data given in the problem literally. But just as often, the textbook author who stated the problem wasn't very careful about accuracy either! Questions about accuracy are very important in lab work, but the focus of *this* book is problem–solving. (After all, the problems *are* fictional!)

I am continually correcting and updating this book, and the date on the title page indicates the version of the copy you are reading. I am sure that no matter what version you are reading there will be some errors and some sections which are incomplete. I apologize in advance.

Reactions, please!

Please help me with this project: Give me your reaction to this work: Tell me what you liked, what was particularly effective, what was particularly confusing, what you'd like to see more of or less of. I can reached at `murdock@tntech.edu` or even at x-3044. If this effort is helping you to learn physics, I'll do more of it!

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