

**Honours Classical Mechanics 1****Problem Solving Strategies**

Note: The following suggestions are taken from D. Morin, *Problems and Solutions in Introductory Mechanics*, self-published (2014), available on Amazon and Kindle at a price of between US \$ 7 and 15. This book contains a lot of problems at a level which is simpler than the ones in the text used in PHYS 251.

**Basic strategies***1. Solve problems symbolically:*

If you are solving a problem where the given quantities are specified numerically, it is highly advantageous to immediately change the numbers to letters and then solve the problem in terms of the letters. After you obtain a symbolic answer in terms of these letters, you can plug in the actual numerical values to obtain a numerical answer. There are many advantages to using letters:

- It is quicker,
- you are less likely to make a mistake,
- you can do the problem once and for all,
- you can see the general dependence of your answer on the various given quantities,
- you can check units and special cases.

*2. Checking units*

The consideration of units offers two main benefits:

- Considering the units of the relevant quantities before you start solving a problem can tell you roughly what the answer has to look like, up to numerical factors. This practice is called dimensional analysis.
- Checking units at the end of a calculation (which is something you should always

do) can tell you if your answer has a chance at being correct. It won't tell you that your answer is definitely correct, but it might tell you that your answer is definitely incorrect.

### 3. *Checking limiting/special cases*

Consideration of limiting/special cases offers two main benefits:

- It can help you get started on a problem. If you are having trouble figuring out how a given system behaves, then you can imagine making, for example, a certain length become very large or very small, and then you can see what happens to the behavior. This will then make it easier to write down the relevant quantitative equations which will allow you to fully solve the problem.

- Checking limiting/special cases is something you should always do at the end of a calculation. As with units, checking limiting cases won't tell you that your answer is definitely correct, but it might tell you that your answer is definitely incorrect.

## **Specific Strategies**

1. Read the problem slowly and carefully.
2. Identify the things you know, and the things you are trying to find out.
3. **Draw a sketch.**
4. Choose wisely your coordinate system or reference frame.
5. Identify the physical principles involved.
6. Convert physical statements into mathematical equations.
7. Think first in terms of physical statements rather than blindly in terms of equations.