Level Physics, Spring 2013
Dynamics Problem-Solving Strategy

When doing dynamics problems, use the following procedure.

1. Write down the problem statement in enough detail that someone looking at just the problem statement you wrote down would be able to re-produce the solution. Convert all units to a consistent set in the process of doing this. Draw one small horizontal line to separate the problem statement from your solution.

2. Draw a large, clear picture of the physical situation described in the problem statement, applying labels to relevant quantities.

3. Draw a free-body diagram: just the object in whose motion you are interested, with ALL the forces on it.

4. From the free-body diagram, choose your coordinate system such that the most number of forces on the free-body diagram are lined up with the axes of your chosen coordinate system.

5. Resolve any forces not lined up with the coordinate system into the coordinate system by using $\sin$ and $\cos$.

6. Identify the target variable. I.e., identify what it is for which you wish to solve.

7. Write down Newton's Second Law $\mathbf{F} = m\mathbf{a}$ in however many dimensions you have, one separate equation for each dimension, by summing all the forces in each direction (as you have done on the free-body diagram).

8. Write down any other constraint equations you need, such as $\mathbf{F}_f = \mu\mathbf{N}$, in order to be able to solve for your target variable. Remember that you need one independent equation for each unknown. If you have more unknowns than equations, then look for another equation.

9. Solve for the target variable, making sure not to plug in numbers for quantities until the end of the problem. Whenever possible, get an analytical algebraic solution, and plug the numbers in at the end, with units.

10. Set the answer inside a box with appropriate units. Write down a sentence explaining or justifying your answer. Include a dimensional analysis (i.e., explain that the units work out), as well as an order-of- magnitude analysis.