Physics 201
Final Project

The final project for this term is to create a review of the subject matter of the entire quarter. The goal is to write something that you will be able to use weeks from now or years from now to remind yourself of the things that you learned in Physics 201. Nothing will be so useful for you in future years than a document that you composed and wrote yourself in your own handwriting. This project is for you to create that document.

Here are the rules:

- For each of the fifteen categories, come up with a problem that illustrates the concept. The problems you choose can be your own creation, problems from the textbook, or problems from quizzes or exams.
- Completely write out the problem and write out the solution *in words and equations.* You must write your solution completely enough that the solution would be understandable to someone who had not seen the problem before. (If English is not your favorite language, you may add notes for yourself in any language, but you *must* also explain the problem and the solution in English.)
- Done with care, each problem will require at least half a page of work. If you draw graphs and diagrams you may need a page for a solution.
- Your solution must be entirely your own work! If you do your own work, this will not be a problem. If you work with anyone else you must be careful that you do not submit identical work. If even part of a solution is identical to that of a classmate, you and the classmate may receive zeros for the entire project.

Examples:

> Category number 1 is: Estimation using *only* dimensional analysis. For this category you need to write out and solve an estimation problem that you can solve using *only* dimensional analysis. This does not mean stating whether an equation is dimensionally consistent. The solution requires estimation of a physical quantity without the benefit of equations that describe the physics of that quantity.
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> Category number 2 is: Interpreting graphs of position, velocity, and acceleration. You can start with a graph of position as a function of time and use that to find information about velocity and acceleration, or you can start with a graph of velocity as a function of time and use that to find information about position and acceleration. You could also start with a graph of acceleration.

The categories appear on the following page:

Come up with a problem and solution that illustrates each of the following. Write out your solution completely enough that it could be understood by someone who had not seen the problem before.

1. Estimation using *only* dimensional analysis.
2. Interpreting graphs of position, velocity, and acceleration.
3. One dimensional kinematics with constant acceleration.
4. Conservation of momentum in one dimension.
5. Newton's second law in it's general form: $\Sigma\vec{F} = \frac{d\vec{p}}{dt}$
6. Calculating acceleration using Newton's 2nd law with constant mass: $\Sigma\vec{F} = m\vec{a}$.
7. Internal forces (normal or tension) between objects using the 2nd and 3rd laws.
8. Adding or subtracting vectors in two dimensions.
9. Projectile motion (or any two dimensional motion with constant acceleration).
10. Uniform (or non-uniform) circular motion.
11. Dynamics (solving for acceleration or forces) in the presence of kinetic friction.
12. Two dimensional motion involving friction and acceleration on an inclined plane.
13. The work-energy theorem.
14. Conservation of energy involving work, kinetic energy, and gravitational potential energy.
15. Conservation of energy involving three kinds of energy other than work (three of the following four: kinetic energy, gravitational potential energy, elastic potential energy, and energy lost to heat via friction).