

Homework Assignment #1

(due: Wednesday, August 29, 9 am)

1. **Inertial Frames:** Taylor 1.26 (5P)

2. **Angular Momentum:** Taylor 1.34 (5P)

3. **Newton's Second Law:** Taylor 1.40 (6P)

Additional Hint: To ensure that r^2 is monotonically increasing look at $\frac{d}{dt}r^2$.

4. **Mathematica Lab:** Finish the mathematica lab from Friday, Aug. 24. Hand in a print out of your saved session. (6P)

5. **Skateboard:** Taylor problems 1.50 and 1.51

Notice that the DE (1.51) is equivalent to the pendulum. You might remember from PHYS 211 Lab that you compared the approximate period T with the numerical T for two different starting angles. In this problem you compare the complete motion. Notice also if the nonlinearity makes T smaller or larger. (6P)

Hint: Use for Taylor 1.50 $\phi_0 = 20 \text{ Pi} / 180$

6. **Air Resistance:** Use mathematica to make your own Fig. (2.10) (6P)

Hint: You will need `ParametricPlot` and `NDSolve`. To get information on these commands click on the Help-button on the right of the menu bar. Using `HelpBrowser` search for `NDSolve` and expand the "Further Examples" at the end of the page by clicking on the triangle. Then expand the examples for the "Ordinary Differential Equations" by double clicking on the right blue square bracket. In there you find even how to get the parametric plot for a numerical solution of `NDSolve`.

7. **Ball in Glycerin** Taylor problem 2.10 (5P)

Hint: The buoyant force of the ball bearing is $\rho_{\text{glyc}} V_{\text{ball}} g$.

8. **Rocket** Taylor problem 3.11 (6P)

9. **Center of Mass:** Taylor problems 3.18 & 3.20 (5P)