Assignments

Assignment 1 - due Friday 10/2 Vector Identities - 1.16(b) 1.19, & $\nabla \left(\vec{A} \cdot \left(\vec{B} \times \vec{r} \right) \right) = \vec{A} \times \vec{B}$ when $\vec{A}$ and $\vec{B}$ are constant vectors, 1.23, 1.32, 1.39, 1.40, 1.45, 2.11*, 2.12, 2.13 *In 2.11(c) include the leading order term due to drag.

Assignment 2 - due Friday 10/9 2.19, 2.39, 2.41*, 2.42, 2.49(a), 2.55*(a-c), 3.4, 3.11, 3.13, 3.22, & Analogous to the dumbbell discussed in class, consider a uniform rod of mass m and length l lying on a frictionless table. The rod is struck on one end by a force F whose direction is perpendicular to the rod. Find the velocity of both ends of the rod immediately after the impulse in terms of the velocity of the center of mass. The moment of inertia of the rod about its center of mass is $I = ml^2/12$.

*Problem 2.55 will be discussed a bit during the discussion session. In problem 2.41 merely perform the necessary integral to determine $y_{\max}(v_0)$.

Assignment 3 - due Friday 10/16 3.27, 3.32, 3.35, 4.3, 4.4, 4.7(a&c), 4.18, 4.19, 4.23, 4.34

Assignment 4 - due Friday 10/23

4.35, 4.36, 4.37, 4.39, 4.46, 4.47, 5.4, 5.13, Prove the Virial Theorem for two particles, $\langle T \rangle = (n/2) \langle U^{int} \rangle$, where T is the total kinetic energy of both particles and U^{int} is the potential for a central conservative force between the two particles of the form $U^{int} = kr^n$. Here r is the relative distance between the two particles and there are no external forces. Hint, for problem 4.39 (a) use the substitution $\sin(\phi/2) = Au$ where $A = \sin(\Phi/2)$ and Φ is the maximum amplitude of oscillation. If you get stuck on 4.39 omit it, but try to complete the rest of the assignment particularly 4.37.

Assignment 5 - Due Friday 10/30 5.11, 5.18, 5.23, 5.27, 5.44, 6.9, 6.11, 6.15 Find the particular solution for the example of a mass being released from a critically damped spring, basically problem 5.28 in the text, using the Green's function

$$G(t - t') = (t - t') e^{-\beta(t-t')} \theta(t - t').$$

Here $\theta(t - t')$ is the Heaviside step function defined so that $\theta(t - t') = 1$ when $t > t'$ and $\theta(t - t') = 0$ when $t < t'$. Additionally the first derivative of $\theta(t - t')$ satisfies $d\theta(t - t')/dt = \delta(t - t')$ where $\delta(t - t')$ is the Dirac delta function.

Performing the required integral is more difficult than simply noting the solution via observation as was done in class, but this exercise demonstrates the power of the concept.

Hint for problem 5.11, think about the conservation of energy.

Hint for problem 5.44, do problem 5.23 first.