PH 125 / LeClair   Fall 2014

Problem Set 1

Instructions:

1. Answer all questions below. Show your work for full credit.
2. All problems are due by the end of the day on 27 Aug 2014.
3. You may collaborate, but everyone must turn in their own work.
4. Use of the problem template is suggested, but not obligatory.

1. Water is poured into a container that has a leak. The mass m of the water is as a function of time t is

$$m = 5.00t^{0.8} - 3.00t + 20.00$$

with $t \geq 0$, m in grams, and t in seconds. At what time is the water mass greatest?

2. (a) Find the separation vector $\Delta \vec{r} = \vec{r} - \vec{r}'$ between the points $\vec{r}' = (3, 4, 5)$ and $\vec{r} = (7, 2, 17)$.
(b) Determine its magnitude, and **(c)** construct the corresponding unit vector.

3. A ball is dropped from rest at height h. Directly below on the ground, a second ball is simultaneously thrown upward with speed v_0. **(a)** If the two balls collide at the moment the second ball is instantaneously at rest, what is the height of the collision? **(b)** What is the relative speed of the balls when they collide? Ignore air resistance.

4. You throw a ball upward. After half of the time to the highest point, the ball has covered what fraction of its maximum height? Ignore air resistance.

5. A ball is dropped, and then another ball is dropped from the same spot one second later. As time goes on while the balls are falling, what is the distance between them at any given time? (Ignoring air resistance, as usual.)

6. Find for me the numerical value I of the following integral, by any means necessary. No work need be shown for this problem, but do note how you obtained the answer.

$$I = \int\limits_{0}^{1.026955} 3\sin\left(x^2\right) dx$$

Find / Given: **Sketch:**

Relevant equations: **Symbolic solution:**

Numeric solution: **Double Check**

Dimensions   Order-of-magnitude