PHY 201 Homework 2

Due Friday, Sept. 13, by noon at SE 316

Use graph paper when drawing graphs.

1. According to your lab notebook, the acceleration of gravity at Geneva college is $9.807\,\mathrm{m/s^2}$. Express this in units of $\mathrm{ft/s^2}$. Be careful to express you answer with the correct number of significant digits.

2. The following exerpt is from an article discussing a drag race held in Norwalk, Ohio:

   ```
   Millican Sets Top Fuel World Records In Fourth Straight Victory IHRA
   Mopar Parts World Nationals
   August 26, 2001

   Norwalk, OH - The Werner Enterprises Top Fuel team threw the doors
   wide open in pursuit of their first IHRA Top Fuel World Championship
   by running the gamut.  Clay Millican qualified number one with an
   IHRA-best 4.63/319, and then went on to win the event over Jim Head
   with a 4.67/320.  The two runs served as backups for each other, so
   Millican comes away from the Mopar Parts World Nationals presented by
   Ethanol with not only an ever-increasing points lead with his fourth
   consecutive title, but also the World Record marks at 4.631 seconds
   and 320.13 mph.  Other winners include Fred Hahn in Mopar Performance
   Parts Pro Modified, Steve Stordeur in Screamin' Eagle Nitro
   Harley-Davidson, Mark Thomas in Funny Car, and
   Gene Wilson in Sunoco Race Fuels Pro Stock.
   ```

   In case you didn't know, drag races are held on a quarter mile track. Be sure to express your answers using the appropriate number of significant digits.

   (a) Express a quarter mile in terms of meters.

   (b) Express Clay Mullican's top speed — for the qualifying round — in terms of SI units. Also, what does 'SI' stand for? What language is this?

   (c) Find Clay Mullican's "average velocity" over the quarter mile.

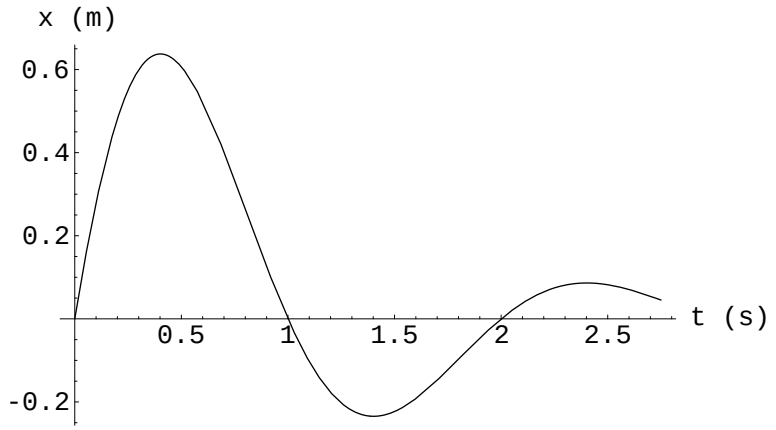
   (d) Find Clay Mullican's "average acceleration" $\bar{a}$ over the quarter mile.

   (e) For the remainder of this problem, let us assume Clay Mullican's acceleration was constant. Based on his "average accleration" $\bar{a}$, sketch a graph of his velocity versus time. Express his velocity as a function of time.

   (f) Using the above, express his position as a function of time.

   (g) Find the time, assuming a constant acceleration of $\bar{a}$, it *would have* taken him to do the quarter mile. Compare your answer with his actual time. What does this mean?

3. The position of an object as a function of time has the following graph:



   (a) Sketch—as well as you can—a graph of velocity versus time.

   (b) When is the acceleration of the object positive and when is it negative?

   (c) When is the object "speeding up" and when is it "slowing down?"

4. A man stands still from $t = 0$ to $t = 30$ seconds. From $t = 30$ seconds to $t = 1$ minute, he walks briskly in a straight line at a constant speed of 2.2 m/s.

   (a) Graph his velocity as a function of time.

   (b) Graph his position as a function of time.

   (c) What is his average velocity between $t = 0$ and $t = 1$ minute?

   (d) What is his average acceleration between $t = 15$ seconds and $t = 40$ seconds?

   (e) What was his displacement between $t = 15$ seconds and $t = 40$ seconds?

   (f) Where was he going?

5. I kick a football into the air. The "hang time" is 4.1 seconds. Be sure to draw a graph to show how you have defined your coordinate system.

   (a) Assuming constant acceleration due to gravity, express the velocity in the vertical direction as a function of time. (Give an algebraic expression.)

   (b) Now, express the height of the ball as a function of time. (Give an algebraic expression.)

   (c) At what time does the ball have zero velocity in the vertical direction? What happens to the acceleration at this time?

   (d) How high did I kick the ball?

   Note: Any former student of Carla's had better get this problem right....