Physics 1a, Section 2

October 4, 2010

Section Business

- Section 2 office hour:
  - Caltech/Cahill 312
  - Tuesdays 3:00 - 4:30 PM
- See other choices on course web site:
  - http://www.its.caltech.edu/~tmu/ph1a

- First homework is due Wednesday 4 PM.

October 6, 2010

PHYSICS 1A

QUIZ 1

Due Monday, October 11

This is an open book quiz. It is to be done in **90 MINUTES**, in one continous sitting. Credit will not be given for overtime work. Please work each of the two problems on **SEPARATE PAGES** (i.e. start your solution to the second problem on a new page).

You may use any class handouts (either paper copies or electronic versions from the Ph1a 2010 course website), any required or recommended textbooks, your own notes taken during lectures or sections, as well as your own homework. You may use a calculator, for numerical calculations only.

You are not allowed to consult any other books, notes, documents, web resources, etc. You are not allowed to discuss your work with anyone.

The quiz is due at **NOON** on Monday, October 11. It is to be deposited in the box outside of 201 E. Bridge (*do not* hand it in during section).

Please remember to write your NAME and SECTION NUMBER clearly on the first page of your answer for EACH problem.

Frautschi, Problem 3.12

- The radioactive isotope ^{11}C decays in such a way that the number of atoms N(t) at any instant is given by $N(t) = N_0 e^{-kt}$, where N_0 is the initial number of atoms, and $k = 0.035$ min-1.
  - a) What fraction of ^{11}C atoms remains after 14 min?
  - b) In how many minutes does the number of ^{11}C atoms decrease to one tenth the original amount?
  - c) After how many minutes does the number of decays per minute equal 1% of the original number of ^{11}C atoms?

Frautschi, Problem 3.12

- a) 0.61
- b) 66 min
- c) 36 min

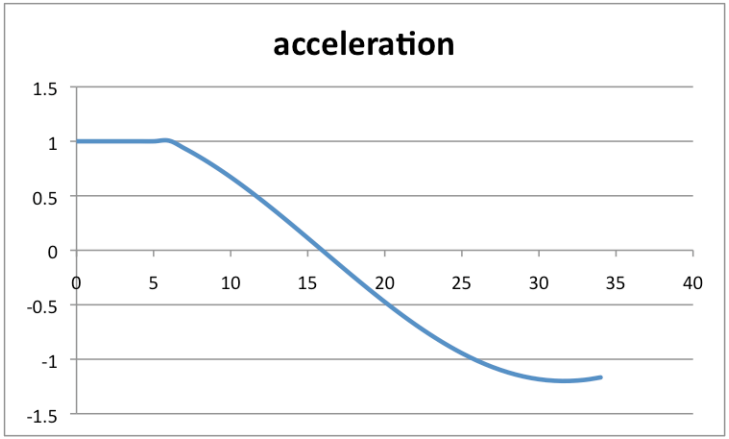
Bungee jumper

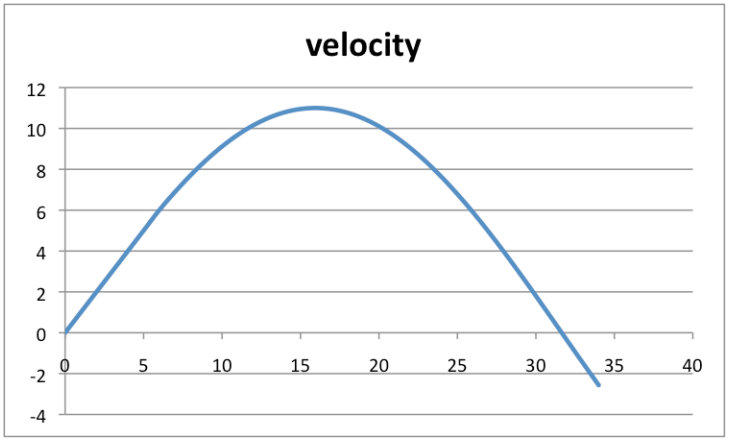
- A bungee jump starts with a downward free fall, followed (hopefully) by an upward acceleration from an elastic rope.
  - a) Sketch the acceleration, velocity, and position experienced during a successful bungee jump.

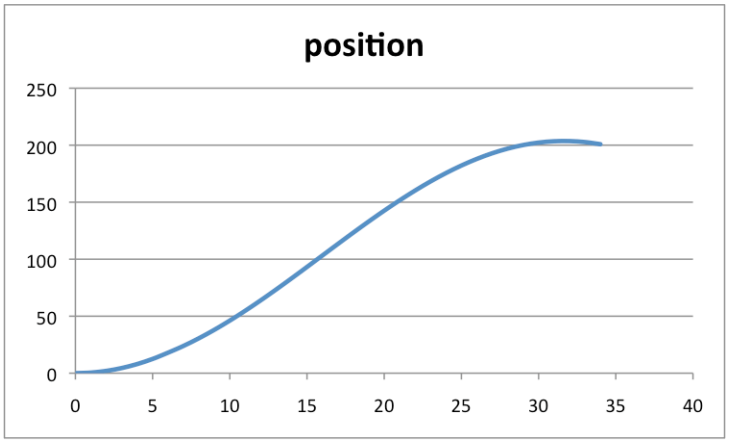
- To simplify a quantitative calculation, assume there is no slack in the bungee at the beginning of the jump, and the acceleration is given by: $a = g - (k/m)\, z$. (This is like a spring.)
  - b) Give an expression for the displacement z and velocity v of the jumper as a function of time.
  - c) What is the maximum extension of the bungee?

Bungee jumper

- a)







- b) $z = g(m/k)\,[1 - \cos\,(k/m)^{1/2}t]$

  $v = g(m/k)^{1/2}\,\sin\,(k/m)^{1/2}t$

- c) extrema of z where $dz/dt = 0$, which is also where $v = 0$:

  $z = 0$ (*minimum*) and $z = 2g(m/k)$ (*maximum*)

Thursday, October 7:

- Final Problem 1
- Quiz Problem 19

- *Optional, but helpful, to try these problems in advance.*