

# Math 46: Applied Math: Homework 1

due Wed Apr 6      ... but best if do relevant questions after each lecture

**p.7-8:** #2 [hint: what are the dimensions of energy?]

#5 (be careful to answer, briefly, all questions)

#6. Please choose your definitions of  $s$  and  $y$  so the plot is a straight line [Hint: choose  $y$  to not involve  $v$ ]. The plot can be a sketch showing intercept and slope.

**p.17-19:** #1 (easy),

#9 'concentration' means mass density; for the last step follow the text above Eqn (1.9) and keep in mind you have *freedom* to choose convenient dimensionless params that get you to the requested law.

**p.30-34:** #3 (it's it nice how 3 parameters  $a, b, \rho$  can be reduced to *zero* parameters by rescaling?) Don't forget to un-rescale when you present your solution for  $x(t)$ .

#4 (you should end up with an ODE with a single small parameter  $\varepsilon$  - what is it?),

#10 (now several steps are left up to you; you should end up with only one free parameter).

#11 (when you reformulate the problem in b, don't forget the initial conditions too. How many ways of nondimensionalizing the problem are there?).

**p.40-44:** #1 a, b, c, d, h. These are review of Math 23; keep in mind the tricks on p.38. Sorry about part b, but I have to do this to you to get you back into ODEs! [Hint: save spacetime by abbreviating  $s$  for  $\sin 2t$  and  $c$  for  $\cos 2t$ ].

#3 Since you've already done a and most of b, finish b and answer the slightly tricky first question in c. In b you'll probably need to look up a vaguely-remembered integral. [Hint for c: to check, do you get the expected time when air resistance vanishes?]