

Math 23 Diff Eq: Homework 9

due Wed Nov 30

... but best if do relevant questions after each lecture

There are a couple of more open-ended questions here. There are lots of exciting Matlab computing and plotting opportunities, but given the short amount of time you have, I have avoided these, favoring applet and pencil-and-paper questions. However, maybe you could do summer research with me on these topics...?

10.4: 35.

10.5: 10 (symmetry about $L/2$ may help you)

13 (You don't need to plot anything here: instead bound the ratio of the n^{th} term in the sum to the first term, and solve for the n value that gives you a ratio of about 0.001. Note, you might get a transcendental equation to solve: you can avoid this by ignoring the $1/n$ dependence of the b_n and focussing only on the exponential decay in t , which is a good approximation)

10.6: 1 (easy)

9 abd (Part a is crucial. For the rest, don't use the computer, just sketch the plots using applets from website to get a feel. For d give an approximation by answering: how much time must elapse before the value of the $n = 1$ sine series term at $x = 5$ drops to 1% of the steady-state value at $x = 5$. This will give a simple algebraic equation to solve. α^2 for aluminum is given on p. 604).

12 ab (Ask yourself: is the $\sin(\pi x/L)$ initial condition an eigenfunction of the $X(x)$ ODE? If not, what are the eigenfunctions? Note orthogonality between sin and cos doesn't apply here since not a full 2π cycle is being integrated over)

10.7: 1 ab (Use the falstad.com/loadedstring applet with maximum number of 'loads', on 'pluck string' mode. Adjust animation speed until you can see it slow enough to sketch at a few times. State your t values in terms of fractions of a period of the motion, eg $t = 1/8$ period etc).

13 (Note you will have to use chain rule twice, as in 3.4.34),

16 (I don't know why the sketch is done for you - don't copy it but do understand it).

10.8: 1 ab. [Note: changed from 5].

8 a (this requires redoing a slight variant on the rectangular separation of variables described. Just write the general solution).