

Math 2250-1 Maple Project 3

Summer 2009

Directions: Hand in a single Maple document, printed and stapled neatly, which contains the answers to the exercises below. At the top of this document, you should create a text field with an appropriate title, the date, your name, and UID. Below this header, please answer the exercises in order. If an exercise calls for computations by hand, you can type up your solutions in a text field, or leave enough space so that you can hand-write your computation/explanation after printing the document.

Maple Help: Maple has an extensive Help menu! You can search for commands to find syntax, related commands, and extensive examples. Additionally, there are some introduction to Maple guides posted on our class webpage (www.math.utah.edu/kitchen/2250Sum09). You can also get help from tutors in the tutoring center, and follow the guidelines in the book as necessary.

Exercises:

1. Plotting Solution Families

Please re-scale your plots to fit on 1/4 page when printed!

- (a) Plot a family of solution curves for the differential equation

$$y'' + 2y' + 2y = 0$$

satisfying (i) $y(0) = 1$ and (ii) $y'(0) = 1$ (use a different plot for each). You should include a hand-written solution to the differential equation itself.

- (b) Plot a family of solution curves for

$$y^{(3)} - 3y'' + 4y' - 2y = 0$$

satisfying initial values $y'(0) = 0$ and $y''(0) = 0$. Include a hand-written solution to the differential equation.

2. Variation of Parameters

Use **Maple** to implement the method of variation of parameters to find the particular solution y_p to $y'' + y = 12x^2 \sin x$.

3. Forced Vibrations

Investigate the solution corresponding to

$$25x'' + 10x' + 226x = 2700te^{-t/5} \cos 3t, \quad x(0) = 0, \quad x'(0) = 0$$

by solving the equation using **dsolve**, then graphing the solution along with its amplitude envelope.

4. Laplace and Inverse Transforms

- (a) Use **Maple** to compute the Laplace transform $F(s) = L\{f(t)\}$ for $f(t) = t \cos 3t$. Then recover $f(t)$ by taking the inverse Laplace transform of $F(s)$.

- (b) Solve the initial value problem $x'' + 4x = \sin(3t)$, $x(0) = 0$, $x'(0) = 0$ by computing a Laplace transform of the entire problem.

5. Laplace Transforms and Resonance

Consider the forced damped oscillation described by the initial value problem

$$25x'' + 10x' + 226x = 16200t^3 e^{-t/5} \cos(3t), \quad x(0) = x'(0) = 0$$

using Laplace transform methods. Then, plot your solution with its amplitude envelope.