

Homework 7 - Math 225 Due Thursday, Mar. 26th

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Office hours: by appointment.

www.math.duke.edu/~mauro/teaching.html

I prefer homework written in pen rather than pencil. The handwriting and organization of your work on the page should be clear. Include appropriate explanations for what you are doing in your calculations and why, and what conclusions you draw or observations you make.

The homework should include a printout of the Matlab/C/Fortran code you used and of the code output (including figures as needed/requested). Also send me a copy of the code via e-mail: if you have multiple files, compress them into a unique zip file. Name the file as `FamilyName_FirstInitial_Homework_xx.zip`, where `xx` is the homework number. This will apply to all the future homework as well. Please use the subject "Math 225 homework" in your e-mail.

1. Consider the following ODE's:

(a) $Y'(x) = (\cos(Y(x)))^2$, with $x \in [0, 10]$, $Y(0) = 0$, with true solution $Y(x) = \arctan(Y(x))$.

(b) $Y'(x) = \frac{1}{1+x^2} - 2(Y(x))^2$, with $x \in [0, 10]$, $Y(0) = 0$, with true solution $Y(x) = \frac{x}{1+x^2}$.

(c) $Y'(x) = \frac{1}{4}Y(x)(1 - \frac{1}{20}Y(x))$, with $x \in [0, 20]$, $Y(0) = 1$, with true solution $Y(x) = \frac{20}{1+19 \exp(-x/4)}$

(d) $Y'(x) = -(Y(x))^2$, with $x \in [1, 10]$, $Y(1) = 1$, with true solution $Y(x) = \frac{1}{x}$.

Solve them with `ode45` and `ode23`, experimenting with the step size, and plotting the \log_{10} error in the solution with different methods and step sizes. Summarize your observations.

Compare with your results from Homework 5.