

Homework 9

Math 330

Type (in \LaTeX) your solutions to the following problems. Submit them either on Moodle or in the homework mailbox (RMS level 3, near the fireplace) by 4:00pm on **Thursday, November 14**.

1. Problem 5.5.9 — Remember that problem 5.5.8 (on HW 8) showed that eigenvalue problems involving the fourth derivative operator are similar to Sturm-Liouville problems in some ways. For this problem, you should derive something analogous to the Rayleigh quotient. You might want to refer to the beginning of Section 5.6.
2. Problem 5.6.1
3. Problem 5.6.2
4. Problem 5.7.1
5. Problem 5.8.6
6. Let $f(x) = x^4$ and $g(x) = \frac{1}{1+x^2}$.
 - (a) Use the forward difference approximation to approximate $f'(1)$ and $g'(1)$. Use $x_0 = 1$ and step sizes $\Delta x = 0.1, 0.01, \text{ and } 0.001$. Compute the error of each approximation. How does the error depend on the step size?
 - (b) Repeat part (a) using the centered difference approximation for the first derivative. How does the error depend on the step size?