

Written Homework 9 (H9)

MA 30300 (Fall 2025, §764)

November 4th, 2025

Instructions

- Due: Saturday, November 15th at 11 PM Eastern Time.
- Total Score: 40 points.
- Section numbers and problem numbers below are as in *Differential Equations and Boundary Value Problems* (6th Edition) by C. Henry Edwards, David E. Penney, and David Calvis. There may be typos below; in this case, always default to the numbers/signs/wording from the textbook.
- The three lowest homework scores will be dropped from the final grade.
- One late submission is permitted (over the course of the semester) with no questions asked.
- Submissions can be hand-written or typed in L^AT_EX and must be submitted on Gradescope.
- You are allowed to discuss and collaborate on problems. However, each student must work on the final submission on their own. **In particular, copying someone else's final submission will be considered cheating and will be reported to the Office of the Dean of Students.**

Problem 0. [0 points] Copy paste the following text in the beginning of your submission:

I have not made use of any unauthorized resources (including online resources) while working on this submission. Any collaboration with other students conforms with the policies of this course.

After that, list all students you collaborated with, clearly indicating which problems you worked with them on. If you did not collaborate with anyone, clearly state this instead.

Problem §9.3 #3. [10 points] Consider the following function:

$$f(t) = 1 - t, \quad 0 < t < 2.$$

Find the Fourier sine series and Fourier cosine series of this function and sketch the graphs of the extensions of f to which these series converge.

Problem §9.3 #14. [10 points] Find the formal Fourier series solution to the following boundary (or endpoint) value problem:

$$x'' + 2x = t, \quad x(0) = x(2) = 0.$$

Problem §9.4 #4. [10 points] Find the steady periodic solution of the following differential equation using Fourier series:

$$x'' + 4x = F(t),$$

where $F(t)$ is the even function of period 4 such that

$$F(t) = 2t, \quad 0 < t < 2.$$

You do not need to plot the graph of the solution.

Problem §9.4 #8. [10 points] For a mass $m = 2$ units and spring (or Hooke's) constant $k = 10$ units in a mass-spring system, determine whether or not pure resonance will occur under the influence of an external force $F(t)$ that is odd and 2-periodic and satisfies

$$F(t) = 1, \quad 0 < t < 1.$$