

Written Homework 10 (H10)

MA 30300 (Fall 2025, §764)

November 16th, 2025

Instructions

- Due: Saturday, November 22nd 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 §9.5 #6. [10 points] Solve the following boundary value problem:

$$\begin{aligned}2u_t &= u_{xx} & (0 < x < 1, t > 0), \\u(0, t) &= u(1, t) = 0, \\u(x, 0) &= 4 \sin(\pi x) \cos^3(\pi x).\end{aligned}$$

Problem §9.5 #15. [10 points] The two faces of a slab $0 \leq x \leq L$ are kept at temperature zero, and the initial temperature of the slab is given by $u(x, 0) = A$ (a constant) for $0 < x < L/2$ and $u(x, 0) = 0$ for $L/2 < x < L$. Derive the formal series solution

$$u(x, t) = \frac{4A}{\pi} \sum_{n=1}^{\infty} \frac{\sin^2(n\pi/4)}{n} \exp(-n^2\pi^2 kt/L^2) \sin \frac{n\pi x}{L}.$$

Problem §9.6 #6. [10 points] Solve the following boundary value problem:

$$\begin{aligned} y_{tt} &= 100y_{xx} & (0 < x < \pi, t > 0), \\ y(0, t) &= y(\pi, t) = 0, \\ y(x, 0) &= x(\pi - x), & y_t(x, 0) = 0. \end{aligned}$$

Problem §9.6 #10. [10 points] Solve the following boundary value problem:

$$\begin{aligned} y_{tt} &= 25y_{xx} & (0 < x < \pi, t > 0), \\ y(0, t) &= y(\pi, t) = 0, \\ y(x, 0) &= y_t(x, 0) = \sin^2 x. \end{aligned}$$