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Math 285 — Midterm 2 practice

Total points: **100**. Please explain all answers. Calculators, computers, books and notes are **not** allowed. Suggestion: even if you cannot complete a problem, write out the part of the solution you know. You can get partial credit for it.

1. **[20 points]** Calculate (so don't give me a memorized answer for) the Fouries Series expansion for $f(t) = 2 + t$ in $-2 \leq t \leq 2$.

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2. **[20 points]** Find all eigenvalues and associated eigenfunctions for the following boundary value problem for $y(x)$:

$$y'' - 2y' + \lambda y = 0$$

$$y(0) = y(2) = 0$$

You may want to consider the substitution $y(x) = e^x g(x)$. To further simplify things you may also want to define $\mu = \lambda$ plus (or minus) an appropriate constant. (But your final answer has to be in terms of $y(x)$ and λ)

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3. [**20 points**] Find the general solution of this forced mechanical oscillator. What will happen to the solution as $t \to +\infty$? Does this result depends on initial conditions and why?

$$x'' + 2x' + 7x = 2\sin(3t)$$

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4. [**20 points**] Find the general solution of the following ODE for $y(x)$:

$$y'' - 6y' + 8y = 8x^2 + 1$$

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5. [**20 points**] Use the method of variation of parameters to find a particular solution to the ODE

$$y'' + 9\,y = \sin(3x)$$