Study guide for Math 302 Midterm 2

November 7, 2018

These are the sorts of questions you should know how to solve for the first midterm.

1. Use the series method to find a degree 4 polynomial approximation to the Taylor series for the solution to $(1+x)y' + y = x^2$ satisfying $y(0) = 3$.
2. Use Laplace transforms to find the solution to $y'' + y = e^x$ satisfying $y(0) = 2$ and $y'(0) = 0$.
3. Find the general solution to $y'' + 2y' + y = e^{3x}$, using whatever method you like.
4. Find the general solution to $y'' - 4y' + 16y = 0$.
5. Show that $e^{(a+bi)x} - e^{(a-bi)x} = 2e^{ax}\sin(bx)$.
6. Find the Laplace transform of the function
$$f(x) = \begin{cases} 2 & \text{if } 0 \le x < 2 \\ 1 & \text{if } 2 \le x < 4 \\ 0 & \text{if } 4 \le x \end{cases}$$
7. Find the general solution to the Bernoulli equation
$$y' + xy = y^3.$$
8. Set up and solve differential equations involving harmonic motion.

You are not expected to be able to use the methods of variation of parameters nor of underdetermined coefficients off the top of your head. Nor are you expected to memorize a table of Laplace transforms. Nor are you expected to have memorized how to solve a Bernoulli equation. For each of these, they will either be on the take-home portion of the exam or they will be on the in-class portion but I will provide the necessary information.