

MATH 307D
Midterm 2
August 2, 2013

Name _____

Student ID # _____

- Your exam should consist of this cover sheet, followed by 5 problems. Check that you have a complete exam.
- Unless otherwise indicated, show all your work and justify your answers.
- Unless otherwise indicated, your answers should be exact values rather than decimal approximations. For example, $\frac{\pi}{4}$ is an exact answer and is preferable to 0.7854.
- You may use a scientific calculator and one double-sided 8.5×11-inch sheet of handwritten notes. All other electronic devices, including graphing or programmable calculators, and calculators which can do calculus, are forbidden.
- The use of headphones, earbuds during the exam is not permitted. Turn off all your electronic devices and put them away.
- If you need more space, write on the back and indicate this. If you still need more space, raise your hand and I'll give you some extra paper to staple onto the back of your test.
- Academic misconduct will guarantee a score of zero on this exam. **DO NOT CHEAT.**

Problem	Points	S C O R E
1	10	
2	10	
3	10	
4	10	
5	10	
Total:	50	

1. (10 points) Find the solution to the initial value problem

$$y'' - 10y' + 25y = 0, \quad y(0) = 1, \quad y'(0) = 1.$$

2. (10 points) Find the general solution to the following equation

$$y'' - 6y' + 8y = (2t + 3)e^t + 3te^{4t} + t^2 + \cos t.$$

You do NOT need to find coefficients for the particular solution. An example:

$$y'' + y = t \Rightarrow y = C_1 \cos t + C_2 \sin t + At + B,$$

where C_1, C_2 are arbitrary real-valued constants, and A, B are coefficients to be determined by plugging into the equation. Your answer should be in a similar form.

3. (10 points) Solve the equation

$$t^2 y'' - 8ty' + 8y = t^2$$

using variation of parameters. One solution is given: $y_1(t) = t$.

4. (10 points) Consider a spring with a ball of mass $m = 1$, with damping coefficient $\gamma = 2$, and spring constant $k = 4$. Suppose it starts from $u(0) = 1$, with velocity $u'(0) = 0$. Find $u(t)$.

5. Continuation of the previous problem. Find:
- (a) (4 points) Quasi frequency, quasi period.
 - (b) (4 points) Amplitude and phase at time t .
 - (c) (2 points) First moment when the ball passes the equilibrium.