

There are a total of 10 problems. Please be sure that you have the entire test. Show all necessary work. Answers that seem to appear by magic will receive no credit.

Your work needs to be done on separate paper and must be neat and easy to read. I suggest that you work out your solutions and then copy them to the paper you plan to submit. All solutions must be submitted in hard copy and in numerical order with your final answer written ON THIS PAPER in the space provided. Multiple pages should be stapled together.

You are to do your own work. You may use any books, your class notes, and Mathematica. This is due by 11:00 a.m., Tuesday, May 8 in my office (16 Colchester Avenue). Late papers will be heavily penalized. You must turn in your test as a hard copy.

We have solved systems by a variety of methods. You may choose whichever method you prefer. But you must show all of work because different methods will give different appearing answers.

I cannot give grades over the telephone. DO NOT call me (or anyone else) asking for your grade. You may ask me in person or you may touch-tone the Registrar for your grade. I will probably turn the grades in sometime on Friday, May 11, 2007.

Each problem is worth 10 points. Good luck!

Solve each of the following differential equations:

Chapter 1 (First-Order Differential Equations)

1. $\frac{dy}{dx} + xy = y, \quad y(1) = 3$

Answer: _____

2. $x \frac{dy}{dx} + (3x+1)y = e^{-3x}$

Answer: _____

Chapter 2 (Linear Equations of Higher Order)

3. $2 \frac{d^5 y}{dx^5} - 7 \frac{d^4 y}{dx^4} + 12 \frac{d^3 y}{dx^3} + 8 \frac{d^2 y}{dx^2} = 0$

Answer: _____

4. $y^{(4)} - 2y''' + y'' = e^x + 1$

Answer: _____

Chapter 3 (Power Series Method)

Your method of solution must use power series and you should leave your answer as a power series.

5. $y' + x^3y = 0$

Answer: _____

6. $(x^2 + 1)y'' + xy' - y = 0$

Answer: _____

Chapter 4 (Laplace Transforms)

You must use Laplace transforms to solve these equations.

7. $y'' + 4y = f(t)$ where $f(t) = \begin{cases} 1, & 0 \leq t < 1 \\ 0, & t \geq 1 \end{cases}$, $y(0) = 0$, $y'(0) = -1$

Answer: _____

8. $ty'' + 2ty' - 2y = 0$, $y(0) = 0$,
 $y'(0) = 0$

Answer: _____

Chapter 5 (Systems of Equations)

9. $x' = \begin{pmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{pmatrix} x$

Answer: _____

10. $x' = \begin{pmatrix} 3 & 1 \\ -1 & 1 \end{pmatrix} x + \begin{pmatrix} -2 \\ 1 \end{pmatrix} e^{2t}$

Answer: _____