Math 202 – 2004

Differential Equations, sections 1–4

Quiz 2. Duration: 70 minutes

GRADES:

| 1 (12 pts) | 2 (12 pts) | 3 (18 pts) | 4 (12 pts) | 5 (18 pts) | TOTAL/72 |
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YOUR NAME:

YOUR AUB ID#:

5 2

PLEASE CIRCLE YOUR SECTION:

| Section 1 | Section 2 | Section 3 | Section 4 |
|---|---|---|---|
| Recitation F 1 | Recitation F 2 | Recitation F 12 | Recitation F 3 |
| Ms. Zantout | Ms. Zantout | Ms. Zantout | Dr. Yamani |

INSTRUCTIONS:

1. Write your NAME and AUB ID number above, and circle your SECTION.
2. Solve the problems inside the booklet. Explain your steps precisely and clearly to ensure full credit. Partial solutions will receive partial credit. Each problem is worth 12 or 18 points.
3. You may use the back of each page for scratchwork OR for solutions. There are three extra blank sheets at the end, for extra scratchwork or solutions. If you need to continue a solution on another page, INDICATE CLEARLY WHERE THE GRADER SHOULD CONTINUE READING.
4. Do as much of the exam as you can, and budget your time carefully. If you cannot do a certain integral, just leave it as an integral in your solution for partial credit on the rest of the problem.
5. No calculators, books, or notes allowed. Turn off and put away any cell phones or beepers.

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6. Problems 3 and 5 ask for series solutions. For full credit on these problems, you need to give a formula for the coefficients. HOWEVER, you can get ALMOST FULL CREDIT if you give the first FOUR nonzero terms for any solution. Example: if you were solving the very simple equation $y''+y=0$, your solution could just say
$$y = c_0\left[1-\frac{x^2}{2!}+\frac{x^4}{4!}-\frac{x^6}{6!}+\cdots\right]+c_1\left[x-\frac{x^3}{3!}+\frac{x^5}{5!}-\frac{x^7}{7!}+\cdots\right]$$
for almost full credit (16/18 points), but for full credit you would have to say that $c_{2\ell}=\frac{(-1)^\ell}{(2\ell)!}c_0$, and that $c_{2\ell+1}=\frac{(-1)^\ell}{(2\ell+1)!}c_1$.

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GOOD LUCK!

**An overview of the exam problems. Each problem is worth 12 points. The problems are repeated inside the booklet — PLEASE SOLVE EACH PROBLEM ON ITS CORRESPONDING PAGE INSIDE.**

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**Remember to READ the instructions on the front of this exam regarding problems 3 and 5, which ask for series solutions.**

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This is the 2004 [illegible]

1. Find the general solution of $y'' - 4y' + 3y = \cos x + e^{3x}$.

2. Find the general solution of $x^2y'' - 4xy' + 6y = x^4e^{10x}$. (Hint: use variation of parameters to find $y_p$. Be careful.)

3. Use a series centered at $x = 0$ to solve the differential equation

$$y'' - x^2y' + xy = 0.$$

4. **USING THE SUBSTITUTION** $x = e^t$, find the general solution of the equation:

$$x^2\frac{d^2y}{dx^2} + 5x\frac{dy}{dx} + 13y = 0.$$

Make sure to explain carefully how you do the substitution.

5. Use a series centered at $x = 0$ to find **ONE** solution of the equation

$$x^2y'' + (2x^2 - 2x)y' + \frac{9}{4}y = 0.$$

6. a) Using the substitution $y = x^{-1}u$, find the general solution of the following differential equation in terms of Bessel functions. **DO NOT WRITE DOWN ANY SERIES IN THIS PROBLEM.**

$$x^2y'' + 3xy' + (x^2 + \frac{8}{9})y = 0.$$

b) (UNRELATED) **WITHOUT SOLVING** the equation below, find the minimum guaranteed radius of convergence for a power series $y = \sum_{n=0}^{\infty} c_n(x-1)^n$ which is a solution of the equation

$$(x^2 + 4)(x - 7)y'' + xy' + 5y = 0.$$