Math 251 Practice Test 2 – Apr 27 2011

name (printed)	*student number*

Instructions:

1. There are **7 pages** (including this cover page) in the test. You will be given **80 minutes** to write the test. Justify every answer, and clearly show your work. Unsupported answers will receive no credit. Read over the test before you begin.

2. You may use a single letter-size "cheat sheet" containing formulae, theory and numerical values, however **your cheat sheet may not contain worked examples.** The instructor will have the final decision on what is or is not appropriate for the cheat sheet. Hand in your cheat sheet along with your completed test. **To be considered for grading, your test must include your cheat sheet.**

3. Other than the cheat sheet noted above, no notes or books are to be used during the test. The last page is for scrap work. Put your name on the scrap paper and return it along with your completed test.

4. A basic scientific non-programmable, non-graphing calculator is permitted, however calculators may not be shared.

5. At the end of the test you will be given the instruction to stop writing. **Continuing to write after this instruction is cheating**.

6. **Academic dishonesty:** Exposing your paper to another student, copying material from another student, or representing your work as that of another student constitutes academic dishonesty. Cases of academic dishonesty may lead to a zero grade in the test, a zero grade in the course, and other measures, such as suspension from this university.

question	value	score
1	10	
2	10	
3	10	
4	10	
5	10	
Total	50	

Question 1:

(a)[6] Given that $y_1(x) = 1/x$ is one solution of

$$2x^2 y'' + 3xy' - y = 0, \qquad x > 0,$$

use reduction of order to find a second linearly independent solution $y_2(x)$. (Do not use "the formula", but rather, find $y_2(x)$ from first principles. You may check your result using the formula however.)

(b)[4] Show that $y_1(x)$ and $y_2(x)$ from part (a) are linearly independent.

Question 2:

(a)[5] Solve the following initial value problem:

$$y'' - 4y' + 4y = 0, \qquad y(0) = 12, y'(0) = -3$$

(b)[5] Find the general solution of

$$y'' + y' + y = 0$$

Question 3:

(a)[5] Find the general solution of

$$y'' - 3y' - 4y = 0$$

(b)[5] Use part (a) to find the general solution of

$$y'' - 3y' - 4y = 3xe^{2x}$$

Question 4 [10]: The temperature $u(r)$ between concentric spheres of radius $r = a$ and $r = b$, (where $a < b$) is determined by the boundary value problem

$$r\frac{d^2u}{dr^2} + 2\frac{du}{dr} = 0, \qquad u(a) = u_0, u(b) = u_1,$$

where u_0 and u_1 are constants. Solve for $u(r)$.
(You may recognize this as homework problem 5.2.27 which was not collected for grading. As a hint, let $y = du/dr$ and reduce the problem to a separable equation.)

Question 5 [10]: Determine the solution of the initial value problem

$$\mathbf{X}' = \begin{bmatrix} 1 & 9 \\ -1 & -5 \end{bmatrix} \mathbf{X}, \qquad \mathbf{X}(0) = \begin{bmatrix} 1 \\ -1 \end{bmatrix}$$