Mathematics 16B
Sarason

April 5, 2006

MIDTERM EXAMINATION 2

Name (Printed): _____

Signature: _____

SID Number: _____

GSI (check one):
- ☐ Tom Dorsey
- ☐ Zak Mesyan
- ☐ David Penneys
- ☐ Arun Sharma

1	
2	
3	
4	
TOTAL	
GRADE POINTS	

Section Number or Time: _____

Put your name on every page.

Closed book except for crib sheet. No calculators.

SHOW YOUR WORK. Cross out anything you have written that you do not wish the grader to consider. Make sure the grader can easily spot your final answer(s) to each question, for example by boxing the answers.

The points for each problem are in parentheses. Perfect score = 70.

Name _____

1. (20) Perform the integrations.

   (a) $I_1 = \int_0^{\sqrt{\pi}} x \sin(x^2) dx$ (b) $I_2 = \int_0^{\pi} x^2 \sin x \, dx$

Name _____

2. (20) For the differential equation $y' = -(y+1)^2(t+1)$:

   (a) What are the constant solutions, if any?

   (b) What is the general solution?

   (c) What is the solution satisfying the initial condition $y(0) = 0$?

3. (20) Roger Rover invests \$300,000 in a real estate trust, which will pay annual interest of 6%, compounded continuously. He arranges for \$1,000 per month to be transferred from his account in the trust to his ex-wife Grouchita's bank account, in payment of alimony.

   (a) Assuming the transfers to Grouchita's account are made continuously, set up a differential equation satisfied by the balance $P(t)$ in Roger's trust account at time t (where t is measured in years, with $t = 0$ corresponding to the inception of the account).

   (b) Find the general solution of the differential equation.

   (c) Find the particular solution describing Roger's account.

   (d) Find an expression for the time it will take for Roger's account to grow to \$400,000.

Name _____

4. (10) An airliner in the fleet of Krate Airways flies at a constant speed of 10 miles/minute along a straight path at a constant altitude of 5 miles. At noon, the plane is directly above radar station A, which records the angle of elevation $\theta(t)$ of the plane as seen from A, as a function of time. Assuming t is measured in minutes with $t = 0$ corresponding to noon, find $\theta'(1)$ in radians/minute.