MAT 250 Exam #1
Spring 2003

DO NOT WRITE ON THIS PAPER (except in the name box to the right). Show all work on blank paper provided. Points may be deducted for insufficient work even if correct answers are given.

Name:

Prob. Num.	Point Value	Points Given
1a	4	
1b	4	
1c	4	
1d	4	
2	8	
3a	4	
3b	4	
3c	4	
3d	4	
4	8	
5	8	
6	8	
7	8	
8a	8	
8b	8	
Total	88	
Adj.		
Grade		

1) Classify each as an ordinary or partial differential equation, give the order, and identify the independent and dependent variables. If the equation is ordinary, state whether it's linear or nonlinear.

a. $\dfrac{d^3y}{dx^3} - 3x^2\dfrac{dy}{dx} + 8y = \sin x$

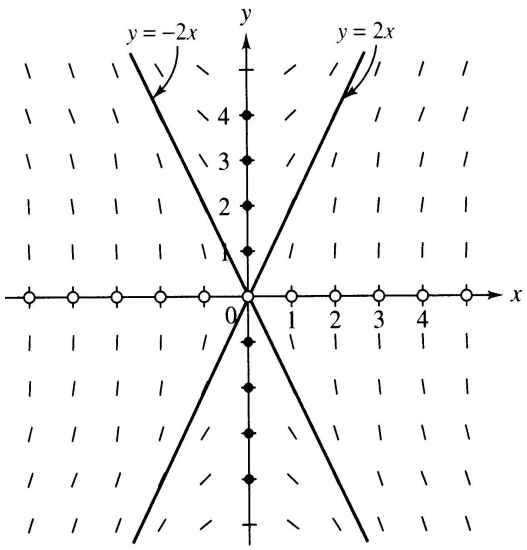
b. $\dfrac{d^4y}{dx^4} - 3x\dfrac{dy^2}{dx^2} + 8y^2 = x$

c. $\dfrac{dr}{dt} = \dfrac{r(5-9t)}{t(2-3r)}$

d. $\dfrac{\partial^2 u}{\partial r^2} + \dfrac{1}{r}\dfrac{\partial u}{\partial r} + \dfrac{1}{r^2}\dfrac{\partial^2 u}{\partial \theta^2} = 0$

2) Show that $\phi(x) = c_1 \sin x + c_2 \cos x$ is a solution to $d^2y/dx^2 + y = 0$ for any choice of the constants c_1 and c_2.

3) The direction field for $dy/dx = 4x/y$ is:



a. Verify that $y = \pm 2x$ are solution curves.

b. Sketch the solution curve with initial condition $y(0) = 2$.

c. Sketch the solution curve with initial condition $y(-2) = -3$.

d. What can be said about the behavior of the above solutions as $x \to \infty$? How about $x \to -\infty$?

4) Determine for which value(s) of m the function $\phi(x) = x^m$ is a solution to the equation $3x^2\dfrac{d^2y}{dx^2} + 11x\dfrac{dy}{dx} - 3y = 0$

5) Use Euler's Method with step size $h = 0.2$ to approximate the solution to the initial value problem $y' = \dfrac{y^2 + y}{2x}$, $y(1) = 1$ at the points x = 1.2, 1.4, 1.6, 1.8.

6) Solve the initial value problem: $\dfrac{dy}{dx} = 2\sqrt{y+1}\cos x, \quad y(\pi) = 0$

7) Assuming only air resistance (b) and gravity (g) are acting on a falling body of mass m, the model for its velocity v is given by $m\dfrac{dv}{dt} = mg - bv$. If m = 150 kg, g = 9.8 m/s^2, b = 5 kg/s, and $v(0) = 12$ m/s^2, solve for $v(t)$. What is the limiting velocity of the body?

8) Solve the following:

a. $\dfrac{dy}{dx} = x^2 e^{-4x} - 4y$.

b. $\sin x\dfrac{dy}{dx} + y\cos x = x\sin x, \quad y\left(\frac{\pi}{2}\right) = 2$