Differential Equations **Math 236 Spring 2001**

This worksheet will concern the following six differential equations. Don't start solving them yet; follow the instructions below. There will be a problem on the test that uses the skills covered on this worksheet.

Differential Equation	Separated form	First-order Linear Form
A. $\frac{dy}{dx} = 4 - 6y$		
B. $\frac{dy}{dx} = \sqrt{xy}\ \sin x$		
D. $\frac{dy}{dx} = \frac{2y + x^2}{x}$		
E. $\frac{dy}{dx} = \cos^2 x - y^2 \sec^2 x$		
C. $\frac{dy}{dx} = e^{x+y}$		
F. $\frac{dy}{dx} = x + y$		
G. $\frac{dy}{dx} = 1 + 2xy$		

1. Exactly three of the differential equations above are separable. Write these equations in the form $p(y)y' = q(x)$ in the second column of the table above. Don't try to solve these equations yet.

2. Exactly four of the differential equations above are first-order linear equations. (Note: it is possible for a differential equation to be *both* separable and first-order linear.) Write each first-order linear equation in the form $y' + p(x)y = q(x)$ in the last column of the table above. Don't try to solve these equations yet.

3. Two of the three separable differential equations are solvable using the methods from this course. (You won't know which one isn't solvable until you get stuck trying to solve it.) Solve the two that you can by using separation of variables, and check your answers by differentiating. Then explain where (and why) you get stuck in the one you can't solve.

4. Three of the four first-order linear differential equations are solvable using methods from this course. (You won't know which one isn't solvable until you get stuck trying to solve it.) Solve the two that you can by using an integrating factor, and check your answers by differentiating. Then explain where (and why) you get stuck in the one you can't solve.

5. Three of the differential equations above are not solvable using the methods of this class (you found two of them in the two problems above; what is the third one and why isn't it solvable for us?). One of these three differential equations has $y = \sin x \cos x$ as a solution. Prove it.