**Millersville University** **Name** _____
**Department of Mathematics**
**MATH 365, *Ordinary Differential Equations*, Homework 02**
**January 21, 2009**

Please answer the following questions. Answers without justifying work will receive no credit. Partial credit will be given as appropriate, do not leave any problem blank. Each problem is worth 10 points. Your completed assignment is due at class time on Friday, January 23, 2009.

1. Find the solution to the following ordinary differential equation.

$$y' + 2t\,y = te^{-t^2}$$

2. Consider the ordinary differential equation

$$y' + (\cos t)y = e^{-\sin t}.$$

Find the solution $\phi(t)$ which satisfies the condition $\phi(\pi) = \pi$.

3. The ordinary differential equation,

$$y' + p(t)\, y = g(t) y^k$$

where $k$ is a constant, is called **Bernoulli's equation**.

(a) Show that if we make the substitution $z = y^{1-k}$, Bernoulli's equation becomes the linear equation,

$$z' + (1-k)p(t)\, z = (1-k)g(t).$$

(b) Use this substitution technique to solve the ordinary differential equation

$$y' - 2t\, y = t\, y^2.$$

4. Suppose $\phi(t)$ is a function with a continuous first derivative and for which $\phi(0) = 1$. Furthermore suppose $\phi'(t) - 2\phi(t) \leq 1$. Show that $\phi(t) \leq \frac{3}{2}e^{2t} - \frac{1}{2}$. (*Hint:* use an integrating factor and properties of the definite integral on the differential inequality given.)