

# Math 385 Spring 2007

## Quiz 2

There are two problems on this quiz. You must show your work to receive credit.

1. Solve the initial value problem

$$y' + 3y = 4x^3e^{-3x}, \quad y(0) = 1.$$

**Answer:**  $y(x) = (x^4 + 1)e^{-3x}$  (solve by the method of integrating factors)

2. Suppose that  $y_1(x)$  is a solution to the first-order ODE

$$y' + P(x)y = Q_1(x),$$

and that  $y_2(x)$  is a solution to the first-order ODE

$$y' + P(x)y = Q_2(x).$$

Write a first-order ODE which has the function  $z(x) = 2y_1(x) + 3y_2(x)$  as a solution. Show that your answer is correct.

**Answer:**  $z' + P(x)z = 2Q_1(x) + 3Q_2(x)$

To see that this is true, calculate

$$\begin{aligned} z'(x) + P(x)z(x) &= (2y_1'(x) + 3y_2'(x)) + P(x)(2y_1(x) + 3y_2(x)) \\ &= 2(y_1'(x) + P(x)y_1(x)) + 3(y_2'(x) + P(x)y_2(x)) \\ &= 2Q_1(x) + 3Q_2(x). \end{aligned}$$