

MATH 4512. Differential Equations with Applications.
Midterm Exam #1. March 4, 2009.

60 points are distributed between 5 problems, 12 points each.
You have 50 minutes to work on these problems.
No books, notes, and calculators.

1. Solve the initial value problem

$$x \frac{dy}{dx} = 2y + \frac{3}{x}, \quad y(1) = 0.$$

2. Find the general solution of the equation

$$\frac{dy}{dx} - xy^2 = xy.$$

3. Find the general solution of the equation

$$x \frac{dy}{dx} = y(\ln y - \ln x).$$

4. Solve the initial value problem

$$y'' - 7y' + 6y = 0, \quad y(0) = 2, \quad y'(0) = 7.$$

5. Find the general solution of the equation of the differential equation

$$y'' + 4y' + 5y = e^{-2x} \sin x.$$

Remark. The formula

$$P(D)[e^{\lambda x} f(x)] = e^{\lambda x} P(D + \lambda) f(x)$$

can make computations shorter. Here $D = d/dx$ and P is a polynomial.