M412 Assignment 2, due Friday September 9

1. [10 pts] Use the method of diagonalization to determine a general solution for the ODE system

$$y_1' = -y_1 + \frac{3}{4}y_2$$
$$y_2' = -5y_1 + 3y_2.$$

2. [10 pts] Use the method of characteristics to solve the PDE

$$u_t + t^2 u_x = 0$$
$$u(0, x) = e^{-x^2}.$$

3. [10 pts] Use the method of characteristics to solve the PDE

$$u_t + 2u_x = t$$
$$u(0, x) = 1 - x.$$

4. [10 pts] Use the method of characterstics to solve the PDE

$$u_t + u_x + 2tu^2 = 0$$
$$u(0, x) = e^{-x}.$$

5. [10 pts] Use the method of characteristics to solve the PDE

$$u_t + 2u_x = x^2$$
$$u(t, 0) = t^2, \quad t > 0$$
$$u(0, x) = x, \quad x > 0.$$