Problem Set 4: Ordinary Differential Equations
FIN 550: Numerical Methods and Optimization in Finance
P. Dybvig

At the start of class December 4, submit all problems for grading.

1. Consider the differential equation

$$y'(x) = -xy(x).$$

a. Find the general solution. (Hint: move all expressions in y and its derivatives to the left-hand side, and move all expressions in x to the right-hand side.)

b. Find the particular solution satisfying $y(0) = 1/\sqrt{2\pi}$.

2. Consider the differential equation

$$xy'(x) + y(x) = \cos(x)$$

for $x > 0$.

a. Use an integrating factor to find the general solution.

b. Find the particular solution $y(x)$ that is continuous at $x = 0$.

3. Consider the differential equation

$$y''(x) + 4y(x) = 8x^3.$$

a. Find a particular solution.

b. Find the general homogeneous solution.

c. Use parts a and b to write down the general solution.

d. Find the particular solution satisfying initial conditions $y(0) = 1$ and $y'(0) = -3$.