MATH 411, Spring 2001
Midterm
Date: February 20, 2001

1) Solve initial-value problem:

$$y + xy' = a(1 + xy), \qquad y\Big|_{x=1/a} = -a, \quad a = \text{constant}.$$

2) Find general solution to the equation

$$y' = \sin(x - y).$$

3) Solve the Bernoulli equation

$$2y' \sin x + y \cos x = y^3 \sin^2 x.$$

4) Integrate the equation

$$(1 - x^2 y)\,\mathrm{d}x + x^2(y - x)\,\mathrm{d}y = 0.$$

5) Find general solution to the equation

$$y'' - y' = \frac{1}{e^x + 1}.$$

6) Discuss simple approaches for solving the linear equation
a) start with definition of linear operator;
b) recall what is the definition of linear equation;
c) recall what is the general (complete) solution to differential equation;
d) show that general solution to inhomogeneous equation can be obtained as a sum of general solution to homogeneous equation and particular solution to inhomogeneous equation.

During the examination you are allowed to use books and your notes. Any communications are prohibited. If you have any questions, please ask the instructor. Good luck!