

Show all your work and indicate your reasoning in order to receive the most credit. Present your answers in “low-entropy” form. Write your name on the problems page and staple it together with your solutions.

**Date:**

**Name:**

1. (10pt) Solve the following first order linear ODE:

$$xy' + (x + 1)y = 3x^2e^{-x}.$$

Compare your answer with a result produced by a computer algebra system.

2. (10pt) Solve the following first order ODE:

$$y' = \frac{y}{3x - y^2}$$

Hint: solve for  $x(y)$ .

Compare your answer with a result produced by a computer algebra system.

3. (10pt) Find the integral representation of the solution of the following ODE:

$$y'' + \alpha xy' + \beta y = 0,$$

where  $\alpha$  and  $\beta$  are constants.

Show that if  $\alpha$  and  $\beta$  are negative then the positive real axis is a possible choice of the integration contour in the solution.

Compare your answer with a result produced by a computer algebra system.

4. (10pt) Find the leading term for the following integral for  $\lambda \rightarrow \infty$ :

$$I(\lambda) = \int_0^2 e^{\lambda x(1-x)} dx.$$