

MATH555  
Differential Equations  
Practice Exam III

1. Determine the Taylor series of the following function about the point  $x_0$ , and determine the radius of convergence of the series.

$$f(x) = \ln x, \quad x_0 = 1.$$

2. Determine all the singular points of the given equation and determine whether each one is regular or irregular.

$$x^2(1 - x^2)y'' + \frac{2}{x}y' + 4y = 0.$$

3. Determine two linearly independent solutions about  $x = 0$  to the following equation.

$$(1 - x^2)y'' - 2xy' + 2y = 0.$$

4. Determine two linearly independent solutions about  $x = 0$  to the following equation.

$$x^2y'' + 3xy' + (1 + x)y = 0.$$

5. Determine two linearly independent solutions about  $x = 0$  to the following equation.

$$x^2y'' + xy' + \left(x^2 - \frac{9}{4}\right)y = 0.$$