NAME **DIFFERENTIAL EQUATIONS** **Test 3D**

4 problems- 25 points each **Show all work for full credit!**

1 Solve by using power series: $2y' - y = \sinh(x)$. Compute the first 6 coefficients $(a_0 - a_5)$.

2 Solve the differential equation below with initial conditions. Compute the first 6 coefficients $(a_0 - a_5)$. Find the general pattern.

$(1-2x)y'' - y' + xy = 0$ $y(0) = 0,\ y'(0) = 1$

3 Consider differential equation: $x^3(x^2-1)^2(x^2+1)y'' + (x-1)x\ y' + y = 0$. Determine whether x=0 is a regular singular point. Determine whether x=1 is a regular singular point. Are there any regular singular points that are complex numbers? Justify conclusions.

4 Use the Frobenius method to solve: $xy'' - y' + 2y = 0$. Find index r and recurrence relation. Compute the first 5 terms $(a_0 - a_4)$ using the recurrence relation for each solution and index r.