Name: _____

Directions: Show all work. No credit for answers without work.

1. [**10 points**] Analyze $y' = y^2(y^2 - 4y - 5)$ qualitatively. That is, identify the equilibrium solutions and classify each as stable, semi-stable, or unstable. Include a sketch of typical solutions with a phase diagram.

2. [**15 points**] Solve the following differential equation: $6x^2y^2 + (e^y + ye^y + 4x^3y)y' = 0$.

3. [**15 points**] Solve the following IVP: $y'' + 4y' - 12y = 0$ with $y(0) = -1$ and $y'(0) = 1$.

4. [**10 points**] Find the general solution to $y^{(5)} + 4y^{(4)} + 4y^{(3)} = 0$.

5. [**20 points**] Find the general solution to $y'' - 10y' + 34y = te^t$.

6. [**20 points**] Given that $y_1 = t^{-1}$ is a solution to $t^2 y'' + 3ty' + y = 0$ for $t > 0$, find another solution y_2 that forms a fundamental set of solutions with y_1.

7. [**10 points**] Show that $y_1 = \cos(t)$ and $y_2 = \sin(t)$ form a fundamental set of solutions to $y'' + y = 0$.