MATH 295 Differential Equations HW # 1, due May 31st.

Show all work justifying your answer. No work, no credit. Solve the problems in order. Write your name or initials on each page. Assignments are due at noon.

1. Verify that $y^2 - 2\ln y = x^2$ is a solution to the differential equation $y' = \frac{xy}{y^2-1}$

2. Verify that $y = e^{-\cos x}$ satisfies the differential equation $y' = y\sin(x), y(\frac{\pi}{2}) = 1$

3. Verify that $y = C_1\sin(3x) + C_2\cos(3x)$ satisfies the differential equation $y'' + 9y = 0$. Then find the particular solution satisfying $y(\pi/6) = 2$ and $y'(\pi/6) = 1$.

4. Verify by substitution that each given function is a solution of
$x^2y'' - xy' + 2y = 0$; $y_1 = x\cos(\ln x)$, $y_2 = x\sin(\ln x)$.

5. Use integration to find the general solution of the differential equation
$y' = xe^{x^2}$

6. Solve the differential equation $y\ln x - xy' = 0$

7. Find the particular solution of the differential equation
$\frac{du}{dv} = uv\sin(v^2), u(0) = 1$

8. Find the orthogonal trajectories of the family $x^2 = Cy$

9. Use separation of variables to solve the differential equation $\frac{dy}{dx} = x(1 + y)$

10. The rate of change of N is proportional to N. When $t = 0$, $N = 250$, and when $t = 1$, $N = 400$. Write and solve the differential equation that models this verbal statement. Then find the value of N when $t = 4$.