Midterm Examination

Print your name: __________________       ____________
Print your ID #: ____________________________

You have 50 minutes to solve the problems. Good luck!
1. Find the solution:
   
   A. \( \dot{y} + 2ty = 2t \cos(t^2), \ y(0) = 0 \).
   
   B. \( \dot{y} + 2ty = 2t \sin(t^2), \ y(0) = 0 \).

2. Solve
   
   A. \( \dot{y} = \left( \frac{t}{y} \right)^2, \ y(0) = 1 \).
   
   B. \( \dot{y} = e^{t-y}, \ y(0) = 1 \).

3. Determine where the solution of
   
   A. \( y'' + 2y' + y = 0, \ y(0) = 0, \ y'(0) = a > 0 \)
   
   B. \( y'' + 4y' + y = 0, \ y(0) = a > 0, \ y'(0) = a \)

   takes on its maximal value.

   [The real number \( a \) is given and positive.]

4. Indicate which of the following equations are linear (l) and which are nonlinear (n) by circling your answer:
   
   A. \( t^2y' = e^y \)
      \( y' = t - \cos(y) \)
      \( y'' + 2y + y^2 = 0 \)
      \( y'' + e^y' + \ln(t)y = 0 \)
      \( y'' + e^y' + y = 0 \)

   B. \( e^y' = t^2y \)
      \( y' = \sin(t) - \cos(y) \)
      \( y'' + (y')^2 + 2y = 0 \)
      \( e^y'' + \cos(t)y' + y = 0 \)
      \( y'' + y' + e^y = 4 \)

5. Solve
   
   A. \( y'' - y = 2, \ y(0) = 0, \ y'(0) = 0 \).
   
   B. \( y'' + y = 1, \ y(0) = 0, \ y'(0) = 0 \).