May 13, 2015
Math 201, Tutorial 1

1) Verify by direct substitution that each of the given functions is a solution to the given DE on the specified interval and suggest why the particular interval is chosen.

   a) $y'' = (y')^2/(2y) - 2y \quad y = sin^2(x)$ on $(0, \pi)$.

   b) $y' = y/x - 4xy \quad y = xe^{-2x^2}$ on $(0, \infty)$.

   c) $y'' = -2y' - 2y \quad y = e^{-t}(sin(t) + cos(t))$ on $(-\infty, \infty)$.

2) Consider the autonomous D.E. $y' = (y-1)(y-2)(y-3)$.

   a) Find the equilibrium solutions.

   b) Draw the 1-dimensional phase protrait and classify the equilibrium points as stable, unstable, or semi-stable.

   c) Comment on uniqueness and existence of the IVP associated with this DE, $y(0) = 1$.

3) Solve the following IVP problems:

   a) $y' = -\lambda y$ where $\lambda > 0$ is a constant and $y(0) = 10000$. ($y = ce^{-\lambda t}$ is a one parameter family of solutions to the ODE on $(-\infty, \infty)$).

   b) $y'' + 2y' + 2y = 0$ where $y(0) = y_0$ and $y'(0) = y_1$ where y_0 and y_1 are constants. ($y = e^{-t}(c_1 sin(t) + c_2 cos(t))$ is a 2 parameter family of solutions to the second order ODE on $(-\infty, \infty)$).