You may work with other class members on this quiz, but you may not receive assistance from people not in MATH 333 (Section 002). You must show all of your work to receive full credit. Do all your work on other sheets of paper and be sure to staple all the pieces of paper together or YOU WILL GET A 'ZERO' ON THE QUIZ. Do not use decimal approximations unless asked to do so. Your work on this quiz must be handed in by Friday, 26 September 2008 at 1040. GOOD LUCK!

1) Consider the differential equation
\[ \frac{dy}{dt} = 6y^2 - y^3 - y^4. \] (1)

a) Find all equilibrium solutions of (1).

b) Draw the phase line and phase portrait for (1).

c) Classify each equilibrium solution as a source, sink, or neither.

d) Describe precisely the long-term behavior (i.e., behavior as \( t \to \infty \)) for the following initial conditions:
   i) \( y(0) = 0 \)
   ii) \( y(0) = -4 \)
   iii) \( y(0) = 4 \)

2) Let \( y = 3 \) be an equilibrium solution of the differential equation
\[ \frac{dy}{dt} = f(y) \]
such that \( f'(3) = 0 \). Give a formula for a function \( f \) such that the equilibrium solution \( y = 3 \) is a

   a) source
   b) sink
   c) node

and show that your function \( f \) satisfies all the necessary properties.