HOMEWORK 3

DUE: MONDAY, JUNE 5

1. For the following autonomous DE's: draw the phase line, draw an integral curve in each *region*, determine the equilibrium points and classify them.

a) $y' = -2y^2(y-1)^2$

b) $y' = y(y^2 - 1)$

c) $y' = (y-1)\ln(2/y)$ (assume y is positive)

2. Draw the bifurcation diagrams for the following differential equations (draw phase lines in every region and indicate stability of every equilibrium).

a) $y' = a - y^2$

b) $y' = y^3 - ay$

c) $y' = y^2 + ay$

3. In each of the following problems determine if the DE is exact and if it is solve the IVP.

a) $(2x - y) + (2y - x)y' = 0$, $y(1) = 3$

b) $(9x^2 + y - 1) - (4y - x)y' = 0$, $y(1) = 0$

c) $(x \ln y + xy) + (y \ln x + xy)y' = 0$, $y(1) = 1$

4. Find the value of k for which the following DE becomes exact, and find the general solution for that value of k

$$(ye^{2xy} + x) + kxe^{2xy}y' = 0$$

5. Show that the given DE's are not exact but become exact when multiplied by the given integrating factor, and find the general solutions.

a) $(x + 2)\sin y + (x \cos y)y' = 0$, $u(x, y) = xe^x$

b) $x^2y^3 + x(1 + y^2)y' = 0$, $u(x, y) = x^{-1}y^{-3}$