## Homework 3
## Due: Monday, June 1

**1.** For the following autonomous DE's: draw the phase line, the direction fields, sketch several integral curves, and determine the equilibrium points and classify each one as stable, unstable, or semistable.

a) $y' = -2y^2(y-1)^2$
b) $y' = y(y^2-1)$
c) $y' = \sqrt{y}(4-y^2)$ (assume $y$ is positive)
d) $y' = y\ln(2/y)$ (assume $y$ is positive)

**2.** 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) $(x\ln y + xy) + (y\ln x + xy)y' = 0$, $y(1) = 1$

**3.** Find the value of $k$ for which the following DE becomes exact, and then solve it using that value of $k$

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

**4.** Show that the given DE's are not exact but become exact when multiplied by the given integrating factor. Then solve the equations

a) $\left(\dfrac{\sin y}{y} - 2e^{-x}\sin x\right) + \left(\dfrac{\cos y + 2e^{-x}\cos x}{y}\right)y' = 0$, $\mu(x,y) = ye^x$
b) $x^2y^3 + x(1+y^2)y' = 0$, $\mu(x,y) = x^{-1}y^{-3}$

**5.** Find the integrating factor and solve the given equations

a) $1 + (x/y - \sin y)y' = 0$
b) $y' = e^{2x} + y - 1$

**6.** Solve the following problems from the book: Chapter 2.3 problems 2, 3, 4, 13