

**Math 330: Review Sheet#1a****First Order ODES**

- (1) For each of the following first order equations, construct approximate graphical solutions by plotting the SLOPE field and several solution curves. For practice, find the ANALYTIC solutions - each of these equations is WHAT SORT? of first order ODE?

a.  $\frac{dy}{dx} = y(9 - y^2)$

b.  $\frac{dy}{dx} = yx$

c.  $\frac{dy}{dx} = \sin(x)$

d.  $\frac{dy}{dx} = y^3 - y^2 - 2y$

- (2) Classify the following ODE's as linear, exact, homogeneous or seperable and find the general solution.

a)  $e^x \sin y - 2y \sin x + (e^x \cos y + 2 \cos x) y' = 0$

b)  $y' + \frac{2}{x}y = x$

c)  $y' = \frac{x - e^{-x}}{y + e^y}$

d)  $y' = \frac{y^2 + 2xy}{x^2}$

- (3) Consider the differential equation:

$$y' - 3y = f(x)$$

- What sort of ODE is this?
- Find the general solution when  $f(x) = e^x + 1$ .
- Find the general solution when  $f(x) = e^{2x} + 1$ .
- Find the general solution when  $f(x) = e^{3x} + 1$ .
- Find the general solution when  $f(x) = e^{4x} + 1$ .
- Which one of the solutions in the above cases is fundamentally *different* from the others. Why?