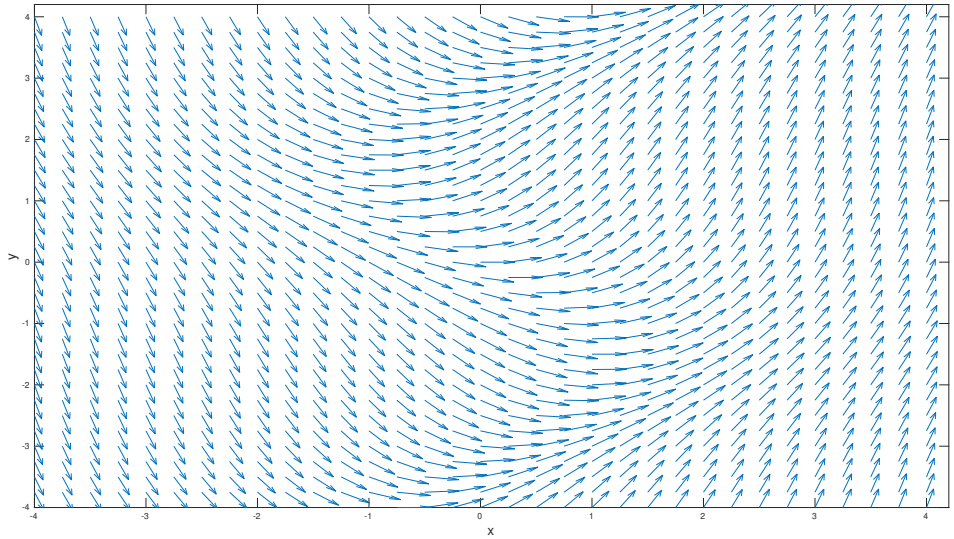
Math 231 Work Sheet 1 NAME:

Summary: This worksheet corresponds to sections 1.1, 1.3, 2.1, 2.2 in the textbook.

1. (Direction Field). The following graph shows the direction fields of the ODE

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



On this graph trace the solutions to the IVP associated with the following initial conditions and label which is which:
(a) $y(0) = 0$
(b) $y(0) = 1$
(c) $y(-2) = -1$

2. (Separable ODE). Find all the solutions of the ODE $y'(x) = xy^2$. (Don't forget constant solutions.)

3. (Solving the model of falling body with air resistance). Solve the following IVP:

$$\frac{dv}{dt} = \frac{mg - bv}{m}, \qquad v(0) = v_0,$$

where m, g, b, v_0 are all given.

4. (Separable ODE, integration by parts. Do this problem only if you have time.). Implicitly solve the separable ODE with initial value:

$$\frac{dy}{dx} = \frac{\cos(x)}{\ln(y)}, \qquad y(0) = 1.$$

5. (order of DEs). Give the order of each of the following differential equations.
(a) $t^3y' + (y'')^2 = 3y + 1$
(b) $y'' = 3t + 1$
(c) $f^{(5)}(t) + f''(t) = t^2 + t + f(t) - 1$

6. (linear or nonlinear DEs). Determine whether each of the following differential equations is linear. If not explain what is not permitted.
(a) $ty' + t^2y = \sin(t)$
(b) $yy' + t^2y = e^t$
(c) $te^y + y' = 2t + 1$
(d) $\sin(t)y'' - \frac{1}{t}y' = y + 1$