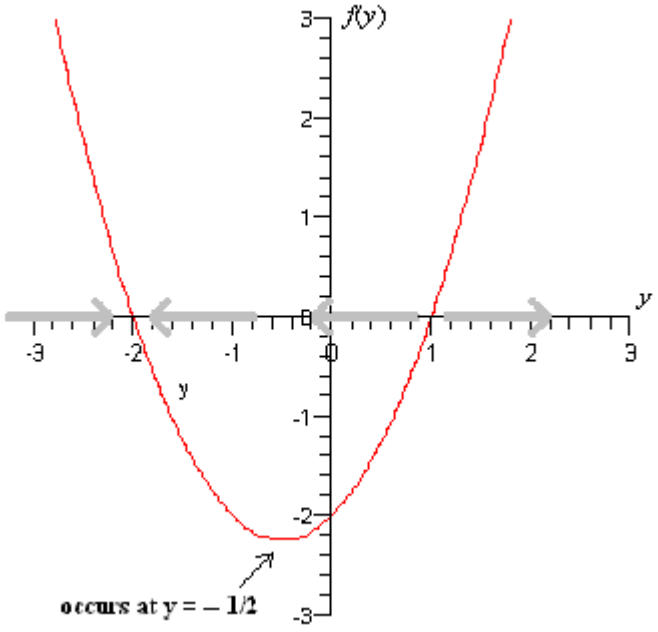
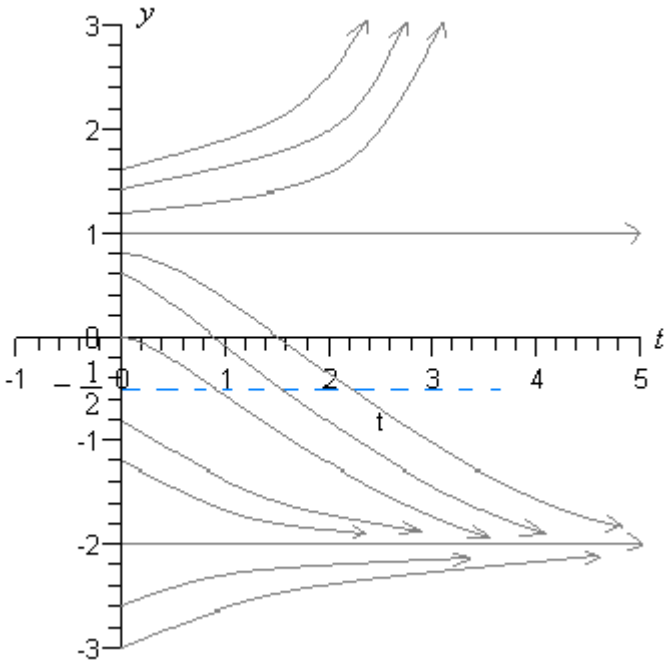
Math 341 Quiz #5 Name: KEY

1. For the following differential equation: $\dfrac{dy}{dt} = (y-1)(y+2) = f(y), \quad -\infty < y_0 < \infty$

   (a) Sketch the graph of $f(y)$ versus y and indicate all relevant information.



   (b) Sketch several graphs of solutions in the $ty-$plane, making sure to include enough detail so that the stability of all critical (equilibrium) points can be visually determined, and the complete shape of each type of solution is clear.



2. Solve (implicitly) the following exact differential equation.

$$3y^2e^{3x} + 4 + 2ye^{3x}\frac{dy}{dx} = 0$$

$$\begin{aligned}
\psi(x,y) &= \int \left(3y^2e^{3x} + 4\right)\ \partial x = y^2e^{3x} + 4x + f(y) \\
\psi(x,y) &= \int 2ye^{3x}\ \partial y = y^2e^{3x} + g(x)
\end{aligned}$$

$$\text{So, } \psi(x,y) = y^2e^{3x} + 4x$$

$$\begin{aligned}
\text{The DE becomes} &: \\
\frac{d}{dx}\left(y^2e^{3x} + 4x\right) &= 0 \\
\text{which solves to} &: \\
y^2e^{3x} + 4x &= c
\end{aligned}$$