1. [10 points]
   a. [4 points] Consider the differential equation $y' = y^2 + y - 2$. Find all of the equilibrium solutions of the differential equation and indicate whether they are stable or unstable. Circle your answers.
   \[
   \begin{align*}
   \text{Solution:} & \quad y' = y^2 + y - 2 = (y + 2)(y - 1). \quad \text{Therefore the equilibrium solutions are } y = -2 \text{ which is stable and } y = 1 \text{ which is unstable.}
   \end{align*}
   \]

   b. [4 points] Solve the differential equation $y' = y^2$ with initial condition $y(0) = 1$.
   \[
   \begin{align*}
   \text{Solution:} & \quad \text{Separating variables we have } \frac{dy}{y^2} = dx. \quad \text{Integrating both sides we have } -\frac{1}{y} = x + c \quad \text{therefore } y = \frac{1}{x + c}. \quad \text{Plugging in the initial condition we must have } c = -1. \quad \text{So } y = \frac{1}{1-x}.
   \end{align*}
   \]

   c. [2 points] Which of the following functions is a solution to the differential equation $y' = \sin(x) + y$? Circle your answer.
   \[
   \begin{align*}
   y &= \frac{1}{2}(\sin(x) + \cos(x)) \\
y &= -\frac{1}{2}(\sin(x) - \cos(x)) \\
y &= \frac{1}{2}(\sin(x) - \cos(x)) \\
y &= -\frac{1}{2}(\sin(x) + \cos(x))
   \end{align*}
   \]