1. Suppose \( y'(t) = f(y) \), where the graph of \( f(y) \) is given below. Carefully draw the integral curves for this equation. What are the equilibrium solutions? What are their stability types? Describe the initial concavity of the solution curves. Assume \( y(t) \) and \( t \) are nonnegative.

2. Match the differential equation with its direction field. (You get 4 points for each correct match, -2 for each wrong match.)
   1. \( y' = y - 2 \)
   2. \( y' = 2 - y \)
   3. \( y' = |y - 2| \)
   4. \( y' = y + x \)
   5. \( y' = x - y \)
3. Find a continuous solution to the initial value problem, \( y' + p(t)y = g(t), \ y(0) = 1, \) where

\[
p(t) = \begin{cases} 
1 & t \leq 1 \\
0 & t > 1 
\end{cases}
\]

and

\[
g(t) = \begin{cases} 
0 & t \leq 2 \\
1 & t > 2 
\end{cases}
\]

Sketch the graph of your solution, \( y(t), \) for \( 0 \leq t \leq 5. \) Hint: \( y(5) = 3 + 1/e. \)

4. Find the general solution of the differential equation \((x^2 + y)y' + 2xy = 6x.\) Hint: check for exactness. (You need not solve for \( y.\))

5. A tank contains 200 gallons of salt water. The initial salinity is .5 lb/gal. The water is then pumped out of the tank, run through a filter, and pumped back in. The flow rate is 5 gallons a minute. The filter removes 30% of the salt. Also, water is evaporating at a rate of 1 gallon per minute. How much salt is left in the tank when the water has all evaporated? Assume the water in the tank is well mixed.