1. (a) second order linear (b) first order linear (c) first order nonlinear
   (d) second order nonlinear (e) first order linear

2. Compute $y_1'y_2 - y_1y_2'$ (the Wronskian) and see if it is nonzero at some point. Alternatively verify that one function is not a constant multiple of the other.

3. There are 3: $y = -1$ is stable, $y = 0$ is unstable and $y = +1$ is stable. Your answer should show how you got these results.

4. (a) The answer is $2\sin(3t)$. The general solution is $c_1\sin(3t) + c_2\cos(3t)$. By the initial conditions, $c_1 = 2$ and $c_2 = 0$.
   Your solution should show how the general solution was found.

   (b) Separate variables: $\int e^{-x}dx = \int e^t dt$ and so $-e^{-x} = e^t + C$. The initial condition gives $-e^{-1} = 1 + C$ and so $C = -1 - e^{-1}$. Another way to write it:
   $e^{-x} + e^t = 1 + 1/e$.

   (c) The equation is exact. Integrating gives $x^2 + xy - y^2 = C$.

   (d) Divide by $t$ to get it in standard form. An integrating factor is $\exp(\int -dt/t) = 1/t$. Thus $y'/t - y/t^2 = 1$ and so $(y/t)' = 1$. Solving, $y/t = t + C$. You could rewrite this as $y = t^2 + Ct$.