ANSWERS:
1. There are infinitely many correct answers for each part. A few examples are given.
   (a) e.g., \( y' = y^2 \) or \( y' = e^y \)
   (b) e.g., \( y'' = 0 \) or \( y'' + y' + y = 0 \)
2. \( y(t) = \sqrt{2e^t - 1} \)
3. (First move everything to the left-hand side of the equation and check to see that this is an exact equation.)
   Solution: \(-2x - e^{xy} + y^2 = C\)
4. The initial value problem is \( Q' = 8 - \frac{1}{50} Q, \quad Q(0) = 100. \)
   The solution is \( Q(t) = 400 - 300e^{\frac{t}{50}}. \)
   Finally, \( \lim_{t \to \infty} Q(t) = 400 \)
5. First rewrite the equation as \( y' - \frac{3}{t} y = 1, \ y(4) = -1. \)
   (a) The guaranteed solution interval is \((0, \infty)\).
   (b) \( y(t) = \frac{-t}{3} + \frac{t^3}{64} \)
6. (a) The equilibrium solutions are: \( y = -1 \) (stable), \( y = 1 \) (unstable), and \( y = 2 \) (stable).
7. (a) \( y(t) = C_1 e^{2t} \cos t + C_2 e^{2t} \sin t \)
   (b) \( y(t) = C_1 e^{-3t} + C_2 e^{-3t} \)
8. (a) \( y(t) = 3e^t - e^{2t} \)
   (b) \( \lim_{t \to \infty} y(t) = \lim_{t \to \infty} e^t (3 - e^{3t}) = -\infty \)
9. First substitute \( y_1(t) \) and \( y_2(t) \) into the equation to verify that they both satisfy it. This shows that both functions are indeed solutions of the given equation. Then calculate their Wronskian, \( W(y_1, y_2) = t^4 \neq 0 \) when \( t > 0 \). This shows that they are linearly independent. Therefore, the two functions do, in fact, form a fundamental set of solutions for the given equation.