1. Show that the function \( f(x) = 5e^{3x} + 4e^{-2x} \) is a solution of the differential equation:
\[
y'' - y' - 6y = 0
\]

2. Given \( y = C_1e^{3x} + C_2e^{-3x} \), find a particular solution of the initial value problem:
\[
y'' - 9y = 0, \quad y(0) = 6, \quad y'(\ln(2)) = 2
\]

Solve each Separable differential equation:

3. \( \frac{dx}{dt} = x^2 + 2x + 2 \)

4. \( \frac{dy}{dt} = y - y^2 \)
5. \( \cot(y) - \frac{dy}{dx} \sec(x) = 0 \)

6. A pot of boiling water at 100°C is removed from a stove at time \( t = 0 \) and left to cool in the kitchen. After 5 min, the water temperature has decreased to 80°C, and another 5 minutes later it has dropped to 65°C. Assuming Newton's Law of Cooling applies, determine the constant temperature of the kitchen.