Answers – Homework on first order linear equations

1. Solve the differential equations.
   
   (a) \( y(x) = -2e^{-x} + Ce^{-x/2} \)
   
   (b) \( z(t) = \frac{t^3/3 - t + C}{t + 1} \)
   
   (c) \( y(t) = \frac{\sin(t) - t\cos(t) - 1 + \pi^2/4}{t^2} \)

2. (a) \( N = 100 \) is stable.

   (b) \( N(t) = 100 + (N_0 - 100)e^{-t/10} \). For all initial conditions the solution approaches the equilibrium as time goes to infinity.

3. (a) \( \frac{dc}{dt} = \frac{G}{V} - kc \)

   (b) \( c = \frac{G}{Vk} \)

4. The tank contains \( \frac{32,000}{9} \) g of salt after 40 minutes, and the concentration is \( \frac{800}{9} \) g/L.