1. Solve the given initial value problems:

(a) (10 points) \( x' = 3t^2 + \sin t, \quad x(0) = 1, \)

(b) (10 points) \( x' + tx = x, \quad x(1) = 3, \)

(c) (15 points) \( xy' - 4y = x^5e^{-x}, \quad y(1) = 0. \)
2. Determine whether the given equation is exact. If it is exact, solve it:

(a) (15 points) \((2y^2x - 3)dx + (2yx^2 + 4)dy = 0,\)

(b) (15 points) \((y \ln y - e^{-xy})dx + \left(\frac{1}{y e^x} + x \ln y\right)dy = 0.\)
3. (20 points) A tank is filled with 500 gallons of pure water. Brine containing 2 pounds of salt per gallon is pumped into the tank at a rate of 5 gal/min. The well-mixed solution is pumped out at the same rate. Find the number of pounds of salt in the tank at any time.
4. (15 points) A 45-volt electromotive force is applied to an LR series circuit in which the inductance is 0.3 henry and the resistance is 15 ohms. Find the current $I(t)$ if $I(0) = 0$. Determine the current as $t \to \infty$.

Bonus problem. (5 points) Solve the IVP: $x' = x^2 - 4$, $x(0) = -2$. 