1) Solve using the method of separation of variables:
   a) \[ y' = \frac{x}{y} \quad \text{and} \quad y(1) = 3 \]
   b) \[ y' = xy \quad \text{and} \quad y(0) = 2 \]
   c) \[ \frac{dP}{dt} = .05P \]

2) Write a differential Equation describing the given situation:
   a) The number of bacteria in a culture grows at a rate the is proportional to the number present.
   b) An investment grows at a rate equal to 7% of its size.
   c) The rate at which the concentration of a drug in the bloodstream decreases is proportional to the concentration.

3) In a certain town the population grows in proportion to the present population at any time \( t \). Set up the differential equation and solve for the exponential growth equation that will give the population at any time \( t \). If there were 1000 people in 1970 and 5000 in 1980, How may people were there in 1990?

4) The price \( p(t) \) of a particular commodity varies in such a way that its rate of change with respect to time is proportional to the shortage \( D - S \), where \( D(p) \) and \( S(p) \) are linear demand and supply equations \( D = 8 - 2p \) and \( S = 2 + p \). This gives the differential equation \( \frac{dp}{dq} = k \cdot (D - S) \). If \( p = $5 \) when \( t = 0 \) and \( p = $3 \) when \( t = 2 \), solve the differential equation to find \( p \) when \( t = 7 \). (hint! First substitute in the equations for \( D \) and \( S \) in the differential equation and then solve)

5) A certain community has voted to discontinue the fluoridation of the water supply. The local reservoir currently holds 200 million gallons of fluoridated water that contains 1,600 pounds of fluoride. The fluoridated water is flowing out of the reservoir at the rate of 4 million gallons per day and is being replaced at the same rate by unfluoridated water. At all times, the remaining fluoride in the reservoir is evenly distributed in the reservoir. This rate of change is represented by the differential equation: \( \frac{dQ}{dt} = \frac{-1}{50}Q \)
   solve the above differential equation to find the amount of fluoride in the reservoir as a function of time. How much fluoride is in the tank after 10 days?
6) In a study of the memorization of unrelated shapes a person can memorize no more than 150 of them in three hours. In a psychology class study, it is found that on average a person can memorize 23 of the shapes after a 10-minute period. The differential equation that models this situation is given by \( \frac{dy}{dt} = k(L - y) \) where \( L \) is the limit of memorizing and \( y \) is the number of shapes memorized and \( t \) is the time in minutes.

a) Solve the differential equation for the equation that will give the number of shapes memorized in a given time \( t \).

(Notice that the initial value would be that at \( t = 0 \ y = 0 \))

b) Find the number of shapes that can be memorized in 45 minutes.