More Differential Equations and Applications

Find the general solution of the differential equation.

1) $\frac{dy}{dx} = xe^{-y}$

2) $x\frac{dy}{dx} = (x^2 + 1)y$

Find the particular solution of the differential equation.

3) $\frac{dy}{dx} = \frac{lnx}{2ye^{y^2}}$; $y = 1$ when $x = 1$

4) $x^2y^2\frac{dy}{dx} - 1 = y^3$; $y = 1$ when $x = 3$

22. ***Profit*** Your monthly profit on sales of avocado ice cream is rising at an instantaneous rate of 10% per month. If you currently make a profit of $15,000 per month, find the differential equation describing your change in profit, and solve it to predict your monthly profits. [**Hint:** See Example 3.]

25. ***Cooling*** A bowl of clam chowder at 190°F is placed in a room whose air temperature is 75°F. After 10 minutes, the soup has cooled to 150°F. Find the value of k in Newton's Law of Cooling, and hence find the temperature of the chowder as a function of time.

***Two Common Types of Growth/Decay Models**

1) **<u>Exponential Growth</u>**: $\frac{dy}{dt} = ky$

e.g. Suppose y = money in a savings account that earns interest.

"The growth rate of y is proportional to the current amount of money in the account"

*Now solve the D.E. using separation of variables:

2) **<u>Logistics Growth</u>**: $\frac{dy}{dt} = ky(L - y)$, where L = maximum value of y.

e.g. Suppose y = the demand of a new Math for Economics Majors book. Initially, the sales are growing exponentially, but it is thought that the maximum number of books that can be sold is 2 million.

*It can be shown that the solution is: $y = \frac{L}{1+Ce^{-kLt}}$

*Find $\lim_{t \to \infty} y$

*Graph: