Differential Equations and Applications (Sec 14.6)

1) (14.6, #21) Your monthly sales of green tea ice cream are falling at an instantaneous rate of 5% per month. If you currently sell 1,000 quarts per month, find the differential equation that describes your change in sales, and then solve it to predict your monthly sales.

2) (14.6, #27) **(Market Saturation)** You have just introduced a new 3D monitor to the market. You predict that you will eventually sell 100,000 monitors and that your monthly rate of sales will be 10% of the difference between the saturation value and the total number you have sold up to that point. Find a differential equation for your total sales (as a function of the month), and solve. (What are your total sales at the moment when you first introduce the monitor?)

3) (14.6, #29) **(Determining Demand)** *Nancy's Chocolates* estimates that the elasticity of demand for its dark chocolate truffles is $E = 0.05p - 1.5$, where p is the price per pound. Nancy sells 20 pounds of truffles per week when the price is $20 per pound. Find a formula expressing the demand q as a function of p. Recall that the elasticity of demand is given by: $E = -\frac{dq}{dp} \times \frac{p}{q}$

Find the general solution of each differential equation. When possible, solve for y as a function of x.

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

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

6) $x\frac{dy}{dx} = \frac{lnx}{y}$

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

Find the particular solution of each differential equation.

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

9) $\frac{dy}{dx} = \frac{xy^2}{x^2+1}$; $y(0) = -1$

10) $\frac{1}{x}\frac{dy}{dx} = \frac{e^x}{y+1}$; $y(0) = 2$