

MTH 256 Lesson 2 - Separation of Variables and Modeling

1. Find a general solution to the separable differential equation $(1 - x^2)\frac{dy}{dx} = 2y$.

2. Find the particular solution of the initial value problem $\frac{dy}{dx} = 3x^2(y^2 + 1)$, $y(0) = 1$.

3. The world's total population reached 6 billion around mid-1999 and was increasing by about 212 thousand people each day at that time. Assuming that the rate of growth of the population is proportional to the population, come up with a differential equation modeling this situation, solve the equation and then determine when the population will reach 10 billion people.

4. A beer has been left out and is 72°F . Suppose you put it in a refrigerator that is 42°F and after 10 minutes note that the beer has cooled to 64°F . Assuming Newton's law of cooling (that the rate of cooling is proportional to the difference between the current temperature and the ambient temperature) applies, how long must you wait until the beer is 46°F ? [Note, I made these numbers up so this may not be realistic.]