

1. Solve the initial boundary problem,

$$\frac{dy}{dx} = x + y, y(0) = 1$$

2. Solve the initial boundary problem,

$$\frac{dx}{dt} = 1 + 2tx, x(0) = 3,$$

and use your calculator to estimate $x(1)$.

3. Solve the differential equation $\frac{dy}{dx} = \frac{1}{e^{-y}-x}$

4. Substance A decays radioactively into substance B with decay constant $k_1 \text{ yr}^{-1}$. Substance B decays radioactively into substance C with decay constant $k_2 \text{ yr}^{-1}$. If we start with m_0 grams of substance A and 0 grams of substance B, when will the mass of substance B reach a maximum? You may assume $k_1 \neq k_2$. What if $k_1 = k_2$?

5. A tank initially contains 1000 liters of water. A salt water solution with concentration 0.1 kg/L enters the tank at the rate of 40 liters/min. The mixture flows out of the tank at the rate of 50 liters/min. When is the mass of salt in the tank a maximum?

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