

LSN #16 Answers

Lesson 16 - Problem Solving Lab

Review all previous lessons and come to class prepared to ask questions.

1. The trouble with tribbles is that they are born pregnant. The only things that limit their rate of growth are available living space and food. Given a constrained environment, say the Starship Enterprise, and a fixed supply of food, say a grain storage bin, the tribble population will grow according to a logistic model. If $T'(t)$ models the growth rate of the tribble population in tribbles/day how long will it take a single tribble smuggled onto the Starship Enterprise to reproduce to the level of 100,000,000 tribbles? You are given the following model for $T'(t)$.

$$T'(t) = 0.5t \left(1 - \frac{t}{200000000} \right)$$

$t \approx 20,000$ days

ANS

2. An investment that has a continuous return of \$150,000 per year for 10 years is being offered for sale for \$850,000. The rate of change of money per year is defined as $P(t) = 150000e^{-rt}$ where r is the current interest rate compounded continuously. Would you buy if the current interest rate is 0.10?

$= \frac{\$948,180}{\text{ANS}}$ So buy at $\$850,000$

3. The number $D(t)$ of deaths per week during the Bombay plague of 1905-1906 was approximated by $D(t) = 3960(e^{0.2t-3.4} + e^{-0.2t+3.4})^{-2}$, where t is in weeks from the outbreak. Find the approximate number of deaths during the first 30 weeks of this plague.

$9,834.67$ deaths

ANS

4. The cost function, in thousands of dollars, of a coat manufacturer is given by $x(1+x)^4$, where x is measured in thousands of coats. Find the average cost for the first 2000 coats.

$\$ 72.93$

ANS

5. The rate of sales of a new product will tend to increase rapidly initially and then fall off. Suppose the rate of sales of a new product is given by $S = 1000te^{-3t}$ items per week, where t is the number of weeks from the introduction of the product. How many items are sold in the first four weeks? Assume that $S(0) = 0$.

111.102 items

ANS