HWK: Topic: 7.8 Exponential Models with Differential Equations

Name ____________________

Fruit Fly Population

1. An absent-minded graduate student at a university is studying a population of fruit flies in a biology lab. She works under the premise that this experimental population of fruit flies increases according to the law of exponential growth. She counts 100 flies after the second day of the experiment and 300 flies after the fourth day, however, she forgot to record the number of fruit-flies she initially had at the beginning of the experiment. Approximately how many flies were in the original population? Round to the nearest fly.

Advertising Problem

2. Four months after it stops advertising, a manufacturing company notices that its sales have dropped from 100,000 units per month to 80,000 units per month. If the sales follow an exponential pattern of decline, what will they be, to the nearest unit, after another 2 months?

PTFs #BC 07 – Logistic Growth

If y is a differentiable function of t such that $\frac{dP}{dt} = kP(L-P)$, then

- $P = \frac{L}{1+Ce^{-Lkt}}$
- $\lim_{t\to\infty} P(t) = L$ (L is the carrying capacity.)
- $\frac{dP}{dt}$ is at its maximum (the rate of growth is increasing the fastest) when the function reaches half its carrying capacity, $\frac{L}{2}$. (this is also the point of inflection on $P(t)$)

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1. The population, P of a species satisfies the logistic differential equation $\frac{dP}{dt} = P\left(2 - \frac{P}{5000}\right)$, where $P(0) = 3000$ and t is the time in years. What is $\lim_{t\to\infty} P(t)$?

2. A rumor spreads at the rate $\frac{dP}{dt} = 2P(1-P)$ where P is the portion of the population that has heard the rumor at time t. What portion of the population has heard the rumor when it is spreading the fastest?