Assignment 12 (5/4)

The One With The Summer Breeze

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Problem 1

Problems $11.4.(2, 23, 27, 40, 48, 53)$.

Problem 2

Problems $11.5.(9, 27)$.

Problem 3

A long time ago in a galaxy far, far away.... students decide to skip class and stand in line to get Summer breeze tickets. They were sent emails saying that the tickets will be sold on a first come, first serve basis; and there are a total of $N = 1000$ tickets available of varying price range.

Students find that the price of the tickets at the counter decrease linearly as time passes. Say, the price at the counter at time t is $50 - t$ and there are say, $n(t)$ tickets remaining at that moment (thus $n(0) = N = 1000$). So theoretically, in 50 hours all tickets will be free, but only if stock lasts!

Interestingly, the rate at which tickets get sold at counter $\left(i.e.\ \frac{dn(t)}{dt}\right)$ is directly proportional to product of number of tickets remaining (i.e. $n(t)$) and inverse of the average price (say, $p(t)$)of a ticket in the market at time t. Thus,

$$\frac{dn(t)}{dt} = -n(t).\frac{1}{p(t)}$$

Here we are assuming that the proportionality constant is -1.

However the average price of a ticket in the market at time t is not equal to the price at the counter because some students are selling tickets at the University marketplace in black at high prices! In fact, at time t, about **a hundredth of tickets which were already sold**(i.e. $N - n(t)$) are going for around

$$\ln\left(\frac{50}{50-t}\right)$$

times the current market average price $p(t)$**.** Assume the tickets on market are available through either the counter [total $n(t)$] or the marketplace [total $\frac{N-n(t)}{100}$] only.

Assuming that the organizers will keep the last 50 tickets for themselves (and friends and family, because...corruption and stuff...), how long would it take for the box office (counter) to

run out of tickets and the students standing in line to realize that they wasted a morning of their life they are never getting back?

Note: Use your calculator/ Wolfram Alpha as necessary. Give an explicit equation for the function $n(t)$.

Disclaimer: All the numbers in this problem are completely fictitious. I do not have any connection to the organizers of Summer Breeze!