MAT126, Paper Homework "Civet"

1. A coffee grower has a number of civets he uses to make Kopi Luwak ("civet coffee"— if you don't know what this is, you don't want to). The amount of coffee beans they process decreases approximately linearly over the course of a day, as $c(t) = 80 - 3t$ kg per hour (there are a lot of civets). How many kilograms of coffee are produced in a day? (Hint: this is an integral, and there are 24 hours in a day.)

2. A lemur rancher needs to invest in some high-tech lemur grooming machines. She determines that the value of the machines will depreciate like $f(t) = V + e^{-at^2}$ (for some constants a and V), and the cost of keeping them in top running condition is $g(t) = B \ln(1+t)$, where t is the time that the machines have been running and B is another constant.

   The cost of keeping the machines around (instead of replacing them with new ones) is given by

   $$C(t) = \frac{1}{t} \int_0^t (f(x) + g(x)) \; dx$$

   Show the critical points of $C(t)$ occur when $C(t) = f(t) + g(t)$ by calculating the derivative of $C(t)$ and setting it to zero.
   (Such a critical point corresponds to a time when this cost is at a high or a low point.)