

Calc II Third-Way-Thru Synthetic Assignment

Due January 31 , 2025

Thoughts on how to approach this assignment

- Try these problems on your own, without or without notes. See how far you get. Then, if you have any questions, come to a help session and/or work with others in the class.
- That said, this is a normal homework assignment, in the sense that you are welcome to work together and you can get help from me or Noelle.
- For all problems, **please show your work**.
- There is also a **WeBWoRK** assignment this week.

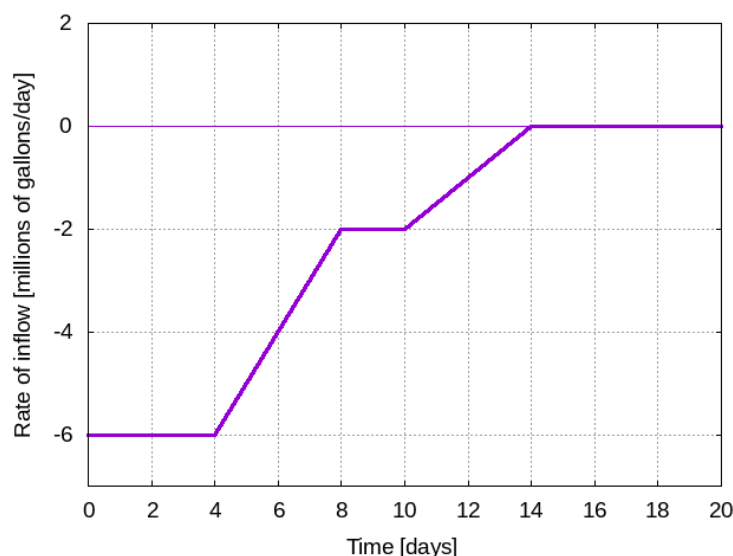


Figure 1: The rate at which water flows into the Kenneth S. Cline reservoir. (A negative rate means that water is flowing *out* of the reservoir.)

1. The Kenneth S. Cline reservoir is filled to capacity with 50 million gallons of water. The radical group CAHE¹ plants an explosive on the dam with the goal of removing the dam entirely. Unfortunately, they miscalculated² and the dam was only slightly damaged. Water leaked out of the dam fairly quickly for four days. Then repairs began and the leakage rate slowed. The rate at which water is leaving the dam is graphed in Fig. 1. Show your work or very briefly explain how you arrived at your answers.
 - (a) What is the volume of the water in the reservoir on day 8?
 - (b) What is the volume of the water in the reservoir on day 18?

¹Coalition of Aging Heartfelt Environmentalists

²In one of their calculations they erroneously assumed that there are 2.2 kg in one pound.



Figure 2: A unicorn with wings. Image by brgfx on [Freepik](#).

2. A population of unicorns on an island in Maine grows according to the function $r(t) = 50 + 7t^2$, where t is measured in months since January 1, 2025, and $r(t)$ has units of kg/month.
 - (a) What is the total change in the unicorn biomass in the first two months. Determine approximate answers using left- and right-hand sums with $\Delta t = 0.5$.
 - (b) Suppose you needed to know change in the biomass over these two months to within 0.5 kg? What Δt would you need to choose?
 - (c) Write a python program to determine a more accurate estimate for the total change in the unicorn biomass. Have your program break the time interval up into 1000 smaller time intervals. Please attach your colab notebook in google classroom.
 - (d) Write the total biomass change as a definite integral, and use the fundamental theorem of calculus to evaluate the integral.
 - (e) What is the average growth rate of the unicorn biomass over the first two months of 2025?
 - (f) Sketch $r(t)$ and then show the average growth rate on the graph. Geometrically, how is the average growth rate related to $r(t)$?

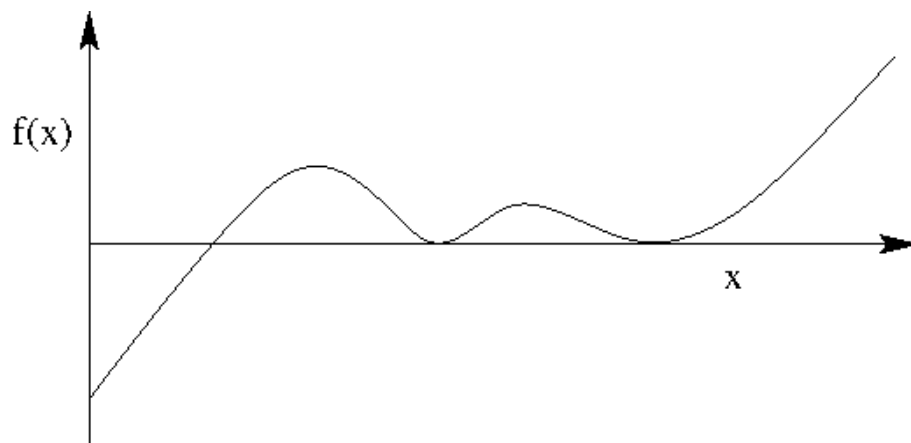


Figure 3: A function

3. Sketch

$$\int_0^t f(x) dx , \quad (1)$$

where $f(x)$ is shown in Fig .3.

4. Let

$$C(x) = \int_0^x \cos(t^2) dt . \quad (2)$$

What is $C'(x)$?