Class 04: Accumulated Change: Formulas

Calculus II

College of the Atlantic. January 13, 2025

Figure 1: A psychedelic unicorn. Image by Gordon Dylan Johnson (`https://openclipart.org/artist/GDJ`. Image source `https://openclipart.org/detail/249455/prismatic-unicorn-silhouette-2-circles-3`

Unicorn theorists have theorized that the growth rate of the unicorn population on Beautiful Things Island is well approximated by the following function:

$$u(t) = 50 + t^2 \,, \tag{1}$$

in units of kg of biomass per month, and where t is measured in months since 1 January, 2025. The biomass of the unicorns on the island is 300 kg at the start of 2023.

1. Using a Δt of 3 months, come up with a lower estimate for the biomass of the unicorns at the end of 2025.

2. Using a Δt of 3 months, come up with an upper estimate for the biomass of the unicorns at the end of 2025. (There is a slow and a less-slow way to do this.)

3. Using a Δt of 2 months, come up with a lower estimate for the biomass of the unicorns at the end of 2025.

4. Using a Δt of 2 months, come up with an upper estimate for the biomass of the unicorns at the end of 2025. (There is a slow and a less-slow way to do this.)

5. Suppose you needed to know the biomass of the unicorns at the end of 2025 to within 5 kg. What Δt would you choose?