Lab 04A: Average and Instantaneous Speeds
Calculus I

College of the Atlantic. October 7, 2024
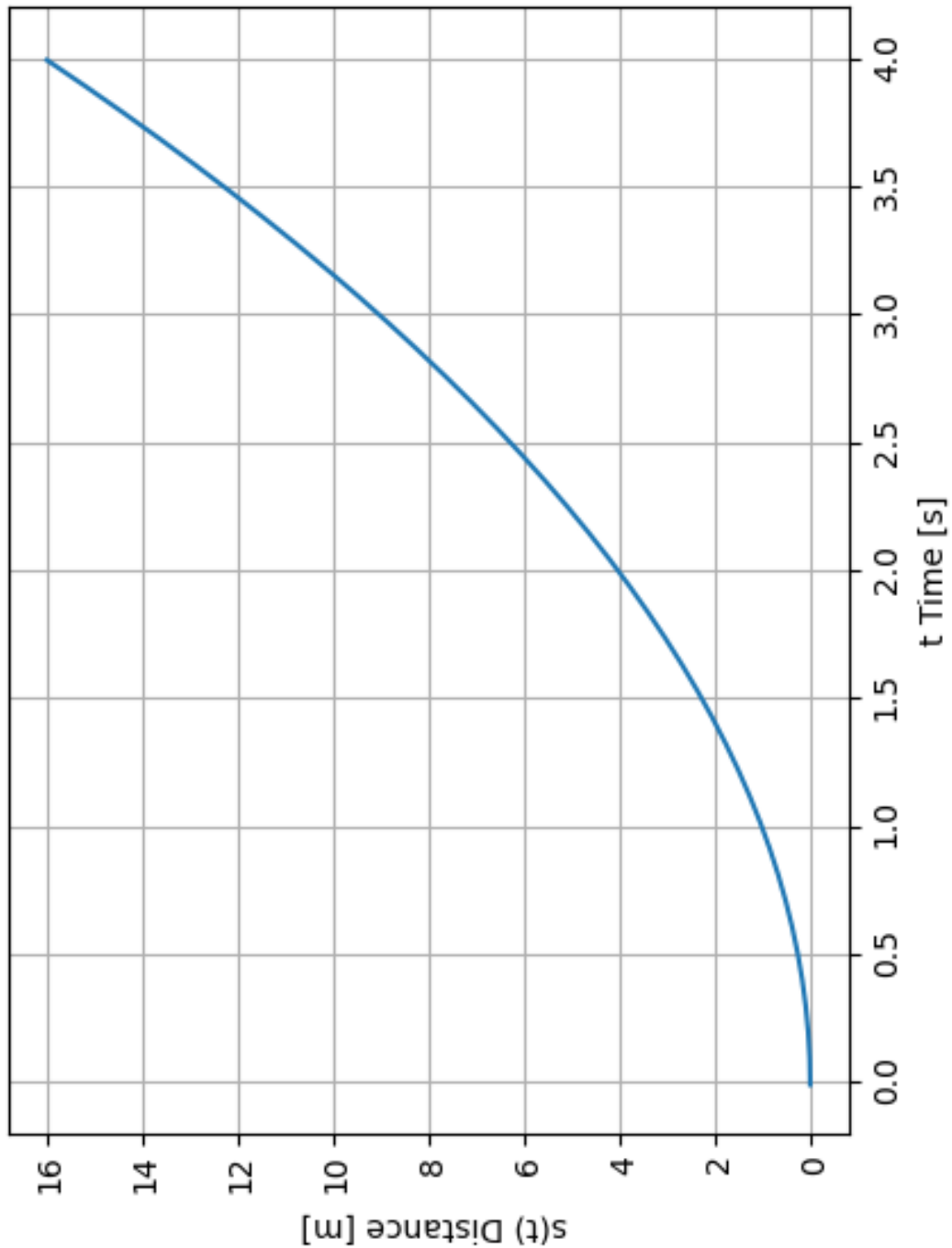

Figure 1: A unicorn is running a straight line. Its position $s(t) = t^2$, measured in meters from its starting position at $t = 0$, is graphed above.

In this exercise we will estimate the unicorn's instantaneous velocity at $t = 2$ using three different methods.

1. **Graphically.** Draw a line on the graph whose slope is the instantaneous speed at $t = 2$. Then estimate the slope of the line.

2. **Numerically.** Using the formula $s(t) = t^2$, evaluate the following:

   (a) The average unicorn velocity between $t = 2$ and $t = 3$.

   (b) The average unicorn velocity between $t = 2$ and $t = 2.1$.

   (c) The average unicorn velocity between $t = 2$ and $t = 2.01$.

   Based on these calculations, what would you conjecture is the velocity at the instant when $t = 2$?

3. **Algebraically:**

   (a) Write down a formula for the average speed between $t = 2$ and $t = 2+h$. Do not simplify (yet).

   (b) What would happen if you tried to plug $h = 0$ into the formula you just wrote down?

   (c) Simplify your formula.

   (d) Now what happens if you plug in $h = 0$?

   Check with me or a TA before proceeding.