

Class 10: Integrals as Averages and Areas

Calculus II

College of the Atlantic. January 27, 2025

1. On a weird Maine day, the temperature is described by the following function: $T(t) = 25 + \frac{1}{4}t^2$, where time t is measured in hours since midnight.
 - (a) What is the average temperature that day – i.e. over the next 24 hours.
 - (b) Sketch $T(t)$.
 - (c) On your sketch, show how to represent the average temperature.

2. Try answering these by thinking, instead of actually evaluating a definite integral:
 - (a) What is the average value of $f(x) = 3$ from $x = -2$ to $x = 2$?
 - (b) What is the average value of $f(x) = x$ from $x = -2$ to $x = 2$?
 - (c) What is the average value of $g(x) = \cos(x)$ from $x = 0$ to $x = 2\pi$?
 - (d) What is the average value of $h(x) = 1 + \cos(x)$ from $x = 0$ to $x = 2\pi$?

3. A rock is launched straight up at an initial velocity of 50 m/s. While in the air, it experiences a constant acceleration of -9.8 m/s^2 .
 - (a) What is the rock's velocity at $t = 2$?
 - (b) What is the rock's velocity at $t = 4$?
 - (c) Sketch $v(t)$, the rock's velocity as a function of time t .
 - (d) Write $v(t)$ as a definite integral.
 - (e) Determine a formula for $v(t)$.
 - (f) At what time t does the rock reach its greatest height?