For this assignment, you are expected to provide full solutions with complete justifications. You will be
graded on the mathematical, logical and grammatical coherence of your solutions. You are encouraged to
work together, but your solutions must be written independently. Please write your name and student
number at the top of the first page. If your solutions are on multiple pages, the pages must be stapled
together.
This assignment is due at 1:00pm on Friday, July 22. Late assignments will not be accepted.

1. Use methods of integration to show that
\[ \int \sec(x) \, dx = \ln |\tan(x) + \sec(x)| + C. \]

Hint#1: First, multiply the numerator and denominator by \( \cos(x) \):
\[ \int \sec(x) \, dx = \int \frac{1}{\cos(x)} \cdot \cos(x) \, dx = \int \frac{\cos(x)}{\cos^2(x)} \, dx = \int \frac{\cos(x)}{1 - \sin^2(x)} \, dx. \]

Hint#2: It might be helpful to note that
\[ \frac{1 + \sin(x)}{1 - \sin(x)} = \frac{1 + \sin(x)}{1 - \sin(x)} \cdot \frac{1 + \sin(x)}{1 + \sin(x)} = \frac{(1 + \sin(x))^2}{1 - \sin^2(x)} = \left( \frac{1 + \sin(x)}{\cos(x)} \right)^2. \]

2. Due to the construction on SW Marine Drive, the 480 bus is often behind schedule and leaves UBC late. The normal distribution is the probability distribution of the probability density function
\[ f(x) = \frac{1}{\sqrt{2\pi}} e^{-\frac{(x-4)^2}{2}}, \]
and can be used to predict the amount of time the bus is delayed (in min).

(a) Use a left Riemann sum with \( n = 10 \) to approximate the probability that the bus will be between
1 and 5 minutes behind schedule.

(b) If you want to take the 480 from UBC, how long do you expect to wait at the bus stop?

Hint#1: Note that
\[ \frac{x}{\sqrt{2\pi}} e^{-\frac{(x-4)^2}{2}} = \frac{(x-4)}{\sqrt{2\pi}} e^{-\frac{(x-4)^2}{2}} + \frac{4}{\sqrt{2\pi}} e^{-\frac{(x-4)^2}{2}}. \]

Hint#2: Since \( f(x) \) is a probability density function, \( \int_{-\infty}^{\infty} f(x) \, dx = 1. \)

3. Use the precise definition of the definite integral to show that the function
\[ f(x) = \begin{cases} 0 & \text{if } x \neq \frac{5}{3} \\ 1 & \text{if } x = \frac{5}{3} \end{cases} \]
is integrable on \([0, 1]\).
