Midterm #3, 11/29
Math 156 (Calculus I), Fall 2023

Each problem is worth 10 points, for a total of 50 points. You have 50 minutes to do the exam. Remember to *show your work* on all problems!

1. For each of the following functions $f(x)$, write an anti-derivative $F(x)$ of $f(x)$:

   (a) $f(x) = 3x^2 + x + 2$

   (b) $f(x) = e^x + \sin(x)$

   (c) $f(x) = \frac{3}{x}$

   (d) $f(x) = \sqrt{x}$

2. Give an approximation for the area under the curve $y = x^2 + 1$ from $x = -1$ to $x = 2$ by using 3 rectangles (of equal width) whose heights are determined by the intervals' left endpoints.

3. Compute the following definite integrals using the Fundamental Theorem of Calculus:

   (a) $\displaystyle\int_{-1}^{2} x^2 + 1 \, dx$

   (b) $\displaystyle\int_{0}^{\pi} \cos(x) \, dx$

   (c) $\displaystyle\int_{0}^{\ln(3)} e^x \, dx$

4. The velocity (in meters per second) at time t (in seconds) of a car moving along a 1-dimesional road is given by the function $v(t) = 2t$. What distance does the car travel between time $t = 2$ seconds and time $t = 4$ seconds?

5. Compute the following indefinite integrals using the u-substitution technique:

   (a) $\displaystyle\int x \, e^{x^2+5} \, dx$

   (b) $\displaystyle\int \frac{\cos(x)}{\sin(x)} \, dx$ [**Hint**: let $u = \sin(x)$.]