Midterm #3, 11/25 Math 156 (Calculus I), Fall 2024

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 the most general anti-derivative F(x) of f(x).
 - (a) $f(x) = 2x^3 3x^2 + 5x 7$ (b) $f(x) = 4e^x - 2\sin(x)$ (c) $f(x) = \sqrt{x} + \frac{1}{x^2}$ (d) $f(x) = \frac{3}{x} - \cos(x)$
- 2. Evaluate the following definite integrals using the Fundamental Theorem of Calculus. Write your answers in as simplified a form as you can.

(a)
$$\int_{-1}^{5} x^2 + x + 1 \, dx$$

(b) $\int_{0}^{\pi/2} 2\cos(x) \, dx$
(c) $\int_{0}^{\ln(2)} e^x - 1 \, dx$

- 3. Approximate the area under the curve $y = x^2 + x + 1$ from x = -1 to x = 5 by using n = 3 rectangles (of equal width), with the sample points being the sub-intervals' left endpoints. Is your approximation an over- or under-estimate of the true area?
- 4. The velocity (in meters per second) at time t (in seconds) of a car moving along a onedimesional road is given by the function v(t) = 2t + 1. What distance does the car travel between time t = 2 seconds and time t = 5 seconds?
- 5. Evaluate the following indefinite integrals using the u-substitution technique.

(a)
$$\int 2x \cdot e^{3x^2 + 5} dx$$

(b)
$$\int \sqrt[3]{4x - 2} dx$$

(c)
$$\int \frac{\cos(x)}{\sin(x)} dx$$
[Hint: let $u = \sin(x)$]