Homework 16

Math 147, Fall 2023

This homework is due on Friday, December 16 (at the start of recitation). *Turn in (via Gradescope) your answers to questions 1–9.*

0. Read Sections 5.5, 5.10, 6.1–6.2. After reading these sections, answer the following questions (which are *not* to be turned in).
   - Is $2\sin x$ an antiderivative of $\sin^2 x$?
   - Is $\cos x + \ln 5$ an antiderivative of $-\sin x$?
   - If $f(x)$ is an even function ($f(-c) = f(c)$ for all real numbers c), does this imply that $\int_{-2}^{2} f(x)dx = 0$?
   - What is an example of a function $f(x)$ for which $\int_{2}^{-5} f(x)dx$ is positive?
1. Compute the following limits:
   (a) $\lim_{x\to 0^+} \frac{\ln x}{x}$
   (b) $\lim_{t\to 0} \frac{10^t - 3^t}{t}$
   (c) $\lim_{x\to 0^+} x^{\sqrt{x}}$
   (d) $\lim_{t\to\infty} t - \ln t$
2. Determine the most general antiderivatives of the following functions:
   (a) $f(x) = \frac{1}{3} - \frac{2}{x}$
   (b) $f(x) = 2^x + e^{3x} + x\sqrt{x}$
   (c) $f(x) = -2\sin x$
3. (a) Sketch the region under the curve $y = \sqrt{x}$, for $0 \le x \le 16$. Compute the area.
   (b) Sketch the region bounded by $y = x^2$ and $y = 18 - x^2$. Compute the area.
   (c) Compute $\int_0^1 (1+s)^3 ds$.
4. (Write your own problem!) A _____ (vehicle) is traveling at _____ (positive number) miles/hour when the brakes are applied, producing a constant deceleration of _____ (positive number) feet/sec^2. What is the distance traveled before the vehicle comes to a stop?
5. Compute the definite integral $\int_1^3 (3-x)dx$ in two ways:
   (a) by drawing the graph, and computing the appropriate area.
   (b) using the Fundamental Theorem of Calculus.

6. Section 5.5 # 12, 16, 18, 24

7. Section 5.10 # 10, 24, 26, 70

8. Section 6.1 # 62, 68

9. Section 6.2 # 100

10. (These problems are *not* to be turned in, but please make sure you can solve them BEFORE the final exam!)

    (a) Graph the function $f(x) = 1 - |x|$, and compute the definite integral $\int_{-2}^{0.5} f(x)dx$.

    (b) (Write your own problem!) Give an example of a definite integral of a non-constant function, for which the Riemann-sum approximation by $\underset{\text{positive number, at least 4}}{\_\_\_\_\_}$ rectangles and left endpoints is equal to $\underset{\text{number}}{\_\_\_\_\_}$.

    (c) Section 6.2 # 1, 7, 15, 19, 27, 35, 39, 45, 51, 57, 61, 65, 67, 69, 75, 77, 81, 87, 97, 99, 105, 109, 113, 119