



Math 106 Exam 2

March 27, 2026



- This is a closed-book examination. No books, notes, calculators, cell phones, communication devices of any sort, webpages, or other aids are permitted.
- Simplify numerical answers such as $\sin\left(\frac{\pi}{6}\right)$ and $4^{\frac{3}{2}}$.
- Please *show* all of your work and *justify* all of your answers. (You may use the backs of pages for additional work space.)

1. [18 Points] Compute and show that $\int_{-1}^2 2 - 2x - x^2 dx = \boxed{-\frac{3}{2}}$ using **ONLY** the **Limit Definition of the Definite Integral**.

2. [26 Points] Evaluate each of the following Indefinite Integrals. Simplify.

(a) $\int \frac{x^6}{(5-x^7)^2} dx$ (b) $\int \frac{(5-x^7)^2}{x^9} dx$ (c) $\int \sin(3x) \cdot \cos(3x) dx$

(d) $\int x(x+4)^6 dx$ (e) $\int \frac{1}{x^3} \cos\left(6 + \frac{1}{x^2}\right) dx$

3. [32 Points] Evaluate each of the following Definite Integrals. Simplify.

(a) Show that $\int_{\frac{\pi}{6}}^{\frac{\pi}{3}} \frac{\sin x}{\cos^5 x} dx = \boxed{\frac{32}{9}}$

(b) Show that $\int_0^{\frac{\pi}{3}} \sin(5x) dx = \boxed{\frac{1}{10}}$

(c) Show that $\int_9^{64} \frac{1}{\sqrt{1+\sqrt{x}}} dx = \boxed{4}$

(d) Show that $\int_0^5 |x^2 - 4| dx = \boxed{\frac{97}{3}}$

4. [8 Points] Compute $f(x)$ where $f'(x) = \frac{\sec^2 x}{\tan^3 x}$ and $f\left(\frac{\pi}{3}\right) = -5$

5. [16 Points] **Sketch and Shade** the Bounded Area represented by these Definite Integrals.

DO NOT COMPUTE THE INTEGRAL

(a) $\int_{-1}^6 x - 5 \, dx$

(b) $\int_{-1}^6 |x - 5| \, dx$

(c) $\int_{-1}^4 x^2 - 6x + 5 \, dx$

(d) $\int_5^8 \sqrt{x - 4} \, dx$

(e) $\int_{-4}^4 |x^2 - 9| \, dx$

OPTIONAL BONUS

Do not attempt this unless you are completely done with the rest of the exam.

OPTIONAL BONUS #1 Compute $\int \frac{\cos^3 x}{\sqrt{1 - \sin x}} \, dx$

OPTIONAL BONUS #2 Compute the following Limit:

$$\lim_{n \rightarrow \infty} \frac{\sqrt{1} + \sqrt{2} + \sqrt{3} + \sqrt{4} + \dots + \sqrt{n-1} + \sqrt{n}}{n\sqrt{n}}$$