Math 106 Exam 2
March 31, 2023

• 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. [20 Points] Compute and show that $\int_{-1}^{2} 3 - 4x - x^2 \, dx = \boxed{0}$

using two different methods:

(a) Fundamental Theorem of Calculus

(b) Limit Definition of the Definite Integral.

2. [32 Points] Evaluate each of the following Indefinite Integrals. Simplify.

(a) $\int \frac{5}{\sqrt{x}\,(3+\sqrt{x}\,)^7} \, dx$

(b) $\int x^7 \left(9 - x^8\right)^6 \, dx$

(c) $\int \frac{\sec^2 x}{(5+\tan x)^3} \, dx$

(d) $\int \frac{x}{(x-3)^9} \, dx$

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

(a) Show that $\displaystyle\int_1^4 \frac{(x+1)(x-1)}{\sqrt{x}}\,dx = \boxed{\frac{52}{5}}$

(b) Show that $\displaystyle\int_{\frac{\pi}{9}}^{\frac{\pi}{3}} \sin(3x)\,dx = \boxed{\frac{1}{2}}$

(c) Show that $\displaystyle\int_{-\pi}^{3\pi} \cos\left(\frac{x}{2}\right)\,dx = \boxed{0}$

(d) Show that $\displaystyle\int_{\frac{\pi}{6}}^{\frac{\pi}{3}} \frac{\sin x}{\cos^3 x}\,dx = \boxed{\frac{4}{3}}$

4. [8 Points] Compute the following Definite Integral. Show all details.

Show that $\displaystyle\int_{-1}^{3} |x-2|+1 = \boxed{9}$

5. [8 Points] Compute $f(x)$ where $\quad f'(x) = \dfrac{1}{x^3\sqrt{3+\dfrac{6}{x^2}}}$ and $f(1) = -\dfrac{5}{2}$