Last Name: ________________________  First Name: ________________________

Directions:
- The use of a calculator, cell phone, laptop or computer is prohibited.
- TURN OFF cell phones and put them away. If a cell phone is seen during the exam, your exam will be collected and you will receive a zero.
- Answer all of the questions, and present your solutions in the space provided. Show all your work neatly and concisely and clearly indicate your final answer. You will be graded not merely on the final answer, but on the quality and correctness of the work leading up to it.

The UC Davis Code of Academic Conduct

I will conduct myself with honesty, fairness, and integrity.

Signature: ________________________________
(1) This problem concerns the following integral.
\[ \int_0^4 e^x \, dx \]

(a) Estimate the value of the above integral using a left hand sum with \( n = 2 \) rectangles.

(b) Estimate the value of the above integral using trapezoid rule with \( n = 2 \) trapezoids.

(c) Use the error estimation formula to bound the error from part (b).
(2) Evaluate each of the following integrals.

(a) \[ \int (24x^7 + 6x^5 + 5x + 7) \, dx \]

(b) \[ \int (5\sin(x) + 6e^x) \, dx \]

(c) \[ \int 20e^{5x} \, dx \]
(3) Evaluate each of the following integrals.

(a) \( \int_{-3}^{3} x^2 \, dx \)

(b) \( \int_{-5}^{-2} \frac{1}{x} \, dx \)

(4) Solve the following initial value problem.

\[ f''(x) = \sin(x) \quad f'(\pi) = 2 \quad f(0) = 5. \]
(5) Suppose a cannon ball is shot up in the air from atop a 2400ft wall, and that its velocity (in ft/sec) is given by the equation

\[ v(t) = -32t + 400. \]

How fast is the cannon ball moving when it hits the ground (i.e. 2400ft below the cannon)?
(6) Evaluate the following integral \textit{without} using the fundamental theorem of calculus.

\[ \int_0^6 (|x - 2| - 1) \, dx \]
Trigonometric Identities

\[ 1 = \sin^2(A) + \cos^2(A) \]
\[ \sec^2(A) = \tan^2(A) + 1 \]
\[ \csc^2(A) = 1 + \cot^2(A) \]

\[ \sin(A + B) = \sin(A) \cos(B) + \cos(A) \sin(B) \]
\[ \sin(A - B) = \sin(A) \cos(B) - \cos(A) \sin(B) \]
\[ \cos(A + B) = \cos(A) \cos(B) - \sin(A) \sin(B) \]
\[ \cos(A - B) = \cos(A) \cos(B) + \sin(A) \sin(B) \]

\[ \sin(2A) = 2 \sin(A) \cos(A) \]
\[ \cos(2A) = \cos^2(A) - \sin^2(A) \]

Error Estimates

\[ |E_T| \leq \frac{M(b-a)^3}{12n^2} \quad f''(x) \leq M \text{ for all } x \in [a,b] \]