Show all your work on the exam paper, legibly and in detail, to receive full credit. The use of a calculator or any other electronic device is prohibited. You may only use techniques discussed to date in class. You must simplify all answers unless you are explicitly instructed not to.

Some useful formulas:

\[
\sum_{k=1}^{n} k = \frac{n(n+1)}{2} \quad \sum_{k=1}^{n} k^2 = \frac{n(n+1)(2n+1)}{6} \quad \sum_{k=1}^{n} k^3 = \left[ \frac{n(n+1)}{2} \right]^2
\]

1. (12 pts) Estimate the area between the graph of \( f(x) = x^2 \) and the x-axis on the interval \([-3, 5]\) using \( n = 4 \) rectangles. (It might help to draw the interval)

   a. Use left endpoints.

   b. Use midpoints.
2a. (8 pts) Find the derivative and state the corresponding integration formula.

\[ \frac{d}{dx} \left[ \sqrt{x^3 + 5} \right] \]

2b. (8 pts) Evaluate the sum. You must use the summation formulas given on the first page.

\[ \sum_{k=1}^{6} k^2 + 2k \]

2c. (8 pts) Evaluate the integral using appropriate formulas from geometry.

\[ \int_{0}^{1} \left( x + 2\sqrt{1-x^2} \right) dx \]
3. Evaluate the following integrals.

a. (8 pts)
\[ \int \left( \frac{2}{x} + 3e^x \right) dx \]

b. (8 pts)
\[ \int \cos^4 (3t) \sin (3t) dt \]
4. Evaluate the following integrals.

a. (10 pts)

\[\int x\sqrt{x+2}\,dx\]

b. (6 pts)

\[\int_{1}^{4} \left( \frac{1}{\sqrt{t}} + 3\sqrt{t} \right) dt\]
5. Evaluate the following integrals.

a. (10 pts)

\[ \int_{e}^{e^2} \frac{\ln x}{x} \, dx \]

b. (6 pts)

\[ \int_{0}^{4} |x - 3| \, dx \]
6a. (8 pts) Given the function \( f(x) = \int_0^x e^t \, dt \), find \( f(0) \) and \( f'(0) \).

6b. (8 pts) Evaluate the following limit. Hint: This relates to a Riemann sum of some function, using right endpoint evaluation.

\[
\lim_{n \to +\infty} \sum_{k=1}^n \left( \sin \frac{\pi k}{n} \right) \frac{\pi}{n}
\]