NAME (please print legibly): ________________________________
Your University ID Number: ________________________________

- No calculators or notes are allowed on this exam.
- Please show all your work. You may use backs of pages if necessary. You may not receive full credit for a correct answer if there is no work shown.
- You do not need to simplify all the way.

Unacceptable answer: $4x^2 - x|_1^2$.
Acceptable answer: $(4(2^2) - 2) - (4 - 1)$.

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1. (20 pts) Compute the following integrals.

(a) \( \int xe^{x^2} \, dx \)

(b) \( \int_0^1 xe^x \, dx \)
2. (20 pts) Compute the following integrals.

(a) \[ \int \cos^3(x) \sin^4(x) \, dx \]

(b) \[ \int \frac{2x + 1}{x^2 + 4} \, dx \]
3. (10 pts)

(a) Give the form of the partial fractions decomposition of
\[
\frac{3x^2 - x - 1}{x^3(x^2 + 1)}.
\]

Do not solve for the constants \(A, B, \ldots\) Do not integrate anything.

(b) Solve for one (your choice) of the unknown constants \(A, B, \ldots\) above.
4. (16 pts) Compute the following integral: \[
\int \frac{1}{x^2 \sqrt{x^2 - 9}} \, dx
\]
5. (16 pts)

(a) Use the Trapezoidal rule with \( n = 4 \) to approximate
\[
\int_{0}^{4} e^{x^2} \, dx.
\]

(b) What \( n \) would you need to guarantee that \( T_n \) is accurate to 5 decimal places?
(Recall that \( ET_n \leq K \frac{(b-a)^3}{12n^2} \).
You may use the following fact: \( f''(x) = 4x^2 e^{x^2} + 2e^{x^2} \).
6. (18 pts) Compute the following improper integrals

(a) $\int_{1}^{2} \frac{1}{\sqrt{x-1}} \, dx$

(b) $\int_{2}^{\infty} \frac{1}{\sqrt{x-1}} \, dx$