

Directions: For a total possible number of 30 bonus points applied to your Exam1 grade, please hand this by Thursday, Feb. 28th at the beginning of class. In other words, no later than 5:30PM, Feb. 28th. Late papers will not be graded or accepted. In addition, you are to work on this assignment entirely individually (you may not consult with your fellow peers, students, other faculty. You may however ask me question(s) if you're stuck or unclear on anything. However, please do not expect a detailed exposition on my part—in other words, treat this assignment like a take-home exam. **IMPORTANT: I will not grade this assignment on partial credit. All parts to all questions below will receive either full credit or no credit at all. Please show your work with maximum amount of care and precision.**

As usual, please write out your answers neatly, (illegible work will not be graded). Attach this sheet signed and dated to your work

I have read, understood, and complied with the instructions set forth in this assignment

Name	Signature	Date
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I.) **10 pts total.** Given the expression: $\int x^4 e^{-2x} dx$

i.) (1) This must obviously be integrated by parts. Write down your choice for u and for dv
ii.) (5) Construct the necessary procedure to integrate by parts. If you'll use the tabular approach, then clearly and correctly label each successive step of differentiation (in the u column) as well as anti-differentiation (in the dv) column. If you select some other method of integration by parts, then clearly present all steps without omitting any relevant detail. **Last of all, and most important, write down explicitly what you consider is the complete and final answer.**

iii.) (1) Now consider the expression: $\int_0^{\infty} x^4 e^{-2x} dx$. Rewrite in correct improper integral from (as a limit).

iv.) (3) Use your answers in iii.) and ii) above to evaluate $\int_0^{\infty} x^4 e^{-2x} dx$. **You must use L'Hopital's Rule** in your derivation.

II.) **20 pts total.** Given the expression: $\int_{-3}^1 \frac{dx}{x^2 - 4}$

i.) (1) Clearly the above expression is an improper integral. Rewrite in correct improper integral from (as a limit).
ii.) (5pts total) Choose the appropriate trigonometric substitution by which to evaluate this integral. Label clearly the trigonometric substitution (1pt) $x(\theta)$ (i.e. x expressed as some trigonometric function with respect to some angular variable θ), (1 pt) dx , **and most importantly, (3 pts) the re-adjusted limits of integration.** Use your

answer in i.) to rewrite the integral expressed accordingly in terms of $d\theta$. (You do not need to evaluate your integral however.

- iii.) (7 pts) Use your answer in ii.) to evaluate your integral. If it converges, write down the correct numerical answer. If it diverges, clearly show by your limit procedure.
- iv.) (2) Now take your answer in i.) and re-express (without evaluating) in terms of an integration by partial fractions. (Find the undertermined coefficients A_1 and A_2 and re-express your integral accordingly).
- v.) (5) Now use your answer in iv.) and evaluate your improper integral. Your final answer should agree with iii.)