

*I have read, understood, and complied with the instructions in the box below. Legible*

*Signature and LSU ID #: \_\_\_\_\_*

- Download and print a copy of this test on 8.5 by 11 inch letter size paper. If no printer is available, make a hand-written facsimile. Be sure to sign the statement above.
- **Show all work** in the space provided. Grading is based on the correctness of the work shown. We can give credit *only* for what you write! *Indicate clearly if you continue a problem on a second page.* There are 5 problems worth 20 points each.
- **You may use your text book, Zoom recordings of our class meetings, your class notes, and your homework!** However, no other sources or communication devices may be used. **All work must be your own.** If you use a calculator, you *must still write out all operations performed* on the calculator. *Do not replace* precise answers, such as  $\sqrt{2}$ ,  $\pi$ , or  $\cos \frac{\pi}{7}$  with decimal approximations. *Make all obvious simplifications.* Submit only your own work!
- This is a take-home test on an *honor system*. You may take as much time as you like, but **I must receive your completed test by email no later than 12:00 noon on Saturday, January 30.** If you have no device that scans your work directly to a single pdf file, then photograph your pages in the correct order with your phone and save as jpeg, then try this please: put the jpeg files into your computer, highlight the whole group of pictures, right click PRINT and then select PRINT TO PDF. That way I can receive a multipage PDF file which is possible to grade in a way you will be able to read later. Email that file to me **rich@math.lsu.edu** as soon as you are ready but no later than Saturday, January 30, at 12:30 noon. *These instructions express my trust and confidence in your integrity and good character.*

*Before you send me your pdf file containing all your pages as one single file, please make sure everything is legible. Use a sufficiently dark writing instrument for your test and make sharp, clear images, so I can read them. I simply cannot grade what I cannot read. Thank you for your consideration in this!*

1. Use *integration by parts* to evaluate  $\int 2x \tan^{-1} x \, dx$ . (Hint: Let  $u = \tan^{-1} x$ . What then must be  $dv$ ? Show how you check your answer.)

2. Evaluate  $\int_0^{\frac{\pi}{8}} \sin^2 x \cos^2 x \, dx$ . (Hint: Do you know an identity for  $\sin 2x$ ?)

3. Use a *trigonometric substitution* to evaluate  $\int \frac{\sqrt{x^2 - 1}}{x^2} dx$ .

4. Use the *Partial Fractions* theorem to evaluate  $\int \frac{3x^2 + 1}{(x - 1)(x^2 + 1)} dx$ .

5. Evaluate the improper integral  $\int_3^{\infty} \frac{1}{x^2 - x} dx$  or else show that it does not converge if that is the case. (Hint: Use a partial fractions decomposition and the definition of the improper integral.)