
Name: _______________________

- There are six problems worth a total of 100 points.
- Show your work. Circle your answers.
- You must not communicate with other students during this test.
- No books, notes, calculators, or electronic devices allowed.
- Do not turn this page until instructed to.

Violations of academic integrity (in other words, cheating) will be taken extremely seriously, and will be handled under the procedures of Article I, Part 4 of the student code.

Do not write below this line—for graders only

<table>
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<td>10 points</td>
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1. (10 points) Write out the form of the partial fraction decomposition of each function. Do not evaluate the numerical values of coefficients. Leave them in the form \( A, B, C, \cdots \) or \( Ax + B, Cx + D, \cdots \)

For example, your answer might include the term \( \frac{A}{x-1} \).

a) \( \frac{x^2 + 2}{x^4 - 1} = \)

b) \( \frac{x^2 + 2}{x^3 + 2x^2 + x} = \)

2. (18 points) Evaluate \( \int x^4 \ln x \, dx \)
3. (18 points) Determine whether each improper integral converges or diverges. Write the proper word in the blank next to each integral. You do not need to show work.

\[ \int_{2}^{\infty} \frac{1}{\sqrt{x}} \, dx \]  
\[ \int_{0}^{1} \frac{10}{x^{3/2}} \, dx \]  
\[ \int_{1}^{\infty} \frac{e^x + x^3 + \ln(x) + 1}{x^4 + 2x + 2} \, dx \]  
\[ \int_{1}^{\infty} \frac{x^3 + 2x + 1}{x^5 + 4x + 2} \, dx \]  
\[ \int_{1}^{\infty} \frac{1}{x^3 + x} \, dx \]  
\[ \int_{1}^{\infty} e^{-x}(x^3 + 2x + 5) \, dx \]

4. (18 points) Evaluate \[ \int \frac{dx}{\sqrt{x(x + 4)}} \, dx \]
Trig identities: \( \sin^2 x + \cos^2 x = 1, \) \( \tan^2 x + 1 = \sec^2 x, \) \( \sin 2x = 2 \sin x \cos x, \) \( \cos^2 x = \frac{1}{2} (1 + \cos 2x), \) \( \sin^2 x = \frac{1}{2} (1 - \cos 2x) \)

5. (18 points) Evaluate \( \int_0^{\pi/4} \sec^4 \theta \tan^2 \theta \, d\theta \)

6. (18 points) Evaluate \( \int \frac{x^2}{\sqrt{9 - x^2}} \, dx \)