Test is two sided.

Rip off this cover page and use it for scratch work.
INSTRUCTIONS:

(1) To receive credit you must:
   (a) work in a logical fashion, show all your work, indicate your reasoning; no credit will be given for an answer that just appears;
   (b) if a line/box is provided, then:
       — show you work BELOW the line/box
       — put your answer on/in the line/box
   (c) if no such line/box is provided, then box your answer

(2) The mark box indicates the problems along with their points.

(3) You may not use an electronic device, a calculator, books, personal notes.

(4) During this exam, do not leave your seat. If you have a question, raise your hand. When you finish: turn your exam over, put your pencil down, and raise your hand.

(5) This exam covers (from Calculus by Anton, Bivens, Davis 8th ed.):
     Sections 8.1, 8.2, 8.3, 8.4, 8.5, 8.8.

Problem Inspiration: If I told you here, you would know what method to use. So see the solution key, which will be available from the course homepage after the exam.

Hints:

(1) You can check your answers to the indefinite integrals by differentiating.
(2) For more partial credit, box your $u - du$ substitutions.

Honor Code Statement

I understand that it is the responsibility of every member of the Carolina community to uphold and maintain the University of South Carolina’s Honor Code.

As a Carolinian, I certify that I have neither given nor received unauthorized aid on this exam. Furthermore, I have not only read but will also follow the above Instructions.

Signature: ________________________________
1. Fill in the blanks (each worth 1 point).

- \( \int \frac{du}{u} = \square \ |u| + C \)
- If \( a \) is a constant and \( a > 0 \) but \( a \neq 1 \), then \( \int a^u \, du = \square + C \)
- \( \int \cos u \, du = \square + C \)
- \( \int \sin u \, du = \square + C \)
- \( \int \tan u \, du = \square + C \)
- \( \int \cot u \, du = \square + C \)
- \( \int \csc u \, du = \square + C \)
- \( \int \sec u \, du = \square + C \)
- \( \int \sec^2 u \, du = \square + C \)
- \( \int \sec u \tan u \, du = \square + C \)
- \( \int \csc^2 u \, du = \square + C \)
- \( \int \csc u \cot u \, du = \square + C \)
- If \( a \) is a constant and \( a > 0 \) then \( \int \frac{1}{a^2 + u^2} \, du = \square + C \)
- If \( a \) is a constant and \( a > 0 \) then \( \int \frac{1}{\sqrt{a^2 - u^2}} \, du = \square + C \)
- If \( a \) is a constant and \( a > 0 \) then \( \int \frac{1}{w\sqrt{a^2 - u^2}} \, du = \square + C \)
- Partial Fraction Decomposition. If one wants to integrate \( \frac{f(x)}{g(x)} \) where \( f \) and \( g \) are polynomials and \( \text{[degree of } f\text{]} \geq \text{[degree of } g\text{]} \), then one must first do \( \square \)
- Integration by parts formula: \( \int u \, dv = \square \)
- Trig substitution: (recall that the integrand is the function you are integrating)
  - if the integrand involves \( a^2 + u^2 \), then one makes the substitution \( u = \square \)
  - Trig substitution:
    - if the integrand involves \( a^2 - u^2 \), then one makes the substitution \( u = \square \)
  - Trig substitution:
    - if the integrand involves \( u^2 - a^2 \), then one makes the substitution \( u = \square \)
  - trig formula ... your answer should involve trig functions of \( \theta \), and not of \( 2\theta \): \( \sin(2\theta) = \square \)
  - trig formula ... your answer should have \( \cos(2\theta) \) in it: \( \cos^2(\theta) = \frac{1}{2} \left( \square \right) \)
  - trig formula ... your answer should have \( \cos(2\theta) \) in it: \( \sin^2(\theta) = \frac{1}{2} \left( \square \right) \)
  - trig formula ... since \( \cos^2 \theta + \sin^2 \theta = 1 \), we know that the corresponding relationship between tangent (i.e., tan) and secant (i.e., sec) is \( \square \)
  - \( \arcsin(-\frac{1}{2}) = \square \) RADIANS. (your answer should be an angle)
2. \[
\int e^{17x} \, dx = + C
\]
$$\int xe^x \, dx = + C$$
\[ \int \ln(x + 2) \, dx = \quad + C \]
\[ \int \sec^3 x \tan^3 x \, dx = \ + \ C \]
\[ \int \frac{x^2}{\sqrt{9-x^2}} \, dx = + \, C \]
7. \[
\int \frac{5x^3 - 3x^2 + 2x - 1}{x^4 + x^2} \, dx = + C
\]

HINT: \(x^4 + x^2 = x^2(x^2 + 1) = (x - 0)^2(x^2 + 1)\)
8. LaPlace Transform (from a homework problem)

A transform is a formula that converts, or transforms, one function into another function.

Consider a function of \( t \), denoted by \( y = f(t) \). The LaPlace Transform of this function \( y = f(t) \) is a (new) function, namely the function

\[
y = L\{f(t)\} (s),
\]

which is a function of \( s \). The formula for the LaPlace Transform of \( y = f(t) \) is

\[
L\{f(t)\} (s) = \int_{t=0}^{t=\infty} e^{-st} f(t) \, dt.
\]  

(8)

where, in the integral in (8) above, \( s \) is treated as a constant.

The LaPlace Transform of the function

\[
f(t) = e^{2t}
\]

is the function

\[
L\{f(t)\} (s) = \quad \text{for } s > 2.
\]

Hint: thus, if \( f(t) = e^{2t} \), then by equation (8),

\[
L\{f(t)\} (s) = \int_{t=0}^{t=\infty} e^{-st} f(t) \, dt = \int_{t=0}^{t=\infty} e^{-st} e^{2t} \, dt
\]