FALL 1991 Math 142—Exam 1—covers 7.2—7.5
8.2—8.3
9.2—9.4

Name__________________________
SSN__________________________

For credit, Show all your work and put your answers in provided box.
No calculators allowed. No "formula sheets" allowed.
During the 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.
Do not leave your seat.
Make sure that you have all 6 pages.

A. Find \( \frac{dy}{dx} \) for:

(A1) \( y = \arctan x \)  \( \frac{4}{A1} \)

(A2) \( y = 2^x \)  \( \frac{4}{A2} \)

(A3) \( y = e^x \)  \( \frac{4}{A3} \)

(A4) \( y = x^e \)  \( \frac{4}{A4} \)

(A5) \( y = e^x \)  \( \frac{4}{A5} \)

Typeset by AMS-TEX
(A6) \( y = x^x \)

(5)

\( A^6 \)

(A7) \( y = \frac{x^2 \sin x}{\sqrt{x+5}e^x} \)

(5)

\( A^7 \)

(A8) \( ye^x + xe^y = 3 \)

(5)

\( A^8 \)
B. Evaluate.

(B1) \( \int_{-1}^{\sqrt{3}} \frac{dx}{1+x^2} = \) \( \boxed{\frac{\pi}{4}} \)

(B2) \( \int_{1}^{\log_e(x^2)} \frac{dx}{x} \) \( dx = \) \( \boxed{2\ln(2)} \)

(B3) \( \int \cos^3 2x \, dx = \) \( \boxed{\frac{1}{2}x - \frac{1}{4} \sin 2x} \)
(B4) \[ \int \cot^2 x \frac{dx}{\tan x} = \frac{-1}{5} \]

(B5) \[ \int \sin(\ln x)dx = \frac{1}{10} \]
C. Graph $y = 3^x$. The inverse of $y = 3^x$ is the function $y = \quad$. Graph the inverse function of $y = 3^x$. Be sure to label your functions.

D. (a) Express, as an integral, the area $A$ under the graph $y = \frac{1}{t}$ from $t = 1$ to $t = 2$. (b) Compute this area, i.e. evaluate the definite integral in (a).

\[
\begin{array}{c}
\text{Answer (a)} \\
A = \int \\
\text{Answer (b)} \\
A =
\end{array}
\]
E. We know that radioactive substances follow the exponential growth and decay equation. What is the half-life of a certain radioactive substance if it takes 5 years for two-thirds of this substance to decay?

Answer: ___ years.