

No calculators, notes, or books allowed. Do all work in the blue book. Cross out any work you do not want graded. Remember to **sign** your blue book: by doing so, you are pledging that you have neither given nor received assistance on this exam.

1. (8 points)

(a) Compute the inverse function $f^{-1}(x)$ where

$$f(x) = x^3 + 5.$$

(b) Give the book's definition of $\ln x$. What is the domain of this function?

2. (12 points) Evaluate or simplify.

$$(a) e^{-3 \ln 4} \quad (b) \cos^{-1} \left(\cos \left(-\frac{\pi}{6} \right) \right) \quad (c) \tan \left(\sin^{-1} \frac{12}{13} \right)$$

In problems 3 to 5, find $\frac{dy}{dx}$ (7 points each).

3. $y = \ln \left(\frac{(x^3 + 5)^4 e^{3x}}{\ln x} \right)$ (Simplify first)

4. $y = \sec^{-1}(e^{2x})$

5. $y = (\tan x)^x$

In problems 6 to 11, integrate (8 points each).

6. $\int 10^{\tan x} \sec^2 x \, dx$

7. $\int \frac{dx}{(4-x^2)^{3/2}}$

8. $\int x \sin x \, dx$

9. $\int \sin^3 x \cos^4 x \, dx$

10. $\int_3^5 \frac{dx}{3-2x}$

11. $\int \sin^2 3x \, dx$

12. (11 points) The mass of a radioactive isotope decreases at a rate proportional to the amount present. If initially the mass is 100 grams, and after 6 days it is 80 grams,

(a) find a formula for the mass after t days.

(b) find the number of days after which the mass will be 40 grams.

You may leave your answer in terms of logarithms.