

ON THE FRONT OF YOUR BLUEBOOK write: (1) your name, (2) your student ID number, (3) your instructor's name, and (4) a grading table. You must work all of the problems on the exam. Show ALL of your work in your bluebook and **BOX IN YOUR FINAL ANSWERS**. A correct answer with no relevant work may receive no credit, while an incorrect answer accompanied by some correct work may receive partial credit. Text books, class notes, calculators and crib sheets are NOT permitted. Please start each new problem on a new page of the bluebook.

1. (30 points) Evaluate each of the following integrals and show your work.

(a) $\int \frac{\log_3(x^{\log_4 x})}{x} dx$

(c) $\int \frac{1}{(1 + \sqrt{x})\sqrt{x}} dx$

(b) $\int x \sin(x^2) \sqrt{\cos(x^2)} dx$

(d) $\int_0^\pi (\cos x) 5^{\sin x} dx$

2. (20 points) Evaluate the derivative $\frac{df}{dx}$ for each of the following functions.

(a) $f(x) = \int_7^{x^2} t \ln(t) dt$

(c) $f(x) = \frac{(x-2)^2(x-3)^3}{(x-4)^4(x-5)^5}$

(b) $f(x) = (\sin x)^{\cos x}$ for $0 < x < \pi$

3. (20 points) Consider the differentiable function $f(x)$ defined for all x . You know the following information about the function: $f(2) = 1$, $f^{-1}(3) = 4$, $\frac{df^{-1}}{dx} = 5$ at $x = 1$, and $\frac{df}{dx} = 3$ at $x = 4$. Determine the following:

(a) What is the value of $f(4)$?

(c) What is the value of $\frac{df}{dx}$ at $x = 2$?

(b) What is the value of $f^{-1}(1)$?

(d) What is the value of $\frac{df^{-1}}{dx}$ at $x = 3$?

4. (20 points) Consider the differential equation $\frac{dy}{dt} = -5y$ with the initial condition $y(0) = 2$.

(a) Find the general solution $y(t)$ for $t \geq 0$.

(b) Find $y(1)$.

(c) Find the time t at which $y(t) = y(0)/2$.

5. (10 points) Consider the function $f(x)$ defined by $f(x) = \int_0^x e^{\sin t} dt$. Find the equation of the tangent line through the point $(0, 0)$.