SECTION: _____

Midterm 1
Math 31B, Section 3, Spring 2014
April 23, 2014

NAME/ID: ____________________________________________

I have read and understood the Student Honor Code, and this exam reflects my unwavering commitment to the principles of academic integrity and honesty expressed therein.

SCORES:

1. _________ /20
2. _________ /20
3. _________ /20
4. _________ /20
5. _________ /20

Total: ___________ /100

TO RECEIVE FULL CREDIT, PLEASE SHOW ALL WORK.
Problem 1 (20 points total) Consider the function $f(x) = x - \log_2(x) + 3$.

(A) Find all intervals where $f(x)$ is invertible.

(B) Find $\frac{df}{dx} f^{-1}(x)$ at $x = 4$.

(C) Find $\frac{d}{dx} f^{-1}(f^{-1}(x))$ at $x = 5$. 
Problem 2 (20 points total) Evaluate the following limits.

(A) \[ \lim_{z \to 1} \frac{4^z - 4}{23^z - 23} \]

(B) \[ \lim_{z \to 0^+} \frac{z \sin(\pi z)}{z} \]

(C) \[ \lim_{z \to 0} (1 + 4z + 3z^2)^{1/5z} \]
Problem 3 (20 points total.) A cup of coffee is sitting in a room at 60 °F. You notice it takes 5 minutes for the coffee to cool from 120 °F to 100 °F. (10 points each.)

(A) How long did it take the coffee to cool from 180 °F to 120 °F?

(B) If you place the coffee cup in a refrigerator at 40 °F, how long will it take the coffee to cool from 100 °F to 60 °F? (Assume it cools at the same rate.)
Problem 4 (20 points) Evaluate the following definite integrals. (10 points each.)

(A)

\[ \int_{0}^{\ln(2)} \frac{1}{1 + e^x} \, dx. \]

(B)

\[ \int_{1}^{2} \frac{x + 3}{x^2 - 2x + 2} \, dx. \]
Problem 5 (20 points total) Evaluate the following indefinite integrals (10 points each.)

(A) $\int x^3 \arctan(x) \, dx$.

(B) $\int \sin(\ln(x)) \, dx$. 