Math 242 Exam 1 February 12th, 2019

Name and UH ID: _____

Section Number: _____

Show all work clearly.

Answer the questions in the spaces provided on the question sheets.

If you run out of room for an answer, use the blank sheet at the end of the exam. Clearly label your work.

No calculators or notes allowed.

Question	Points	Score
1	10	
2	10	
3	20	
4	20	
5	40	
Total	100	

1. (10 points) Let $f(x) = x^2 - 2x - 8$, $x > 1$. Find the value of $(f^{-1})'(x)$ at $x = 0 = f(4)$.

2. (10 points) Suppose you invest \$500 at 7% interest. If the interest is compounded continuously, calculate how many years must pass in order for the investment to be valued at \$1,500. Leave your answer unsimplified.

3. (20 points) Differentiate the following functions.

   (a) (10 points) $h(t) = \cos(e^{\sin t})$

   (b) (10 points) $y = \ln(2xe^x)$

4. (20 points) Evaluate the following limits. Remember to use proper notation, and to indicate if you are using L'Hospital's Rule.

   (a) (10 points) $\lim_{x \to 0} \dfrac{2 - 2\cos x}{e^x - x - 1}$

   (b) (5 points) $\lim_{x \to \infty} \arctan\left(e^x\right)$

   (c) (5 points) $\lim_{x \to 0^-} \sin^{-1}(e^x)$

5. (40 points) Evaluate the following integrals.

   (a) (10 points)

$$\int x \ln x \; dx$$

(b) (10 points)

$$\int_0^{\pi/4} \tan^2\theta \sec^4\theta \; d\theta$$

(c) (10 points)

$$\int e^x(1+e^x)^3\,dx$$

(d) (10 points)

$$\int \frac{dx}{x^2\sqrt{x^2-9}}$$

BLANK SHEET FOR EXTRA WRITING

Formula Sheet

- Inverse Trigonometric Derivatives
  - $\frac{d}{dx}\sin^{-1}(x) = \dfrac{1}{\sqrt{1-x^2}}$
  - $\frac{d}{dx}\cos^{-1}(x) = -\dfrac{1}{\sqrt{1-x^2}}$
  - $\frac{d}{dx}\tan^{-1}(x) = \dfrac{1}{1+x^2}$
  - $\frac{d}{dx}\cot^{-1}(x) = -\dfrac{1}{1+x^2}$
  - $\frac{d}{dx}\sec^{-1}(x) = \dfrac{1}{x\sqrt{x^2-1}}$
  - $\frac{d}{dx}\csc^{-1}(x) = -\dfrac{1}{x\sqrt{x^2-1}}$
- Pythagorean Identities (true for all values of x where the functions are defined.)

$$\sin^2 x + \cos^2 x = 1 \qquad \tan^2 x + 1 = \sec^2 x \qquad 1 + \cot^2 x = \csc^2 x$$

- Reduction of Powers / Double-angle Formula (true for all x.)

$$\cos^2 x = \frac{1}{2}(1+\cos 2x) \qquad \sin^2 x = \frac{1}{2}(1-\cos 2x) \qquad \sin x \cos x = \frac{1}{2}\sin 2x$$

- Addition Formula for sine and cosine (true for all x and y.)
  - $\sin x \sin y = \frac{1}{2}\cos(x-y) - \frac{1}{2}\cos(x+y)$
  - $\cos x \cos y = \frac{1}{2}\cos(x-y) + \frac{1}{2}\cos(x+y)$
  - $\sin x \cos y = \frac{1}{2}\sin(x-y) + \frac{1}{2}\sin(x+y)$
- Common Integrals
  - $\int \tan x \; dx = \ln|\sec x| + C$
  - $\int \sec x \; dx = \ln|\sec x + \tan x| + C$
  - $\int \csc x \; dx = -\ln|\csc x + \cot x| + C$