Math 161

Midterm 1

February 25, 2016

Name: _____

Student ID Number: _____

Circle your instructor: **Bridy (MW 2:00)** **Demiroglu (MW 4:50)**

Academic honesty statement:
With my signature, I affirm that I will not give or receive any unauthorized help on this exam, and that all work will be my own.

Signature: _____ Date: _____

- **Justify your answers.**
- **No calculators are allowed on this exam, but you are allowed one sheet of paper with writing on both sides.**
- **You do not need to simplify arithmetic expressions like 5^8 or $\frac{24}{120} + \frac{14}{36}$, but you do need to evaluate expressions like $\sin^{-1}(1)$, $\sin(\pi)$, or $e^{\ln 2}$.**

QUESTION	VALUE	SCORE
1	15	
2	15	
3	15	
4	20	
5	10	
6	15	
7	10	
TOTAL	100	

1. (15 points)

(a) Let $f(x) = \sin(3x)$ and $g(x) = \dfrac{x}{2}$. Compute $(f \circ g)(\pi)$ and $(g \circ f)(\pi)$.

(b) Let $f(x) = 5^{2x-3}$. Find a formula for $f^{-1}(x)$.

(c) Solve $2^{2x^2+1} = 8$.

2. (15 points)

(a) Find all solutions to the inequality $|4x - 6| \geq 14$. Write your answer as an interval or as a union of intervals.

(b) Write $\tan(\sin^{-1}(2x))$ in terms of x in a way that has no trig or inverse trig functions.

(c) Solve $\ln(x + 2) + \ln(x) - \ln(3) = 0$.

3. (15 points)

(a) Use the definition of the derivative to compute $f'(2)$, where

$$f(x) = \frac{x}{x+3}.$$

(b) Suppose you know that $f'(-2) = 3$ (you don't have to show this). Write an equation for the tangent line to $y = f(x)$ at the point where $x = -2$.

4. (20 points) Compute the following limits. If the limit does not exist, write "DNE." Be sure to distinguish between limits that are ∞ or $-\infty$ instead of "DNE." You may only use methods discussed in this class so far.

(a) $\lim_{x \to 3^-} \dfrac{2x^2 - 18}{x^2 - 6x + 9}$

(b) $\lim_{x \to 2} \dfrac{x^3 - 4x}{x^2 + 5x - 14}$

(c) $\lim_{x \to 3} \dfrac{2x - 6}{|x - 3|}$

(d) $\lim_{x \to \infty} \sqrt{4x^2 + 5x} - 2x$

5. (10 points) Find all vertical and horizontal asymptotes of $f(x) = \dfrac{\sqrt{9x^2} + x}{x}$.

6. (15 points)

(a) State the definition of continuity of the function $f(x)$ at the point a.

(b) Let the following piecewise function be defined for some numbers a, b, and c.

$$f(x) = \begin{cases} x^2 + 3 & : x < -2 \\ a & : x = -2 \\ bx + c & : -2 < x < 1 \\ 2x^3 - 1 & : x \geq 1 \end{cases}$$

Find the values of a, b, c that make $f(x)$ continuous everywhere. (Justify your answer.)

7. (10 points) Suppose you have a function $f(x)$ and you know that $f'(x) = \dfrac{x^2 + 3x}{x^2 - 2x + 1}$.

(a) Find all values of x where the tangent line to the graph of $y = f(x)$ is perpendicular to the line $y + x + 1 = 0$.

(b) Is $f(x)$ continuous at $x = 2$? Explain your answer.