Midterm 1
Math 13100
Instructor: Reid Harris
October 14, 2016

Name: _____

Instructions:

1. Print your name clearly at the top of each page.

2. This midterm has 6 questions for a total of 100 points. The value of each part of each question is stated.

3. Please show your work in the space provided. Partial credit will be awarded for partial or incomplete solutions.

4. The parts of the fourth question are true/false questions. In other questions please show your work. If you need more space, you can use the final page, which is blank, or request additional paper.

Good Luck!

Question	Points	Score
1	18	
2	18	
3	20	
4	20	
5	12	
6	12	
Total:	100	

1. (18 points) Solve the following inequalities. Write the set of solutions in interval nota-
   tion.

   (a) $\qquad |x + 2| \geq 3$

   (b) $\qquad x(x - 2)^2 > 0$

   (c) $\qquad \dfrac{1}{x + 1} < 3.$

2. (18 points) What is the natural domain of the following functions? Write your answer in interval notation.

(a) $f(x) = \dfrac{1}{x-4} \cdot \dfrac{x-4}{(x+4)^2}$

(b) $f(x) = \sqrt{x+4}$

(c) $f(x) = \dfrac{1}{x^2+1}$

3. (20 points) Determine whether each of the following statements is true or false. Circle true or false.

(a) We write $\lim\limits_{x \to 1} f(x) = L$ if

for every $\epsilon > 0$, there is a $\delta > 0$ such that $|x - 1| < \delta \implies |f(x) - L| < \epsilon$.

True   **False**

(b) If f is a polynomial, then $\lim\limits_{x \to 57} f(x) = f(57)$.

True   **False**

(c) If f and g are functions such that $\lim\limits_{x \to 0} f(x)$ and $\lim\limits_{x \to 0} g(x)$ exist, then $\lim\limits_{x \to 0} \dfrac{f(x)}{g(x)}$ exists

and is equal to $\dfrac{\lim\limits_{x \to 0} f(x)}{\lim\limits_{x \to 0} g(x)}$.

True   **False**

(d) If f is a function such that $\lim\limits_{x \to 0} f(x) = 3$, then $\lim\limits_{x \to -2} f(x + 2) = 3$.

True   **False**

4. (20 points) Compute the following limits or state that they do not exist. Show all work.

(a) $\lim\limits_{x\to 3}(x^2 - 4x - 2)$

(b) $\lim\limits_{x\to 1}\dfrac{1 + x + x^2 - 4x^3}{1 - x}$

(c) $\lim\limits_{x\to 6}\dfrac{x^2 - 8x + 12}{x - 6}$

(d) $\lim\limits_{x\to 1}\dfrac{1 - x}{1 - \sqrt{x}}$

5. (12 points) There is only one value of a such that the limit

$$\lim_{x \to 4} \frac{x^2 - 8x + a}{x - 4}$$

exists. What is that value of a?

6. (12 points) Prove that
$$\lim_{x \to 5}(5x - 3) = 22$$

using the ϵ-δ definition of limits.