

### Rules

There are 5 problems. Complete all problems.

Clearly indicate your your answer to each problem.

Show all your work - partial credit may be given for some problems, but only if you show your work.

The exam is closed book and closed notes.

Calculators are allowed.

PDA's, computers, cell phones are prohibited.

#### **Student Conduct Certification**

This certification must be signed or your exam will not be graded.

I certify that I have read and understand the rules of the exam, and further, that the work shown in this examination is my own and that it has been completed in accord with the California State University Northridge student conduct code. I also understand that failure to abide by the student conduct code is subject to discipline as provided in sections 41301 through 41304 of Title 5, California Code of Regulations.

Sign here: \_\_\_\_\_

Problem	Points/Total
1	/20
2	/20
3	/20
4	/20
5	/20
Total	/100

1. Determine each of the following limits and simplify.

(a) (5 pts)  $\lim_{x \rightarrow 1} \frac{5x^3 - 4}{3x^2 + 97}$

(b) (5 pts)  $\lim_{x \rightarrow 4} \frac{\frac{1}{4} - \frac{1}{x}}{x - 4}$

(b) (5 pts)  $\lim_{x \rightarrow 3} \frac{x^2 - 9}{x^2 - x - 6}$

(c) (5 pts)  $\lim_{x \rightarrow 0} \frac{7 - \sqrt{49 - x^2}}{x^2}$

2. The precise definition of  $\lim_{x \rightarrow a} f(x) = L$  says that for any  $\epsilon > 0$ , there exists a  $\delta > 0$ , such that  $|x - a| < \delta \implies |f(x) - L| < \epsilon$ . In the remainder of this problem consider the limit

$$\lim_{x \rightarrow 4} (x^2 - 8x - 1) = -17$$

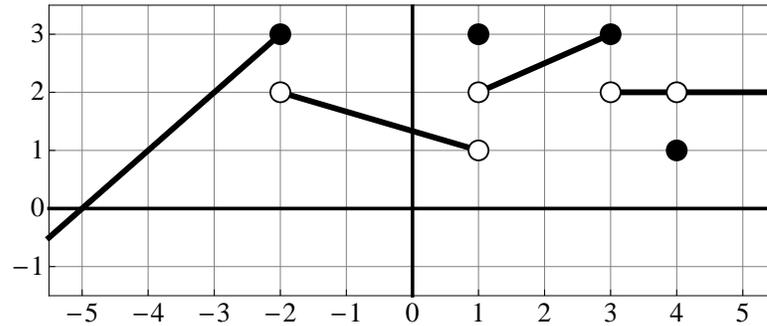
- (a) (5 pts) Write the expression  $|x - a| < \delta \implies |f(x) - L| < \epsilon$  for  $\lim_{x \rightarrow 4} (x^2 - 8x - 1) = -17$

- (b) (5 pts) Suppose I tell you what value of  $\epsilon$  to use. Find a value of  $\delta$  that will work.

- (c) (5 pts) Prove that  $\lim_{x \rightarrow 4} (x^2 - 8x - 1) = -17$

- (d) (5 pts) Using the result of part (b), suppose that  $\epsilon = 0.01$ , and find a value of  $\delta$ .

3. Determine each of the following values from the graph. Write DNE if a value does not exist.



(a) (1 pt)  $\lim_{x \rightarrow -3} f(x) =$

(e) (1 pt)  $f(-2) =$

(b) (1 pt)  $\lim_{x \rightarrow 3^-} f(x) =$

(f) (1 pt)  $f(1) =$

(c) (1 pt)  $\lim_{x \rightarrow 3^+} f(x) =$

(g) (1 pt)  $\lim_{x \rightarrow 4} f(x) =$

(d) (1 pt)  $\lim_{x \rightarrow 3} f(x) =$

(h) (1 pt)  $\lim_{x \rightarrow 1^+} f(x) =$

(i) (3 pts) Write the interval where  $f(x)$  is continuous:

(j) (1 pts) Write the definition of the statement “ $f(x)$  is continuous at  $x = a$ ”.

(k) (4 pts) Explain why  $f(x) = x^3$  is continuous at  $x = 2$ .

(l) (4 pts) Find a value of  $c$  that will make the function  $f(x) = \begin{cases} x^3 - 3cx, & x < 3 \\ cx, & x \geq 3 \end{cases}$  continuous at  $x = 3$ .

Your Name Here

4. Find an equation of the tangent line to  $y = 3x^2 - 4x$  at  $x = 3$ .

5. Let  $f(x) = 1/x$ . Find the EXACT answers for the following (do not use a calculator and there should not be any decimal points in the answers).

(a)(3 pts) Find the average rate of change of  $f(x)$  on the interval  $[1, 2]$ .

(b)(3 pts) Find the average rate of change of  $f(x)$  on the interval  $[1, 1.5]$ .

(c)(3 pts) Find the average rate of change of  $f(x)$  on the interval  $[1, 1.1]$ .

(d)(11 pts) Find  $f'(1)$ .