

Name: \_\_\_\_\_

Student ID: \_\_\_\_\_

## Final Exam

**Instructions:** Unless the problem explicitly states otherwise, you absolutely must show your work! A correct answer without a reasonable amount of work will be given a 0. You are allowed 1 page of notes. Please use your note sheet to cover your exam solutions whenever possible. You do not need to simplify your final answers. Please leave your final answers in the boxes at the bottom of each page.

- **102.01.1 UC Davis Code of Academic Conduct** This Code of Academic Conduct exists to support high standards of behavior and to ensure fair evaluation of student learning. Students who violate the Code of Academic Conduct are subject to disciplinary sanctions that include Censure, Probation, Suspension, or Dismissal from the University of California. Unless specifically authorized by the instructor in writing, misconduct includes, but is not limited to, the following:
  - Copying or attempting to copy from another student, allowing another student to copy, or collaborating on an exam
  - Displaying or using any unauthorized material such as notes, cheat-sheets, or electronic devices, or content generated by artificial intelligence
  - Looking at another student’s exam
  - Not following an instructor’s directions
  - Talking, texting or communicating during an exam
  - Altering assignments or exams for re-grading purposes
  - Having another person take an exam for the student, or taking an exam for another student
  - Theft of academic work
  - Unexcused exit and re-entry during an exam period
- Please understand that if another student copies your solutions on the exam then you may be accused of “allowing another student to copy” and may have to defend yourself in a litigation process through the UC Davis Office of Student Judicial Affairs.

**Problem 1.** Compute the following limit using any method you are familiar with. You must show your work on this limit!

$$\lim_{x \rightarrow 0} \frac{x \sin(2x)}{1 - \cos(3x)}$$



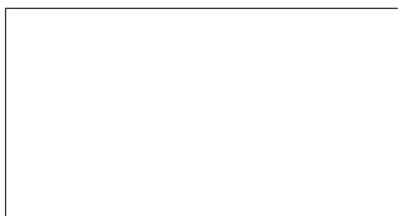
**Problem 2.** Compute the following limit using any method you are familiar with. You must show your work on this limit!

$$\lim_{x \rightarrow -2} \frac{x^2 + x - 2}{2x^2 - 8}$$



**Problem 3.** Compute the following limit using any method you are familiar with. You must show your work on this limit!

$$\lim_{x \rightarrow \infty} \sqrt{4x^2 + x} - 2x$$



**Problem 4.** The following limit using any method you are familiar with. You must show your work on this limit! [Hint:  $\cos(0) = 1$ ]

$$\lim_{x \rightarrow \infty} x \tan\left(\frac{1}{2x}\right)$$



**Problem 5.** Compute the limit and write your final answer in the box. If the limit approaches infinity write  $\infty$  for your answer. If the limit approaches negative infinity write  $-\infty$ . You must have some work or explanation to receive credit!

a)

$$\lim_{x \rightarrow \infty} \frac{x^3 + 2x^2 - x + 3}{e^x}$$

b)

$$\lim_{x \rightarrow -\infty} \frac{2x^3 + x - 4}{2 - x + 2x^2 - 3x^3}$$

c)

$$\lim_{x \rightarrow \infty} \frac{(\ln(x))^2}{\sqrt{x}}$$



d)

$$\lim_{x \rightarrow \infty} \frac{5 - 2e^{2x}}{3e^{2x} + 4}$$



**Problem 6.** Consider the curve defined by the equation  $x^3 + y^3 = 6xy$ . Use implicit differentiation to find the equation of the tangent line for this curve at the point  $(3, 3)$ .



**Problem 7.** Animal  $A$  and Animal  $B$  begin at the same position. Animal  $A$  is traveling North at a rate of  $3m/sec$  and Animal  $B$  is traveling East at a rate of  $4m/sec$ . How fast is the distance from Animal  $A$  to Animal  $B$  changing when Animal  $A$  is  $6m$  from the starting position and Animal  $B$  is  $8m$  from the starting position.



**Problem 8.** Suppose  $24m^2$  of material is available to make a box with a square base and open top. Find the dimensions of the box that maximize the volume of the box. [Hint: the volume might normally be expressed as  $V = l \cdot w \cdot h$ , but we have a square base! Also, the box with an open top should have 5 sides!]



**Problem 9.** Identify all  $x$ -values at which the given function  $f$  has local maxima or local minima. Clearly label each  $x$ -value you find as a Max or Min.

$$f(x) = x\sqrt{4 - x^2}$$

**Problem 10.** Identify the absolute maximum value and the absolute minimum value of the function

$$f(x) = 2x^3 - 3x^2 - 12x + 10 \quad \text{for} \quad -2 \leq x \leq 2.$$

