

# Math 1271-70 (Calculus 1). Fall 2014.

## *Midterm Exam 1*

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

TA: \_\_\_\_\_

Section: \_\_\_\_\_

1. **Do not open this exam until you are told to do so.**
2. This exam has 6 pages including this cover. There are 5 problems.
3. Not all problems are of equal difficulty, so you may want to skip over and return to a problem on which you are stuck.
4. Do not separate the pages of this exam. If they do become separated, write your name on every page and point this out to your instructor when you hand in the exam.
5. Show an appropriate amount of work for each problem.
6. You may (but do not need to) use a scientific calculator.
7. No notecards are allowed.
8. **No cell phones, smartphones, headphones, or other devices allowed.**

**Problem 1.** (10 points) Answer the following true-false questions. You do not need to show your work and there is no partial credit.

1. A differentiable function must be continuous. T F
2. A continuous function must be differentiable. T F
3. If  $|f(x)| \leq |x|$  then  $\lim_{x \rightarrow 0} f(x)$  exists. T F
4. The equation  $x^3 + \sin(3x) = 98$  has a solution in  $(0, 10)$ . T F
5. The equation  $5 \cos(x) + 4 = 0$  has a solution in  $(0, 2\pi)$ . T F

**Problem 2.** (10 points) Find the equations of the tangent lines to the curve  $f(t) = t^3 + 3t^2 - 5t$  which are parallel to the line  $g(t) = 19t + 27$ .

Answer:  $y =$  \_\_\_\_\_

**Problem 3.**

a. (2 points) Write down the definition of the derivative of a function  $f$  at a point  $a$ .

b. (3 points) Suppose  $f(s) = \cos(e^{1/s})$ . Write down the definition of  $f'(1)$ . Your answer should not involve the symbol  $f$  or the symbol  $s$ . Do not attempt to evaluate the limit.

**Answer:**  $f'(1) =$  \_\_\_\_\_

c. (5 points) Find the derivative of  $f(s) = \frac{1}{s+3}$  using the definition of derivative.

**Answer:**  $f' =$  \_\_\_\_\_

**Problem 4.** As part of a science experiment, a student is growing mold. At the beginning it seems that the mass of the mold is increasing exponentially, however it eventually stabilizes at 15 grams.

Suppose that  $t$  hours after the experiment begins, the mass of the piece of mold is  $M(t)$  grams, where  $M(t)$  is defined by the equation

$$M(t) = \begin{cases} e^{25t} & t \leq 4, \\ \frac{5t^4}{at^b+c} & t > 4. \end{cases}$$

- a. (3 points) At what time, between 0 and 4, did the piece of mold weight 2 grams?

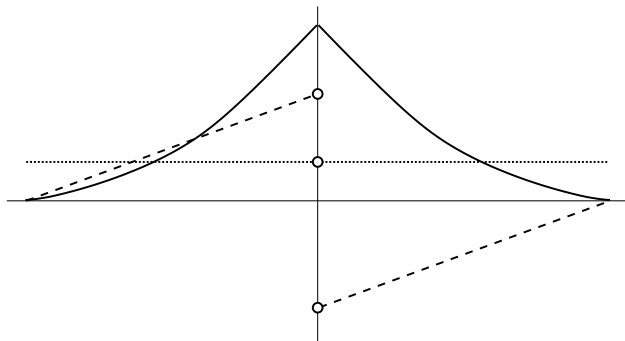
**Answer:**  $t =$  \_\_\_\_\_

- b. (7 points) Assuming that  $M$  is a continuous function determine  $a$ ,  $b$ , and  $c$ . (Recall that the mass stabilizes at 15 grams.)

**Answers:**  
 $a =$  \_\_\_\_\_  $c =$  \_\_\_\_\_  
 $b =$  \_\_\_\_\_

**Problem 5.** In each of the following cases you are given a graph of  $f$ ,  $f'$ , and  $f''$ . Label clearly which is which and briefly explain your choice.

a. (5 points)



b. (5 points)

