

# MATH 1311 FALL 2016

## CALCULUS I

### SECOND MIDTERM EXAM

FRIDAY, OCTOBER 28

YOUR NAME (PLEASE PRINT):

**Instructions:** This is a closed book, closed notes exam. **Use of calculators or other electronic devices such as cell phones, mp3 players, etc. is not permitted.** Unless indicated otherwise, you must justify all of your answers to receive credit. Unjustified answers and/or disorganized or otherwise illegible work will receive partial credit at best. Notation is important, and points will be deducted for incorrect use. Please do all of your work on the paper provided.

**The Honor Code requires that you neither give nor receive any aid on this exam.**

Please indicate that you have read and understood these guidelines by signing your name in the space provided:

Pledged: \_\_\_\_\_

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Do not write below this line

Problem	1	2	3	4	5	6	7	8
Points	10	10	10	10	5	10	10	15
Score								

**Total:**\_\_\_\_\_

1. Find  $\frac{dy}{dx}$ .

a.  $y = \frac{(x^2 + 2x)^5}{1 + 2 \tan(3x)}$

b.  $y = \ln(x + \sqrt{x^2 - 1})$

2. Evaluate  $\lim_{x \rightarrow 0} \left( \frac{1}{x} - \frac{1}{e^x - 1} \right)$ . [*Suggestion:* Express the limit as a quotient.]

**3.** Let  $f(x) = \sqrt{x + 100}$ .

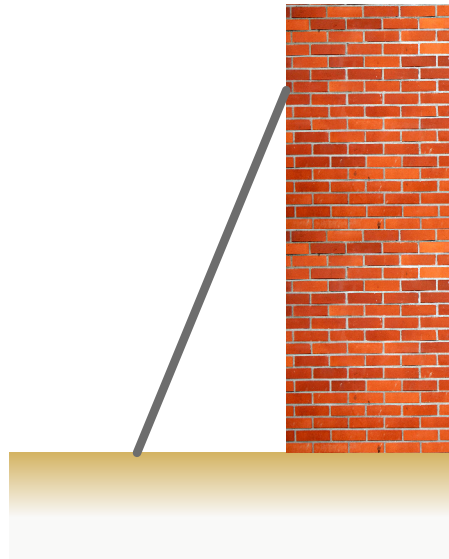
**a.** Find the linear approximation to the function  $f$  at  $a = 0$ .

**b.** Use your answer to part **a** to estimate  $\sqrt{99.5}$ .

4. Find an equation of the tangent line to the curve  $x^2 + 4xy + y^2 = 13$  at the point  $(2, 1)$ .

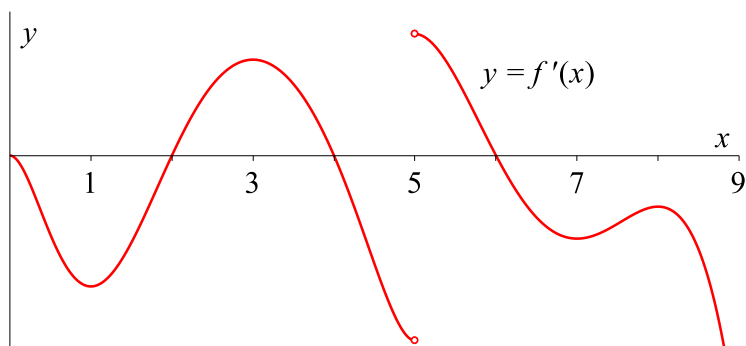
5. Suppose that  $g$  is a function that is continuous on the closed interval  $[-3, 5]$  and differentiable on the open interval  $(-3, 5)$ . If  $g(5) = -6$  and  $-1 \leq g'(x) \leq 2$  for all  $x$ , what are the largest and smallest possible values of  $g(-3)$ ?

6. A 13 ft tall ladder is resting against a vertical wall, as shown below. If the bottom of the ladder slides away from the wall at a rate of 6 in/s, how fast is the top of the ladder falling when it is 5 ft from the ground? [*Note: You must* define any variables that you introduce, by either labelling the diagram or stating them explicitly.]



7. Find the absolute extreme values of  $f(x) = x^4 + 4x^3 - 20x^2 + 1$  on the interval  $[-1, 3]$ .

8. The graph of the first derivative  $f'$  of a function  $f$  is shown below.



- a. Find the intervals on which  $f$  is increasing or decreasing.
- b. Find the  $x$ -coordinates of the local extrema of  $f$ . Be sure to specify the type of extremum.
- c. Find the intervals on which the graph of  $f$  is concave upward or concave downward.
- d. Find the  $x$ -coordinates of the inflection points of the graph of  $f$ .