

MATH 1311 FALL 2009

CALCULUS I



SECOND MIDTERM EXAM

WEDNESDAY, OCTOBER 28

YOUR NAME (PLEASE PRINT):

Instructions: This is a closed book, closed notes exam. **Use of calculators is not permitted.** You must justify all of your answers to receive credit. 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: _____

Problem	1	2	3	4	5	6	7	8
Points	12	12	10	10	10	14	12	20
Score								

Total: _____

HW: _____

Exam 1: _____

Average: _____

1. A ladder 10 ft long rests against a vertical wall. The bottom of the ladder begins to slide away from the wall at a rate of 1 ft/s.

a. Draw a diagram that describes this situation at any time t .

b. Write down a relationship between the distance from the base of the ladder to the wall and the angle between the ladder and the ground. Be sure to define any variables that you introduce!

c. How fast is the angle between the ladder and the ground changing when the bottom of the ladder is 8 ft from the wall?

2.

a. Use a linear approximation to estimate $(2.001)^5$.

b. Is your estimate from part (**a**) too large or too small? Be sure to justify your answer.

3. Find the absolute maximum and minimum values of the function $q(x) = e^{x^3-12x}$ on the interval $0 \leq x \leq 3$.

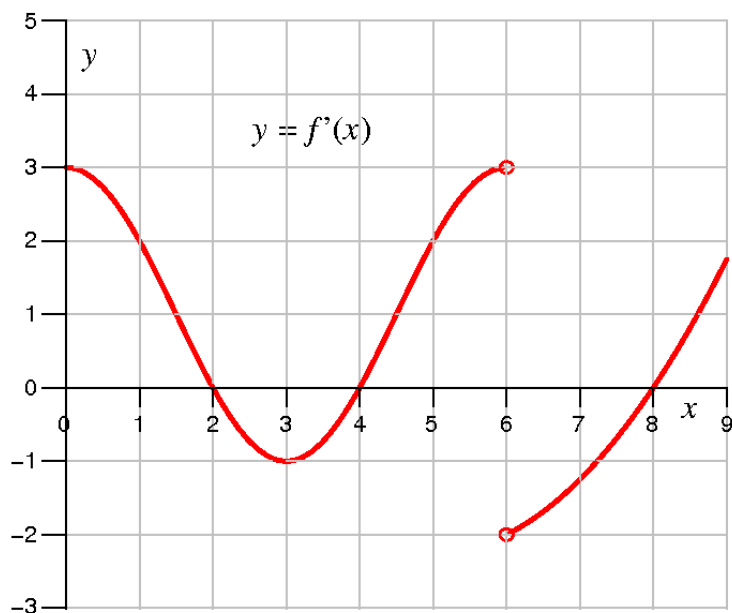
4. Show that the equation $x^3 - 15x + 1 = 0$ has exactly one solution in the interval $[-2, 2]$.

5. Let $h(x) = x(x + 3)^{1/3}$.

a. Find the critical numbers of h .

b. Determine if h has a local maximum, local minimum, or neither at each of the critical points found in part **(a)**.

6. The graph of the derivative f' of a continuous function f is shown below.



In parts (a) through (d) you do not need to justify your answers.

- a. On what intervals is f increasing or decreasing?
- b. At what values of x does f have a local maximum or minimum?
- c. On what intervals is f concave upward or downward?
- d. State the x -coordinate(s) of the point(s) of inflection on the graph of f .

7. Evaluate the following limits.

a. $\lim_{x \rightarrow 0} \frac{\tan x}{x - x^2 + x^3}$

b. $\lim_{x \rightarrow \infty} x^{1/x}$

c. $\lim_{x \rightarrow 0^+} xe^{1/x}$

8. If $f(\theta) = \frac{\sin \theta}{2 + \cos \theta}$ then

$$f'(\theta) = \frac{2 \cos \theta + 1}{(2 + \cos \theta)^2},$$

$$f''(\theta) = \frac{2(\cos \theta - 1) \sin \theta}{(2 + \cos \theta)^3}.$$

Use these facts to carefully sketch the graph of f . Indicate all asymptotes, local and global extrema, and inflection points.

