MA 113 - Calculus I
THIRD MIDTERM

Spring 2002
04/09/2002

Name: _____ Sec.: ____

SEC.	INSTRUCTORS	T.A.'S	LECTURES	RECITATIONS
001	A. Corso	B. Bennewitz	MWF 8:00-8:50, CB 204	TR 8:00-9:15, CB 341
002	A. Corso	B. Bennewitz	MWF 8:00-8:50, CB 204	TR 9:30-10:45, CB 345
004	M. Silhavy	H. Song	MWF 10:00-10:50, CB 214	TR 8:00-9:15, CB 349
005	M. Silhavy	C. Budovsky	MWF 10:00-10:50, CB 214	TR 2:00-3:15, CB 343
006	M. Silhavy	H. Song	MWF 10:00-10:50, CB 214	TR 3:30-4:45, CB 345
007	A. Martin	M. Neu	MWF 12:00-12:50, CB 208	TR 9:30-10:45, CB 347
008	A. Martin	Y. Jia	MWF 12:00-12:50, CB 208	TR 11:00-12:15, CB 347
009	A. Martin	Y. Jia	MWF 12:00-12:50, CB 208	TR 12:30-1:45, CB 349
010	M. Silhavy	C. Budovsky	MWF 2:00-2:50, CB 204	TR 12:30-1:45, CB 345
011	M. Silhavy	M. Slone	MWF 2:00-2:50, CB 204	TR 2:00-3:15, CB 345
012	M. Silhavy	M. Slone	MWF 2:00-2:50, CB 204	TR 3:30-4:45, CB 349

Answer all of the following questions. Use the backs of the question papers for scratch paper. No books or notes may be used. You may use a calculator. You may not use a calculator which has symbolic manipulation capabilities. When answering these questions, please be sure to:

- check answers when possible,
- clearly indicate your answer and the reasoning used to arrive at that answer (*unsupported answers may receive NO credit*).

QUESTION	SCORE	TOTAL
1.		10
2.		10
3.		15
4.		8
5.		10
6.		15
7.		10
8.		10
9.		12
TOTAL		100

1. Find all the critical values and the absolute maximum and absolute minimum values for

$$f(x) = 3x^4 - 16x^3 + 18x^2$$

on the closed interval $-1 \leq x \leq 4$.

pts: /10

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2. (a) Does the Mean Value Theorem apply to the function $f(x) = \dfrac{x+1}{x-1}$ on the interval $2 \leq x \leq 3$? Why? If so, find all possible values of c for which the Mean Value Theorem holds on the given interval.

(b) Same as (a), but on the new interval $0.5 \leq x \leq 1.5$.

pts: /10

3. Consider the function: $f(x) = x^4(x^2 - 3)$.

Each question is worth 5 points.

(a) Determine the intervals where the graph of $f(x)$ is increasing or decreasing.
Find the values of $f(x)$ at the local maxima and minima of $f(x)$.

(b) Determine the intervals where the graph of $f(x)$ is concave up or down.
Find the values of $f(x)$ at the inflection points of $f(x)$.

(c) Sketch the graph of $f(x)$.
Make sure to label the local maxima, the local minima and the inflection points of $f(x)$.

pts: /15

4. Without using a calculator, show that the equation

$$x^{101} + x^{51} + x - 1 = 0$$

has exactly one real root.

pts: /8

5. Show that if $x > 0$ then $x + \frac{4}{x^2} \geq 3$.

pts: /10

6. Each question is worth 5 points.

(a) $\lim_{x\to\infty} \dfrac{\sqrt{x}+3}{3-2x} =$ _____

(b) $\lim_{x\to\infty} \dfrac{2\sqrt{1+9x^2}}{9-16x} =$ _____

(c) Find the vertical and horizontal asymptotes of the curve

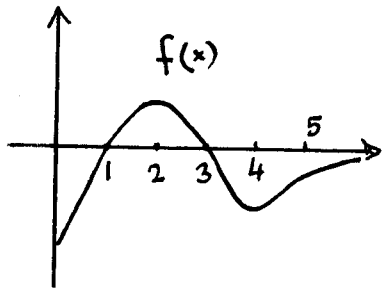
$$f(x) = \frac{3x^2+4}{2-x^2}.$$

Compute $\lim_{x\longrightarrow a^+} f(x)$ and $\lim_{x\longrightarrow a^-} f(x)$ for all the values of 'a' such that the line $x = a$ is a vertical asymptote of the given function $f(x)$.

pts: /15

7. Each problem is worth 5 points.

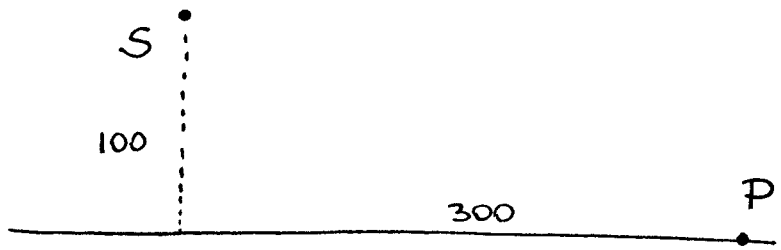
(*a*) The graph of a function $f(x)$ is shown. Which graph is an antiderivative of $f(x)$ and why?



(*b*) Find the most general antiderivative of: $f(x) = x^3 + \sqrt{x} - 2\cos(2x)$.

pts: /10

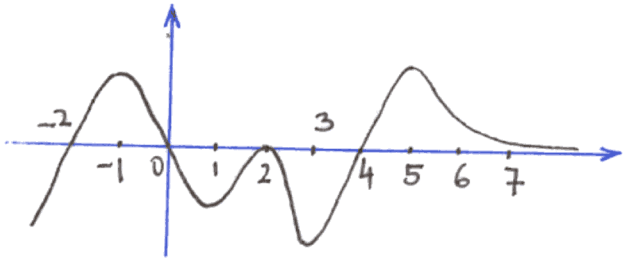
8. A swimmer S is in the ocean 100 meters from a straight shoreline. A person P in distress is located on the shoreline 300 meters from the point on the shoreline closest to the swimmer.



If the swimmer can swim 3 meters per second and run 5 meters per second, what path should the swimmer follow in order to reach the person in distress as quickly as possible?

pts: /10

9. The graph of the derivative $f'(x)$ of a function $f(x)$ is shown:



Each question is worth 3 points.

(*a*) On what intervals is $f(x)$ increasing or decreasing?

(*b*) At what values of x does $f(x)$ attains a local maximum or minimum?

(*c*) On what intervals is $f(x)$ concave up or down?

(*d*) State the x-coordinates of the inflection points.

pts: /12