

First Midterm MAT 131

February 21, 2006

8:30 – 10:00 pm

Name: _____ ID number: _____

Recitation number (e.g., R01): _____

(for evening lecture, use “ELC 4”)

Lecture 1	MWF 9:35am–10:30am	Stephen Preston
R01	MW 11:45am–12:40pm	Yinghua Li
R02	TuTh 3:50pm–4:45pm	Bryan Kim
R03	TuTh 12:50pm–2:10pm	Ariel Hitron
Evening Lec 4	TuTh 5:20pm–7:10pm	Wenchuan Hu

1	
2	
3	
4	
5	
6	
7	
8	
<hr/>	
Sum	

Instructions.

- Show all work to get full credit; a correct answer with incorrect justification will not get credit.
- All electronic devices, including cell phones, beepers, and other noisemakers, must be turned off.
- Calculators of any sort are unnecessary and not allowed.
- When finished, give your exam to your own TA or lecturer. If we do not recognize you, we will ask to see your student ID.
- Remember: *calm, confident, and calculating correctly.*

Do not open the exam until instructed!

1. The U.S. national debt was about \$4 trillion in 1995 and about \$8 trillion in 2005.

(a) If we model the debt with a linear function of time, what prediction will we have for the debt in 2015?

(b) If we model the debt with an exponential function of time, what prediction will we have in 2015?

2. Suppose $f(x) = 3x^2 - x$. Simplify the equation

$$(f \circ f)(x) = x$$

and find all solutions x .

(Note: if you get an equation you can't solve, you probably did something wrong.)

3. Suppose the function $f(x)$ has a vertical asymptote at $x = 3$ and a horizontal asymptote at $y = 2$. What are the two asymptotes of the function $y = 2f(2x) + 1$? Explain your method.

4. Consider the function $f(x) = \frac{1}{1 - e^{-x}}$.

(a) Find the inverse function in the form $y = f^{-1}(x)$.

(b) Write down the domain and range of f . Explain your reasoning.

5. Compute the limits:

(a) $\lim_{x \rightarrow -1} \frac{x^2 + 3x + 2}{x^2 + 4x + 5}$

(b) $\lim_{x \rightarrow -1} \frac{x^2 + 9x + 8}{x^2 - 1}$

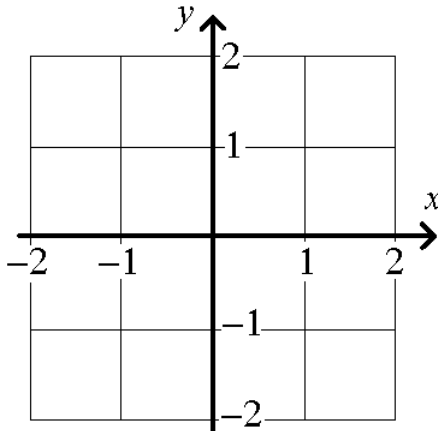
(c) $\lim_{x \rightarrow -1} \frac{x^2 - 5x + 4}{x^2 + 1}$

6. (a) How do you know the function $f(x) = x^4 - 17x + 3$ is continuous for all x ? (One sentence only.)

(b) Find an interval of length 1 that contains a solution of $f(x) = 0$. What technique are you using?

7. On the given axes, sketch the graph of a function defined at all points of $[-2, 2]$ such that

- f is continuous at all points of $[-2, 2]$ except for $x = 1$ and $x = -1$.
- $\lim_{x \rightarrow -1} f(x) = -1$
- $\lim_{x \rightarrow 1^+} f(x) = 0$
- $\lim_{x \rightarrow 1^-} f(x) = 1$
- $f(1) = 2$



8. Compute the limits.

(a) $\lim_{x \rightarrow -\infty} \sqrt{x^2 + x - 1} - x$

(b) $\lim_{x \rightarrow \infty} \sqrt{x^2 + x - 1} - x$