Practice Final Exam
MAT 125

May 8, 2006

Name:____ ID number: ____________________

Recitation number (e.g., R01):__________
(for evening lecture, use "ELC 4")

Lecture 1	MWF 9:35–10:30	An, Daniel
R01	M 11:45am–12:40pm	Solorzano, Pedro
R02	Th 3:50pm– 4:45pm	Ostrovsky, Stanislav
R03	W 11:45am–12:40pm	Solorzano, Pedro
R04	Tu 11:20am–12:15pm	Basu, Somnath
R05	Tu 11:20am–12:15pm	Han, Zhigang
R31	M 10:40am–11:35am	Patu, Ionel
Lecture 2	TuTh 2:20pm – 3:40pm	Kirillov, Alexander
R06	M 11:45am–12:40pm	Zeng, Huayi
R07	F 11:45am–12:40pm	Nowicki, Jan
R08	W 9:35am-10:30am	Ma, Xin
R09	Tu 3:50pm– 4:45pm	Ostrovsky, Stanislav
R10	F 8:30am–9:25am	Ma, Xin
Lecture 3	MW 3:50pm–5:10pm	Chen, Je-Wei
R11	M 9:35am–10:30am	Poole, Thomas
R12	F 10:40am–11:35am	Panok, Lena
R13	W 2:20pm–3:15pm	Poole, Thomas
R14	Tu 11:20am-12:15pm	Lyberg, Ivar
R15	Th 11:20am–12:15pm	Lyberg, Ivar
R32	M 2:20pm– 3:15pm	Guo, Weixin
Evening Lec 4	TuTh 6:50pm–8:10pm	Bulawa, Andrew

Please answer each question in the space provided. Please write full **solutions**, not just answers. Unless otherwise marked, **answers without justification will get little or no partial credit**. Cross out anything the grader should ignore and circle or box the final answer. Do **NOT** round answers.

No books, notes, or calculators!

Do not open the exam until instructed by proctor!

1. Compute the following limits. Please distinguish between "$\lim f(x) = \infty$", "$\lim f(x) = -\infty$" and "limit does not exist even allowing for infinite values".

   (a) $\lim_{x \to -1} x^2 + x - 1$

   (b) $\lim_{x \to -3} \dfrac{x^2 + 2x - 3}{x + 3}$

   (c) $\lim_{t \to 0} \dfrac{\sqrt{2-t} - \sqrt{2}}{t}$

   (d) $\lim_{x \to 0} x \sin \pi \left(x^2 + \dfrac{1}{x^2} \right)$

   (e) $\lim_{x \to \infty} \dfrac{x^3 + 2x + 1}{x^3 - 2x + 1}$

   (f) $\lim_{x \to \pi/2} \dfrac{\cos x}{2x - \pi}$

2. Compute the derivatives of the following functions

   (a) $f(x) = x^3 - 12x^2 + x + 2\pi$

   (b) $f(x) = (2x + 1) \sin(x)$

   (c) $g(s) = \sqrt{1 + e^{2s}}$

   (d) $h(t) = \frac{1+e^t}{1-e^t}$

   (e) $f(x) = (2x + 2)^{10}$

   (f) $g(x) = x^{(\sin x)}$

3. Let $f(x) = xe^{(-x^2)}$.

   (a) Find asymptotes of $f(x)$ (hint: $f(x) = \frac{x}{e^{(x^2)}}$)
   (b) Compute the derivative of $f(x)$
   (c) On which intervals is $f(x)$ increasing? decreasing?
   (d) Sketch a graph of $f(x)$ using the results of the previous parts and the fact that $f(0) = 0$.

4. Let $f(x) = \frac{1}{\sqrt{1+x}}$. Write the linear approximation for $f(x)$ near $x = 0$ and use it to estimate $f(0.1)$.

5. Let $f(x) = -2x^3 + 6x^2 - 3$.

   (a) Compute f', f''.

   (b) On which intervals is $f(x)$ increasing/decreasing?

   (c) On which intervals is $f(x)$ concave up/down?

   (d) Find all critical points of $f(x)$. Which of them are local maximums? local minimums? neither? Justify your answer.

6. It is known that the polynomial $f(x) = x^3 - x - 1$ has a unique real root. Between which two whole numbers does this root lie? Justify your answer.

7. It is known that for a rectangular beam of fixed length, its strength is proportional to $w \cdot h^2$, where w is the width and h is the height of the beam's cross-section.

   Find the dimensions of the strongest beam that can be cut from a 12" diameter log (thus, the cross-section must be a rectangle with diagonal 12").

8. The curve defined by the equation

$$y^2(y^2 - 4) = x^2(x^2 - 5)$$

   is known as the "devil's curve". Use implicit differentiation to find the equation of the tangent line to the curve at the point $(0; -2)$.