

Math 10A
Final Exam
August 4, 2012

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Version A

Instructions

1. No calculators or other electronic devices are allowed during this exam.
2. You may use one page of notes, but no books or other assistance during this exam.
3. Write your *Name*, *PID*, and *Section* on the front of your Blue Book.
4. Write the *Version* of your exam on the front of your Blue Book.
5. Write your solutions clearly in your Blue Book
 - (a) Carefully indicate the number and letter of each question and question part.
 - (b) Present your answers in the same order they appear in the exam.
 - (c) Start each question on a new page.
6. Read each question carefully, and answer each question completely.
7. Show all of your work; no credit will be given for unsupported answers.

0. (1 point) Carefully read and complete the instructions at the top of this exam sheet.

1. (12 points) Evaluate the following limits. If the limit does not exist, write "limit does not exist". Please justify your answers.

(a) $\lim_{x \rightarrow 4} \frac{x^2 - 16}{x - 4}$

(b) $\lim_{x \rightarrow \infty} \sin(x)$

(c) $\lim_{x \rightarrow 0} \frac{x^4 - 3x + 7}{2x^4 - 6}$

2. (6 points) At the start of August, there are 156 mice living in a field. Their population doubles every month.

(a) Write a formula for their population $P(t)$ as a function of the number of months t since August.

(b) What are the units of $P'(t)$?

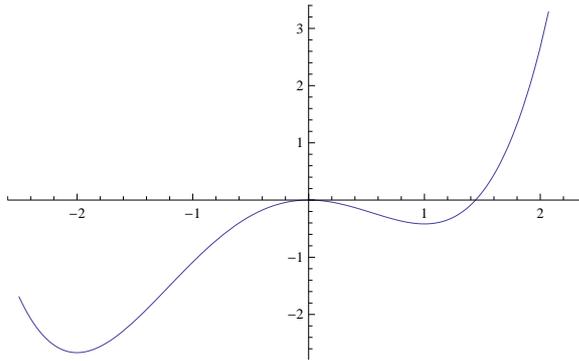
3. (14 points) Let $f(x) = \frac{e^{x-2}}{x^3}$.

(a) Find the average rate of change of $f(x)$ over the interval $[1, 3]$.

(b) Find the equation of the tangent line to $f(x)$ at $x = 2$.

(c) Use part (b) to approximate $f(3)$.

4. (5 points) Consider the graph below of the function $f(x)$.



Sketch the graph of the derivative of $f(x)$. In your sketch, be sure to

- Label x values for which $f'(x) = 0$.
 - Show clearly where $f'(x)$ is positive or negative.
5. (12 points) Calculate the derivatives of the following functions. No need to simplify.
- $\arctan(1 - 3x^2)$
 - $e^{\sin(x)+x}$
 - $\frac{x^3}{9}(2\ln x - 1)$
6. (8 points) Given the equation $\sin(xy) = 2y^2 + 6$, find $\frac{dy}{dx}$ using implicit differentiation.
7. (15 points) Find all critical points of the function $f(x) = x^2e^{-x}$ and classify each critical point as a local maximum, local minimum, or neither.
8. (8 points) Find the global maximum and minimum for the function $f(x) = x^3 - 6x^2$ on the interval $[-1, 2]$.
9. (10 points) You want to make a closed box with a square base (side length x) and height h . What is the volume of the largest box you can make if its surface area is required to be 54 square inches?