MAT131 Fall 2008 Final Exam

Name: ____________________ SB ID number: ____________________

Please circle the number of your recitation.

1. TuTh 12:50 – Physics
Norton

2. MF 2:20 – ESS
Malkoun

3. TuTh 8:20 – ESS
Rogers

4. WF 11:45 – Physics
Flanagan

5. TuTh 11:20 – ESS
Kim

6. MW 10:40 – Physics
Lyubich

7. MW 6:55 – Physics
Dalton

8. MW 3:50 – SB Union
Dalton

9. TuTh 5:20 – ESS
Norton

10. WF 9:35 – Lgt Engr Lab
Flanagan

11. TuTh 3:50 – Physics
Stimpson

12. TuTh 8:20 – Lgt Engr Lab
Nam

13. MF 12:50 – Lgt Engr Lab
Malkoun

14. TuTh 3:50 – Physics
Findley

Problem 1: ________ /35 **Problem 2**: ________ /25 **Problem 3**: ________ /25

Problem 4: ________ /30 **Problem 5**: ________ /20 **Problem 6**: ________ /40

Problem 7: ________ /25 **TOTAL**: ________ /200

Instructions: *Please write your name at the top of every page of the exam.* The exam is closed book, closed notes, calculators are not allowed, and all cellphones and other electronic devices must be turned off for the duration of the exam. You will have approximately 90 minutes for this exam. The point value of each problem is written next to the problem – use your time wisely. Please show all work, unless instructed otherwise. Partial credit will be given only for work shown.

You may use either pencil or ink. If you have a question, need extra paper, need to use the restroom, etc., raise your hand.

Name: ______________________________ **Problem 1**: ______________ /35

Problem 1(35 points) **(a)**(25 points) For the function $y = f(x)$,

$$f(x) = 2x^3 - 6x$$

do all of the following.

(i) Determine whether $f(x)$ is even, odd or neither.

(ii) Determine where the function is increasing and where the function is decreasing.

(iii) Determine where the function is concave up and where the function is concave down.

(iv) Find the x and y coordinates of every local maximum, and find the x and y coordinates of every local minimum.

(v) Find the x and y coordinates of every inflection point.

(vi) On the following page sketch the graph of $f(x)$ labelling every local maximum, local minimum and inflection point.

Show all work.

Name: ______________________________ **Problem 1, continued**

(b)(10 points) Still for the function $y = f(x)$,

$$f(x) = 2x^3 - 6x$$

find the absolute maximum value on the closed interval $[-2, 3]$ and find the absolute minimum value on the closed interval $[-2, 3]$. Show all work and circle your final answers.

Name: ____ **Problem 2**: _________________ /25

Problem 2(25 points) Find the largest area of a right triangle whose hypotenuse has fixed length 1 meter. Although you may use geometric intuition to guess the answer, you must show your calculus work to justify your answer (correct guesses without calculus justification will receive little credit).

Name: ______________________________ **Problem 3**: ______________ /25

Problem 3(25 points) A cube is increasing in volume. At the moment when the volume of the cube equals 8 cubic inches, the surface area is increasing at a rate of 2 square inches per minute. At what rate is the volume of the cube increasing at this moment? Show all work and circle your final answer.

Name: ______________________________ **Problem 4**: ______________ /30

Problem 4(30 points) In each of the following cases, compute the value of the limit. Show all work and circle your final answers.

(a)(5 points)

$$\lim_{x\to 1} \frac{x^2 - x}{x^3 - x}$$

(b)(5 points)

$$\lim_{x\to 0} \frac{\tan(2x)}{\sin(3x)}$$

(c)(10 points)

$$\lim_{x\to\infty}\left(x-\frac{x^3}{x^2+1}\right)$$

(d)(10 points)

$$\lim_{x\to\infty}(x^2+1)^{1/x}$$

Name: ______________________________ **Problem 5**: ______________ /20

Problem 5(20 points) Find the equation of the tangent line to the curve

$$x^2 + y^3 = 5$$

at the point $(2, 1)$.

Name: ____________________ **Problem 6**: __________ /40

Problem 6(40 points) In each of the following cases, evaluate the given integral.

(a)(5 points)

$$\int 7^{2x} dx$$

(b)(5 points)

$$\int_0^1 \sqrt[3]{x^2} - \sqrt{x^3} dx$$

(c)(10 points)

$$\int_{\pi/4}^{\pi/3} \frac{\sin(\theta)}{\cos(\theta)} d\theta$$

(d)(10 points) The inverse function of $\tan(x)$ is often written as $\arctan(x)$.

$$\int_1^{\sqrt{3}} \frac{\arctan(x)}{1+x^2}dx$$

(e)(10 points)

$$\int \frac{\sin(e^{2x})}{e^{-2x}}dx$$

Name: ______________________________________ **Problem 7**: ________________ /25

Problem 7(25 points) Consider the limit,

$$\lim_{n\to\infty} \sum_{i=1}^{n} \frac{n}{n^2 + 2ni + i^2}.$$

(a)(15 points) Find a Riemann integral, also known as a definite integral, such that the limit above is the limit of Riemann sums for this integral. Show all work and circle your integral.

(b)(10 points) Compute the limit by evaluating the integral. Show all work and circle your final answer.