MA 123 — Elementary Calculus Fall 2009
THIRD MIDTERM 11/18/2009

Name: _____ **Sec.:** _____

Do not remove this answer page — you will return the whole exam. You will be allowed two hours to complete this test. No books or notes may be used. You may use a graphing calculator during the exam, but NO calculator with a Computer Algebra System (CAS) or a QWERTY keyboard is permitted. Absolutely no cell phone use during the exam is allowed.

The exam consists of 15 multiple choice questions. Record your answers on this page by filling in the box corresponding to the correct answer. For example, if (b) is correct, you must write

[a] [b] [c] [d] [e]

Do not circle answers on this page, but please do circle the letter of each correct response in the body of the exam. It is your responsibility to make it CLEAR which response has been chosen. You will not get credit unless the correct answer has been marked on both this page and in the body of the exam.

GOOD LUCK!

1. [a] [b] [c] [d] [e]

2. [a] [b] [c] [d] [e]

3. [a] [b] [c] [d] [e]

4. [a] [b] [c] [d] [e]

5. [a] [b] [c] [d] [e]

6. [a] [b] [c] [d] [e]

7. [a] [b] [c] [d] [e]

8. [a] [b] [c] [d] [e]

9. [a] [b] [c] [d] [e]

10. [a] [b] [c] [d] [e]

11. [a] [b] [c] [d] [e]

12. [a] [b] [c] [d] [e]

13. [a] [b] [c] [d] [e]

14. [a] [b] [c] [d] [e]

15. [a] [b] [c] [d] [e]

For grading use:

number of correct problems	**(out of 15)**
Total	**(out of 100 pts)**

Please make sure to list the correct section number on the front page of your exam.
In case you forgot your section number, consult the following table:

Section #	**Instructor**	**Lectures**
001	P. Koester	MWF 8:00 am - 8:50 am, CP 153
002	P. Koester	MWF 12:00 - 12:50 pm, BS 107
003	T. Chapman	TR 8:00 am - 9:15 am, CP 153
004	M. Shaw	MWF 2:00 pm- 2:50 pm, BS 107
005	M. Shaw	MWF 1:00 pm-1:50 pm, BS 107
006-009	D. Leep	MWF 10:00 am - 10:50 am, CB 114
401	D. Little	TR 6:00 pm-7:15 pm, CB 347
402	D. Little	TR 7:30 pm-8:45 pm, CB 347

Multiple Choice Questions

Show all your work on the page where the question appears.
Clearly mark your answer both on the cover page on this exam
and in the corresponding questions that follow.

1. Suppose that the derivative $f'(x) = 1 + 2x^2 + 3x^4$. Find the value of x in the interval $[-5, 7]$ where $f(x)$ takes its minimum.

Possibilities:

(a) $x = -5$
(b) $x = -1$
(c) $x = 0$
(d) $x = 3$
(e) $x = 7$

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2. Find the x-coordinate of the inflection point of the function $f(x) = (2x - 3)e^{-x}$.

Possibilities:

(a) $5/2$
(b) 3
(c) $7/2$
(d) 4
(e) $9/2$

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3. Suppose that the derivative $f'(x) = 2x^3 - 3x^2 - 72x + 5$. Then the graph of $y = f(x)$ is concave upward on the following intervals.

Possibilities:

(a) $(-\infty, -3)$ and $(4, \infty)$
(b) $(-\infty, -4)$ and $(3, \infty)$
(c) $(-3, 4)$
(d) $(-4, 3)$
(e) $(0, \infty)$

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4. Assume that $f(x)$ is a differentiable function for all values of x. Suppose that $f'(x) > 0$ for $x < -6$, $1 < x < 4$, and $10 < x < \infty$. Suppose also that $f'(x) < 0$ for $-6 < x < 1$ and $4 < x < 10$. The local minimum points of $f(x)$ occur at

Possibilities:

(a) $x = 1$ and $x = 4$

(b) $x = -6$ and $x = 10$

(c) $x = -6$, $x = 1$, $x = 4$, and $x = 10$

(d) $x = 1$ and $x = 10$

(e) $x = -6$ and $x = 4$

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5. What is the largest possible product you can form from two non-negative numbers x, y that satisfy the relation $6x + y = 11$.

Possibilities:

(a) $122/24$

(b) $121/24$

(c) 5

(d) $119/24$

(e) $118/24$

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6. Find the area of the largest rectangle with one corner at the origin, the opposite corner in the first quadrant on the graph of the parabola $f(x) = 96 - 2x^2$, and sides parallel to the axes.

Possibilities:

(a) 256

(b) 260

(c) 264

(d) 268

(e) 272

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7. A ladder 20 feet long rests against a vertical wall. If the bottom of the ladder slides away from the wall at a rate of 6 feet/sec, how fast is the top of the ladder sliding down the wall when the bottom of the ladder is 16 feet from the wall? Give your answer in feet per second. (The answer is a positive number because we use the phrase "sliding down")

Possibilities:

(a) 6

(b) 7

(c) 8

(d) 9

(e) 510

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8. A conical salt spreader is spreading salt at a rate of 4 cubic feet per minute. The diameter of the base of the cone is 6 feet and the height of the cone is 8 feet. How fast is the height of the salt in the spreader decreasing when the height of the salt in the spreader (measured from the vertex of the cone upward) is 3 feet? Give your answer in feet per minute. (The answer is a positive number because we use the word "decreasing")

Possibilities:

(a) $64/81\pi$

(b) $96/81\pi$

(c) $128/81\pi$

(d) $256/81\pi$

(e) $512/81\pi$

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9. Estimate the area under the graph of $f(x) = 18 - 4x^2$ on the interval $[0, 2]$ by dividing the interval into four equal parts. Use the left endpoint of each interval as a sample point.

Possibilities:

(a) 25

(b) 26

(c) 27

(d) 28

(e) 29

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10. Suppose that the integral $\int_3^8 2x^2\,dx$ is estimated by the sum $\sum_{k=1}^{40}[A+B(k\Delta x)+C(k\Delta x)^2]\cdot\Delta x$. The terms in the sum equal areas of rectangles obtained by using right endpoints of the subintervals of length Δx as sample points. What is the value of $A + B + 2C$?

Possibilities:

(a) 30
(b) 31
(c) 32
(d) 33
(e) 34

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11. Suppose that the integral $\int_{12}^{28} f(x)\,dx$ is estimated by the sum $\sum_{k=1}^{N} f(12+k\Delta x)\cdot\Delta x$. The terms in the sum equal areas of rectangles obtained by using right endpoints of the subintervals of length Δx as sample points. If $N = 400$ equal subintervals are used, what is the value of Δx?

Possibilities:

(a) 0.01
(b) 0.02
(c) 0.04
(d) 0.05
(e) 0.08

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12. Suppose that the integral $\int_7^{27} f(x)\,dx$ is estimated by the sum $\sum_{k=1}^{N} f(7+k\Delta x)\cdot\Delta x$. The terms in the sum equal areas of rectangles obtained by using right endpoints of the subintervals of length Δx as sample points. If $f(x) = x^2$ and $N = 40$, then find the area of the 6^{th} rectangle.

Possibilities:

(a) 48
(b) 50
(c) 52
(d) 54
(e) 56

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13. Evaluate the sum

$$\sum_{k=5}^{22}(4+3k).$$

Possibilities:

(a) 801

(b) 802

(c) 803

(d) 804

(e) 805

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14. Evaluate the sum

$$30+36+42+48+54+\cdots+270.$$

Possibilities:

(a) 6135

(b) 6140

(c) 6145

(d) 6150

(e) 6155

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15. Evaluate the sum

$$\sum_{k=1}^{12}(2k^2+5k+3).$$

Possibilities:

(a) 1725

(b) 1726

(c) 1727

(d) 1728

(e) 1729

Some Formulas

1. **Summation formulas:**

$$\sum_{k=1}^{n} k = \frac{n(n+1)}{2}$$

$$\sum_{k=1}^{n} k^2 = \frac{n(n+1)(2n+1)}{6}$$

2. **Areas:**

   (a) Triangle $A = \frac{bh}{2}$

   (b) Circle $A = \pi r^2$

   (c) Rectangle $A = lw$

   (d) Trapezoid $A = \frac{b_1 + b_2}{2}\, h$

3. **Volumes:**

   (a) Rectangular Solid $V = lwh$

   (b) Sphere $V = \frac{4}{3}\pi r^3$

   (c) Cylinder $V = \pi r^2 h$

   (d) Cone $V = \frac{1}{3}\pi r^2 h$