MA 123 — Elementary Calculus Spring 2009
THIRD MIDTERM 04/15/2009

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	A. Corso	MWF 12:00 pm-12:50 pm, CB 106
002	M. Shaw	MWF 2:00 pm-2:50 pm, KAS 213
003	T. Chapman	TR 12:30 pm-1:45 pm, CB 118
004	M. Shaw	TR 9:30 am-10:45 am, FB 213
005	M. Shaw	TR 12:30 pm-1:45 pm, CB 217
401	T. Muldoon	TR 6:00 pm-7:15 pm, CB 339
402	T. Muldoon	TR 7:30 pm-8:45 pm, CB 339

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. 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 $f(x) = 6 - 2x^2$, and sides parallel to the axes.

Possibilities:

(a) 3
(b) 4
(c) 5
(d) 6
(e) 8

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2. Let (x_0, y_0) be the point on the line $y = 2x + 1$ that is closest to the point $(12, 0)$. Find the distance between the points (x_0, y_0) and $(12, 0)$.

Possibilities:

(a) $\sqrt{115}$
(b) $\sqrt{120}$
(c) $\sqrt{125}$
(d) $\sqrt{130}$
(e) $\sqrt{135}$

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3. A triangle has a base of length 10 on the x-axis. The height of the triangle is increasing at a rate of 5 units per second. How fast is the area of the triangle increasing (in square units per second) when the area of the triangle equals 18 square units?

Possibilities:

(a) 15
(b) 18
(c) 20
(d) 25
(e) 30

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4. A ladder 13 feet long rests against a vertical wall. If the bottom of the ladder slides away from the wall at a rate of 3 feet per second, how fast is the top of the ladder sliding down the wall (in feet per second) when the bottom of the ladder is 5 feet from the wall?
(**Hint**: Use the Pythagorean Theorem.)

Possibilities:

(a) $5/3$
(b) $5/4$
(c) $3/5$
(d) $4/3$
(e) $13/4$

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5. Evaluate the sum $\sum_{k=3}^{7}(k^2 - 5k)$.

Possibilities:

(a) 2
(b) 4
(c) 6
(d) 8
(e) 10

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6. Evaluate the sum $\sum_{k=1}^{50}(2k^2 + 4k + 5)$.

Possibilities:

(a) 91000
(b) 91100
(c) 91200
(d) 91300
(e) 91400

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7. Evaluate the sum $16 + 20 + 24 + 28 + 32 + 36 + \cdots + 800$.

Possibilities:

(a) 80364

(b) 80368

(c) 80372

(d) 80376

(e) 80380

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8. Estimate the area under the graph of $f(x) = x^2 + 5$ on the interval $[0, 2]$ by dividing the interval into four equal parts. Use the right endpoint of each interval as a sample point.

Possibilities:

(a) 13.75

(b) 14.25

(c) 14.75

(d) 15.25

(e) 15.75

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9. Suppose that the integral $\displaystyle\int_2^{14} f(x)\,dx$ is estimated by the sum $\displaystyle\sum_{k=1}^{N} f(a + k\Delta x) \cdot \Delta x$. The terms in the sum equal areas of rectangles obtained by using right endpoints of the subintervals of length Δx as sample points. If $N = 36$, then what is Δx?

Possibilities:

(a) $1/3$

(b) $.35$

(c) $.40$

(d) $.5$

(e) Cannot be determined

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10. Suppose that the integral $\int_2^{27} f(x)\,dx$ is estimated by the sum $\sum_{k=1}^{N} f(a+k\Delta x)\cdot\Delta x$. The terms in the sum equal areas of rectangles obtained by using right endpoints of the subintervals of length Δx as sample points. If $f(x)=2\sqrt{x}$ and $N=50$, then find the area of the second rectangle.

Possibilities:

(a) $\sqrt{2}$
(b) $\sqrt{2.5}$
(c) $\sqrt{3}$
(d) $\sqrt{2.5}/2$
(e) $\sqrt{3}/2$

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11. Evaluate the limit

$$\lim_{n\to\infty}\frac{1}{n}\sum_{k=1}^{n}\left(k\frac{3}{n}\right)^2.$$

(Use the summation formulas to simply first.)

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

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12. The integral $\int_3^{10} x^3\,dx$ is computed as the limit of the sum $\sum_{k=1}^{n}\frac{A}{n}\left(B+k\frac{A}{n}\right)^3$.
What is $A+B$?
(Determine A and B separately, and then compute $A+B$.)

Possibilities:

(a) 6
(b) 7
(c) 8
(d) 9
(e) 10

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13. The graph of $f(x) = xe^x$ is concave upward on the following interval(s).

Possibilities:

(a) $(-\infty, -2)$

(b) $(-2, \infty)$

(c) $(-\infty, 2)$

(d) $(2, \infty)$

(e) None of the above

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14. Suppose that the derivative of $f(x)$ is given by $f'(x) = x^2 - 6x + 8$. Then the graph of $f(x)$ is concave downward on the following interval(s).

Possibilities:

(a) $(2, 4)$

(b) $(-\infty, 2)$ and $(4, \infty)$

(c) $(-\infty, 3)$

(d) $(3, \infty)$

(e) The graph of $f(x)$ is not concave downward on any interval.

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15. Evaluate the integral $\displaystyle\int_0^2 (6 - 2x)\, dx$.
(Graph the function and interpret the integral as an area.)

Possibilities:

(a) 6

(b) 6.5

(c) 7

(d) 7.5

(e) 8

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 $V = \frac{1}{3}\pi r^2 h$