MA 123 — Elementary Calculus Spring 2009
FINAL EXAM 05/06/2009

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. Let $F(x) = \int_1^x (t^3 - 4t^2 + t + 2)\, dt$. Find $F'(4)$.

Possibilities:

(a) 4
(b) 5
(c) 6
(d) 7
(e) 8

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2. Use the Fundamental Theorem of Calculus to compute $\int_4^9 \frac{1}{\sqrt{t}}\, dt$.

Possibilities:

(a) 1
(b) 2
(c) 3
(d) 4
(e) 5

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3. Suppose that a particle moves in a straight line and its velocity in ft/sec after t seconds is given by $v(t) = 8t + 2$. How many feet has the object traveled in 6 seconds?

Possibilities:

(a) 154
(b) 156
(c) 158
(d) 160
(e) 162

---

4. The number of bacteria in a sample t hours from now is given by $Q(t) = Q_0 e^{kt}$. If $Q(0) = 15000$ and $Q'(0) = 6000$, then how many bacteria are there in 5 hours?

Possibilities:

(a) $15000e$

(b) $15000e^2$

(c) $15000e^3$

(d) $15000e^4$

(e) $15000e^5$

---

5. Compute $\lim_{n\to\infty} \dfrac{10n^2 - 3n + 7}{(2n+6)^2}$.

Possibilities:

(a) 1

(b) 1.5

(c) 2

(d) 2.5

(e) 3

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6. Compute $\dfrac{f(2+h) - f(2)}{h}$ where $f(x) = 2x^2 - x + 3$.

Possibilities:

(a) 7

(b) $7 - h$

(c) $7 + h$

(d) $7 - 2h$

(e) $7 + 2h$

---

7. Compute $f'(1)$ where $f(x) = 2\sqrt{3x^2 - 4x + 5}$.

Possibilities:

(a) $1/2$

(b) $-1/2$

(c) 1

(d) $3/2$

(e) $-3/2$

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8. Estimate the area under the graph of $f(x) = x^2 + 4$ 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) 11.75

(b) 12.25

(c) 12.75

(d) 13.25

(e) 13.75

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9. Compute $f'(1)$ where $f(x) = (1/2)e^{-2x} + \ln(x^2 + 1)$. (Be sure to correctly use the chain rule on each term when taking the derivative.)

Possibilities:

(a) $e^{-2} + 1$

(b) $-2e^{-2} + 1/2$

(c) $-2e^{-2} + 1$

(d) $e^{-2} + 1/2$

(e) $-e^{-2} + 1$

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10. Find the equation of the tangent line to the graph of $f(x) = 2x^3 + x^2 - 7x + 8$ at $x = 2$.

Possibilities:

(a) $y = 21x - 28$

(b) $y = 22x - 30$

(c) $y = 23x - 30$

(d) $y = 21x - 30$

(e) $y = 23x - 32$

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11. Compute $\lim_{x \to 4^+} f(x)$ where

$$f(x) = \begin{cases} -2x + 11 & \text{if } x < 4 \\ 2x^2 + 3 & \text{if } x \geq 4. \end{cases}$$

(a) 1

(b) 2

(c) 3

(d) 22

(e) 35

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12. 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 line $f(x) = 12 - 2x$, and sides parallel to the axes.

Possibilities:

(a) 10

(b) 12

(c) 14

(d) 16

(e) 18

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13. The graph of $f(x) = x^3 + 6x^2 + 9x - 7$ 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 decreasing on the following interval(s).

Possibilities:

(a) $(2, 4)$

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

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

(d) $(3, \infty)$

(e) $(0, \infty)$

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15. Compute $f'(1)$ if $f(x) = \dfrac{2 \ln x}{x^2 + 1}$. (Be sure to apply the quotient rule correctly.)

Possibilities:

(a) e

(b) 2

(c) 1

(d) $.5$

(e) $1/e$

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