MA 123 — Elementary Calculus FALL 2008
FINAL EXAM 12/17/2008

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 8:00am-8:50am, CP 153
002	J. Robbins	MWF 12:00pm-12:50pm, CP 153
003	T. Chapman	TR 8:00am-9:15am, BS 116
004	M. Anton	MWF 12:00pm-12:50pm, BS 116
005	D. Leep	MWF 3:00pm-3:50pm, CP 153
401	P. Cooley	TR 6:00pm-7:15pm, CB 347
402	P. Cooley	TR 7:30pm-8:45pm, 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. Find the equation of the tangent line to the graph of $y = 2x^3 - 3x^2 + 4x + 2$ at $x = 1$.

Possibilities:

(a) $y = x + 1$

(b) $y = 5x - 4$

(c) $y = 5x - 3$

(d) $y = 4x - 2$

(e) $y = 4x + 1$

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2. An expanding rectangle has its length always equal to three times its width. The area is increasing at a rate of 42 square feet per minute. At what rate (in feet per minute) is the width increasing when the width is 4 feet?

Possibilities:

(a) 1.50

(b) 1.75

(c) 2.00

(d) 2.25

(e) 2.75

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3. Find the interval(s) where $f(x) = -x^3 + 18x^2 - 105x + 4$ is increasing. (Note that the coefficient of x^3 is -1, so compute carefully.)

Possibilities:

(a) $(-\infty, 5)$ and $(7, \infty)$

(b) $(5, 7)$

(c) $(-\infty, -5)$ and $(7, \infty)$

(d) $(-5, 7)$

(e) $(-7, 5)$

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4. Find the interval(s) where the graph of $f(x) = x^4 + 18x^3 + 120x^2 + 10x + 50$ is concave downward.

Possibilities:

(a) $(-5, 4)$

(b) $(4, 5)$

(c) $(-\infty, 4)$ and $(5, \infty)$

(d) $(-5, -4)$

(e) $(-\infty, -5)$ and $(-4, \infty)$

---

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

Possibilities:

(a) $1/3$

(b) $2/3$

(c) 1

(d) $4/3$

(e) $5/3$

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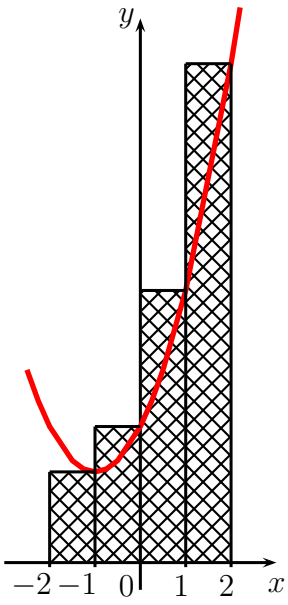
6. Estimate the area under the graph of $y = x^2 + 2x + 3$ for x between -2 and 2. Use a partition that consists of 4 equal subintervals of $[-2, 2]$ and use the right endpoint of each subinterval as a sample point.



Possibilities:

(a) 22

(b) 23

(c) 24

(d) 25

(e) 26

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7. Find $f'(-1)$ where $f(x) = \dfrac{x}{e^x}$.

Possibilities:

(a) e^{-2}

(b) $-e^{-2}$

(c) $2e$

(d) $-2e$

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

---

8. Compute $\dfrac{f(2+h)-f(2)}{h}$ where $f(x) = 3x^2 + 1$.

Possibilities:

(a) 12

(b) $12 + h$

(c) $12 + 2h$

(d) $12 + 3h$

(e) None of the above

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9. A rectangular field as shown below is constructed using 2400 feet of fencing. (There are six parallel fences in the vertical direction.) What is the maximum possible area in square feet of the rectangular field?

Possibilities:

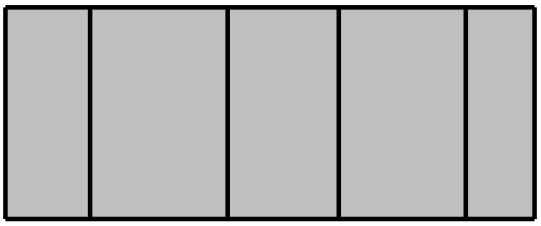
(a) $100,000$

(b) $110,000$

(c) $120,000$

(d) $130,000$

(e) None of the above



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10. Use the Fundamental Theorem of Calculus to compute $\int_1^6 \sqrt{x+3}\,dx$.

Possibilities:

(a) $37/3$
(b) $38/3$
(c) $39/3$
(d) $40/3$
(e) $41/3$

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11. Compute $\int_{-4}^{8} |x|\,dx$. (Suggestion: Draw a graph.)

Possibilities:

(a) 40
(b) 41
(c) 42
(d) 43
(e) 44

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12. Let $F(x) = \int_1^x (2t^2 - 3t + 1)\ dt$. Find $F'(3)$.

Possibilities:

(a) 7
(b) 8
(c) 9
(d) 10
(e) 11

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13. Compute $\lim_{x \to 3^+} f(x) = \begin{cases} -5x + 7 & \text{if } x < 3 \\ x^2 - 16 & \text{if } x \geq 3. \end{cases}$

Possibilities:

(a) The limit does not exist.

(b) 6

(c) -6

(d) -7

(e) -8

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14. Compute $\lim_{n \to \infty} \dfrac{7n^2 - 7n + 5}{(3n + 4)^2}$.

Possibilities:

(a) $5/3$

(b) $5/9$

(c) $7/9$

(d) 1

(e) The limit does not exist.

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15. The number of bacteria in a sample t hours from now is given by $Q(t) = Q_0 e^{kt}$. If $Q(0) = 10,000$ and $Q'(0) = 20,000$, how many bacteria are there in 4 hours?

Possibilities:

(a) $10,000\, e^6$

(b) $10,000\, e^8$

(c) $10,000\, e^{10}$

(d) $10,000\, e^{12}$

(e) $10,000\, e^{16}$

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 $\quad A = \dfrac{bh}{2}$

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

   (c) Rectangle $\quad A = lw$

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

3. **Volumes:**

   (a) Rectangular Solid $\quad V = lwh$

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

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

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

4. **Definition of the definite integral:**

$$\int_a^b f(x)\,dx = \lim_{n\to\infty} \sum_{k=1}^{n} f(a + k\Delta x) \cdot \Delta x, \quad \text{where} \quad \Delta x = \frac{b-a}{n}$$