**MA 123 — Elem. Calculus** SPRING 2007
3rd MIDTERM 11 April 2007

**Name:** _____ **Sec.:** _____

Do not remove this answer page — you will turn in the entire exam. You have two hours to do this exam. 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 (a) 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:**

| | |
|---|---|
| **Total** | |
| | **(out of 100 pts)** |

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

| **Section #** | **Instructor** | **Lectures** |
|---|---|---|
| 001 | J. Robbins | MWF 12:00pm-12:50pm, BS 107 |
| 002 | P. Perry | MWF 2:00pm-2:50pm, CB 118 |
| 003 | J. Robbins | TR 3:30pm-4:45pm, CB 337 |
| 401 | S. Speakman | MW 7:30pm-8:45pm, CB 339 |
| 402 | N. Kirby | TR 6:00pm-7:15pm, 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.** Estimate the area under the graph of $f(x) = x^2 + 2$ 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) $11.75$ square units

(b) $5.71875$ square units

(c) $9.5$ square units

(d) $5.75$ square units

(e) $7.75$ square units

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**2.** A sandbox with square base is being filled with sand at the rate of 9 cubic feet per minute. The sandbox is 9 feet long and 9 five wide. How fast is the level of sand in the sandbox rising?

**Possibilities:**

(a) $3/5$ feet per minute

(b) $2/9$ feet per minute

(c) $2/5$ feet per minute

(d) $1/9$ feet per minute

(e) $1/5$ feet per minute

**3.** The formula for the sum of the sixth power of $k$ is

$$\sum_{k=1}^{n} k^6 = \frac{An^7 + 21n^6 - 7n^3 + 21n^5 + n}{42}.$$

what is the value of $A$?

**Possibilities:**

(a) 7
(b) 21
(c) 15
(d) 6
(e) 3

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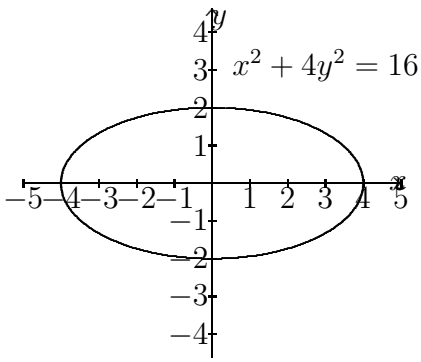
**4.** Suppose you want to find the shortest distance between the point $(1, 0)$ on the $x$-axis and a point on the ellipse $x^2 + 4y^2 = 16$. Which problem do you need to solve?




**Possibilities:**

(a) Minimize $D = \sqrt{(x-1)^2 + \left(\sqrt{\frac{16-x^2}{4}}\right)^2}$ where $-4 \le x \le 4$.

(b) Minimize $D = \sqrt{(x)^2 + \left(\sqrt{\frac{16-x^2}{4}} - 1\right)^2}$ where $-4 \le x \le 4$.

(c) Minimize $D = \sqrt{(x)^2 + \left(\sqrt{16-4x^2} - 1\right)^2}$ where $-2 \le x \le 2$.

(d) Minimize $D = \sqrt{(x-1)^2 + \left(\sqrt{16-4x^2}\right)^2}$ where $-2 \le x \le 2$.

(e) None of the above.

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**5.** Evaluate the limit as $n$ tends to infinity.

$$\lim_{n\to\infty} \sum_{k=1}^{n} \left( \frac{4k}{n^2} + \frac{3}{n} \right)$$

**Possibilities:**

(a) 6
(b) 5
(c) 3
(d) 4
(e) 7

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**6.** The integral

$$\int_1^6 x^3 \, dx$$

is computed as

$$\lim_{n\to\infty} \sum_{k=1}^{n} \frac{A}{n} \left( 1 + k \cdot \frac{A}{n} \right)^3$$

What is the value of $A$?

**Possibilities:**

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

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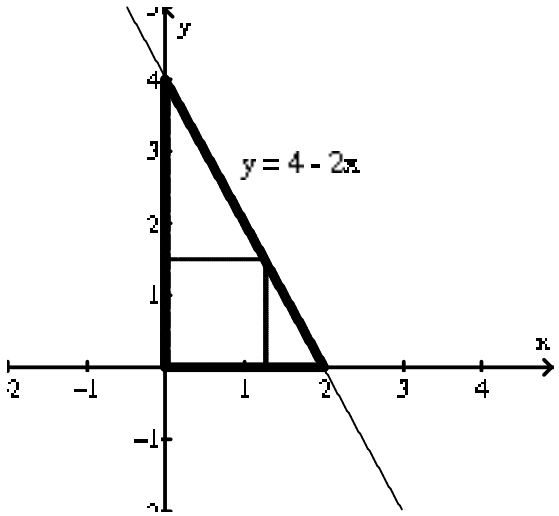
**7.** Let $T$ be the triangle enclosed by the $x$-axis, the $y$-axis, and the line $y = 4 - 2x$. (See the graph below.) Find the area of the largest rectangle with sides parallel to the coordinate axes that can be inscribed in $T$.




**Possibilities:**

(a) 2 square units
(b) 8 square units
(c) 4 square units
(d) 6 square units
(e) 3 square units

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**8.** Suppose you estimate the integral

$$\int_2^6 f(x)\,dx$$

by evaluating the sum

$$\sum_{k=1}^{n} (\Delta x) f(2 + k\Delta x).$$

If you use $\Delta x = .2$, what value should you use for $n$?

**Possibilities:**

(a) 25
(b) 10
(c) 30
(d) 20
(e) 15

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**9.** Evaluate the limit as $n$ tends to infinity.

$$\lim_{n\to\infty} \frac{8n^3+7n+5}{2n^3+8n^2}$$

**Possibilities:**

(a) 2
(b) 3
(c) 4
(d) 6
(e) 8

**10.** The limit

$$\lim_{n\to\infty} \sum_{k=1}^{n} \frac{15}{n}\left(2+\frac{3k}{n}\right)^4$$

is obtained by applying the definition of the integral to

$$\int_2^5 f(x)\,dx.$$

What is $f(x)$?

**Possibilities:**

(a) $f(x) = 3(2+x)^4$
(b) $f(x) = \frac{3}{x}\left(2+\frac{3}{x}\right)^4$
(c) $f(x) = 2x^4$
(d) $f(x) = 5x^4$
(e) $f(x) = 4x^4$

**11.** Evaluate the sum

$$\sum_{k=2}^{4}(5k+1)$$

**Possibilities:**

(a) $112$

(b) $66$

(c) $29$

(d) $64$

(e) $48$

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**12.** Suppose $y = \dfrac{32}{x^2}$. What is the minimum sum of $x$ and $y$ if $x$ and $y$ are both positive?

**Possibilities:**

(a) 6

(b) 9

(c) 3

(d) 2

(e) 4

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**13.** Evaluate

$$\int_0^6 \sqrt{6^2 - x^2}\, dx$$

**HINT:** Think of the definite integral as an area.

**Possibilities:**

(a) $4\pi$

(b) $16\pi$

(c) $9\pi$

(d) $6\pi$

(e) $25\pi$

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**14.** Evaluate the sum

$$3 + 6 + 9 + 12 + \cdots + 30$$

**Possibilities:**

(a) 55
(b) 550
(c) 110
(d) 275
(e) 165

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**15.** Two trains leave a station at the same time. One travels north on a track at 30 miles per hour. The second travels east on a track at 40 miles per hour. How fast are the trains travelling away from each other in miles per hour when the northbound train is 60 miles from the station?

**Possibilities:**

(a) $60$ miles per hour
(b) $40$ miles per hour
(c) $50$ miles per hour
(d) $130$ miles per hour
(e) $50\sqrt{5}$ miles per hour