MA123 Exam 3

15 November 2006

NAME ________________________________ Section ___________

Problem	Answer
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*

Instructions. Circle your answer in ink on the page containing the problem and on the cover sheet. After the exam begins, you may not ask a question about the exam. Be sure you have all pages (containing 15 problems) before you begin. You will find a table of logarithms at the end of the exam that you need for Problem 6.

NAME____

1. A rectangle in the first quadrant has one corner at $(0, 0)$ and the opposite corner on the curve $y = 2 - x^2$. What is the largest possible area of this rectangle?

   (a) $\frac{2}{3}\sqrt{\frac{8}{3}}$

   (b) $\frac{8}{3}\sqrt{\frac{2}{3}}$

   (c) $\frac{8}{3}\sqrt{\frac{4}{3}}$

   (d) $\frac{4}{3}\sqrt{\frac{2}{3}}$

   (e) $\frac{2}{3}\sqrt{\frac{4}{3}}$

2. Find the length of the shortest line segment that connects the point $(4, 0)$ in the (x, y) plane to the line $y = 2x$.

   (a) $\frac{8}{5}\sqrt{5}$

   (b) $\frac{10}{7}\sqrt{7}$

   (c) $\frac{16}{17}\sqrt{17}$

   (d) $\frac{12}{15}\sqrt{15}$

   (e) $\frac{18}{19}\sqrt{19}$

3. A triangle has a base of length 5 on the x axis. The altitude of the triangle is increasing at a rate of 3 units per second. How fast is the area of the triangle increasing when the area of the triangle equals 14 square units?

   (a) $\frac{45}{2}$

   (b) $\frac{40}{2}$

   (c) $\frac{35}{2}$

   (d) $\frac{25}{2}$

   (e) $\frac{15}{2}$

4. At 12:00 noon a ship sailing due East at 20 miles per hour passes directly North of a lighthouse located on the coast exactly one mile South of the ship. How fast is the distance between the ship and the lighthouse increasing at 1:00 pm?

(a) $\frac{100}{\sqrt{101}}$
(b) $\frac{200}{\sqrt{201}}$
(c) $\frac{300}{\sqrt{301}}$
(d) $\frac{400}{\sqrt{401}}$
(e) $\frac{500}{\sqrt{501}}$

5. Water is evaporating at a rate of .5 cubic feet per day from a cylindrical tank. The circular base of the tank (parallel to the ground) has a radius of 4 feet. How fast is the depth of the water decreasing when the tank is half full (measured in feet per day)?

(a) $\frac{1}{64\pi}$
(b) $\frac{1}{32\pi}$
(c) $\frac{1}{16\pi}$
(d) $\frac{1}{8\pi}$
(e) $\frac{1}{4\pi}$

6. Use the table of logarithms (last page of exam) to estimate the integral

$$\int_{2}^{2.25} \log(x)dx$$

Use five (5) subintervals and the left endpoint of each subinterval to determine the height of the rectangles used in the approximation. The approximate value of the integral is

(a) .131
(b) .128
(c) .113
(d) .104
(e) .08

7. Suppose you estimate the integral

$$\int_{10}^{20} x^2 dx$$

by the sum of the areas of 50 rectangles of equal base length. Use the left endpoint of each base to determine the height. What is the area of the first (leftmost) rectangle?

(a) 20
(b) 30
(c) 40
(d) 50
(e) 60

8. Write the sum $7 + 9 + 11 + 13 + 15 + 17 + 19 + 21$ in summation notation as

$$\sum_{k=2}^{N} (A + 2k)$$

What are the values of A and N?

(a) $A = 1$, $N = 10$
(b) $A = 2$, $N = 10$
(c) $A = 1$, $N = 9$
(d) $A = 2$, $N = 9$
(e) $A = 3$, $N = 9$

9. Evaluate the sum $10 + 15 + 20 + 25 + 30 + \cdots + 1000$. Note that each term is a multiple of 5. The sum equals

(a) 100460
(b) 100485
(c) 100495
(d) 100500
(e) 100525

10. Given the summation formula below, determine the correct value of A.

$$\sum_{k=1}^{n} k^5 = \frac{n^2(2n^2+2n-A)(n+1)^2}{12}$$

(a) -1
(b) 0
(c) 1
(d) 2
(e) 3

11. Evaluate the limit

$$\lim_{n\to\infty} \frac{n^2+n+1}{(3n+2)^2}$$

(a) 1/12
(b) 1/11
(c) 1/10
(d) 1/9
(e) 1/8

12. Evaluate the limit

$$\lim_{n\to\infty} \frac{1}{n}\sum_{k=1}^{n}(5+\frac{k}{n})$$

(a) $\frac{3}{2}$
(b) $\frac{5}{2}$
(c) $\frac{7}{2}$
(d) $\frac{9}{2}$
(e) $\frac{11}{2}$

13. Find the area of the triangle of minimum area with base equal to the unit interval $0 \le x \le 1$ on the x axis and with opposite vertex lying on the curve $y = 8x + \frac{4}{x^2}$ with $x > 0$.

(a) 1

(b) 2

(c) 3

(d) 4

(e) 6

14. You make two estimates using rectangles for the integral

$$\int_0^1 (1 - x^2)dx$$

The first estimate uses 50 equal length subintervals and the left endpoint of each subinterval. The second estimate uses 50 equal length subintervals and the right endpoint of each subinterval. What is the difference between the two estimates (first minus second)?

(a) $\frac{8}{50}$

(b) $\frac{6}{50}$

(c) $\frac{4}{50}$

(d) $\frac{2}{50}$

(e) $\frac{1}{50}$

15. Suppose the cost, $C(q)$, of stocking a quantity q of a product equals

$$C(q) = \frac{100}{q} + q$$

Which positive value of q gives the minimum cost?

(a) 10

(b) 15

(c) 20

(d) 25

(e) 30

x	$logx$	x	$logx$
2.00	.301	2.50	.398
2.05	.312	2.55	.407
2.10	.322	2.60	.415
2.15	.332	2.65	.423
2.20	.342	2.70	.431
2.25	.352	2.75	.439
2.30	.361	2.80	.447
2.35	.371	2.85	.454
2.40	.382	2.90	.462
2.45	.389	2.95	.470

Geometric Formulas

1. Areas
   - (a) Triangle $A = \frac{bh}{2}$
   - (b) Circle $A = \pi r^2$
   - (c) Rectangle $A = lw$
   - (d) Trapazoid $A = \frac{b_1+b_2}{2}h$
2. Volumes
   - (a) Rectangular Solid $V = lwh$
   - (b) Sphere $V = \frac{4}{3}\pi r^3$
   - (c) Cylinder $V = Bh$
   - (d) Cone $V = \frac{1}{3}Bh$