MA 123 — Elem. Calculus Fall 2011
EXAM 3 11/16/2011

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 multiple choice questions. Record your answers on this page. For each multiple choice question, you will need to fill 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 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]

16. [a] [b] [c] [d] [e]

17. [a] [b] [c] [d] [e]

18. [a] [b] [c] [d] [e]

19. [a] [b] [c] [d] [e]

20. [a] [b] [c] [d] [e]

For grading use:

Number Correct	
	(out of 20 problems)

Total	
	(out of 100 points)

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. Your section number is determined by your recitation time and location.

Section #	**Instructor**	**Lectures**
001	L. Graham	T 8:00 am - 9:15 am, CB 243
002	X. Kong	T 9:30 am - 10:45 am, CP 208
003	X. Kong	T 11:00 am - 12:15 pm, CB 219
004	L. Graham	T 12:30 pm - 1:45 pm, DH 135
005	X. Kong	T 2:00 pm - 3:15 pm, DH 353
006	L. Graham	T 3:30 pm - 4:45 pm, CB 341
007	T. Kyriopoulos	R 8:00 am - 9:15 am, CB 243
008	N. Armenoff	R 9:30 am - 10:45 am, DH 323
009	N. Armenoff	R 11:00 am - 12:15 pm, L 213
010	T. Kyriopoulos	R 12:30 pm - 1:45 pm, CB 247
011	N. Armenoff	R 2:00 pm - 3:15 pm, DH 353
012	T. Kyriopoulos	R 3:30 pm - 4:45 pm, CB 341
013	C. Taylor	T 8:00 am - 9:15 am, CB 241
014	C. Taylor	T 9:30 am - 10:45 am, CB 338
015	J. Jung	T 11:00 am - 12:15 pm, CB 347
016	C. Taylor	T 12:30 pm - 1:45 pm, OHR 226
017	J. Jung	T 2:00 pm - 3:15 pm, CB 233
018	J. Jung	T 3:30 pm - 4:45 pm, CB 303
019	T. Brewer	R 8:00 am - 9:15 am, CB 341
020	R. May	R 9:30 am - 10:45 am, CP 208
021	T. Brewer	R 11:00 am - 12:15 pm, CB 219
022	T. Brewer	R 12:30 pm - 1:45 pm, DH 135
023	R. May	R 2:00 pm - 3:15 pm, CB 233
024	R. May	R 3:30 pm - 4:45 pm, CB 214

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.

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1. Suppose $f(x) = x\,e^{10x}$. Find the largest interval on which $f(x)$ is increasing.

   Possibilities:

   (a) $(-\infty, 1/10)$
   (b) $f(x)$ is increasing everywhere.
   (c) $(1/10, \infty)$
   (d) $(-1/10, \infty)$
   (e) $(-\infty, -1/10)$

---

2. Suppose the derivative of $g(t)$ is $g'(t) = (t-7)\,(t-3)\,(t+2)$. Determine the largest interval(s) on which $g(t)$ is increasing.

   Possibilities:

   (a) $(-2, 7)$
   (b) $(-\infty, -2)$ and $(7, \infty)$
   (c) $(-2, 3)$ and $(7, \infty)$
   (d) $(-\infty, -2)$ and $(3, 7)$
   (e) $(7, \infty)$

---

3. Suppose the derivative of $g(t)$ is $g'(t) = (t-3)\,(t-2)\,(t-8)$. $g(t)$ has a local maximum at $t = 3$ because

   Possibilities:

   (a) $g(t) > 0$ to the immediate left of $t = 3$ and $g(t) < 0$ to the immediate right of $t = 3$
   (b) $g'(3) = 0$
   (c) $g'(t) < 0$ to the immediate left of $t = 3$ and $g'(t) > 0$ to the immediate right of $t = 3$
   (d) $g(t) < 0$ to the immediate left of $t = 3$ and $g(t) > 0$ to the immediate right of $t = 3$
   (e) $g'(t) > 0$ to the immediate left of $t = 3$ and $g'(t) < 0$ to the immediate right of $t = 3$

---

4. Suppose $f'(x) = -96x + 2x^3 + 9$. Find the largest interval(s) so that $f(x)$ is concave down.

Possibilities:

(a) $(-4, 4)$
(b) $(0, \infty)$
(c) $(-\infty, 0)$
(d) $(4, \infty)$
(e) $(-4, \infty)$

---

5. Suppose $f(x) = (x + 13)\ln(x + 5)$. Find the x-coordinate of the inflection point of $f(x)$
HINT: $f'(x) = \ln(x + 5) + \dfrac{x + 13}{x + 5}$ and $f''(x) = \dfrac{x - 3}{(x + 5)^2}$

Possibilities:

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

---

6. Let $f(x) = x^2 + 32\ln(x)$ for $x > 0$. Find the largest interval on which $f(x)$ is concave up.

Possibilities:

(a) $(0, 4)$
(b) $f(x)$ is never concave up.
(c) $(4, \infty)$
(d) $(16, \infty)$
(e) $(0, 16)$

---

7. Two positive real numbers, x and y, satisfy $x + y = 15$. What is the maximum value of the expression x^2y?

Possibilities:

(a) 497

(b) 498

(c) 499

(d) 500

(e) 501

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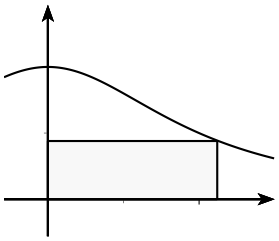
8. Find area of the largest rectangle with one corner at the origin, the opposite corner in the first quadrant on the graph of the curve $f(x) = 1/(x^2 + 4)$. (See the graph, but the graph is not to scale.)



Possibilities:

(a) $1/4$

(b) $3/8$

(c) $1/2$

(d) $5/8$

(e) $3/4$

---

9. The area of a circle is increasing at a rate of 12 square inches per minute. Determine the rate at which the radius of the circle is increasing when the radius of the circle is 2

Possibilities:

(a) $\frac{1}{\pi}$ inches per minute

(b) $\frac{2}{\pi}$ inches per minute

(c) $\frac{3}{\pi}$ inches per minute

(d) $\frac{4}{\pi}$ inches per minute

(e) $\frac{5}{\pi}$ inches per minute

---

10. A ladder of length 10 feet rests against a wall. The bottom of the ladder is being pulled away from the wall at a rate of 2 feet per second. How fast is the top of the ladder sliding down the wall when the bottom of the ladder is 6 feet from the wall? (Just give the numeric value of the answer. Do not worry about the plus or minus sign.)

Possibilities:

(a) $3/2$ feet per second
(b) 2 feet per second
(c) $5/2$ feet per second
(d) 3 feet per second
(e) $7/2$ feet per second

---

11. The price of a share of stock is increasing at a rate of 16 dollars per share per year. An investor is buying stock at a rate of 24 shares per year. How fast is the value of the investor's stock growing when the price of the stock is 53 dollars per share and the investor owns 50 shares of the stock? (Hint: Write down an expression for the total value, V, of the stock owned by the investor.)

Possibilities:

(a) $\$384$ per year.
(b) $\$2048$ per year.
(c) $\$800$ per year.
(d) $\$2650$ per year.
(e) $\$2072$ per year.

---

12. Estimate the area under the graph of $f(x) = 5x^2$ for x between 0 and 6. Use a partition that consists of 3 equal subintervals of $[0, 6]$ and use the left endpoint of each subinterval as the sample point.

Possibilities:

(a) 200
(b) 135
(c) 1080
(d) 560
(e) 675

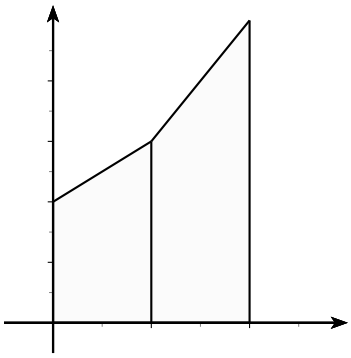
---

13. Suppose you are given the data points for a function $f(x)$:

x	0	1	2
$f(x)$	18	23	24

If $f(x)$ is a linear function on each interval between the given points, find

$$\int_0^2 f(x)\,dx$$

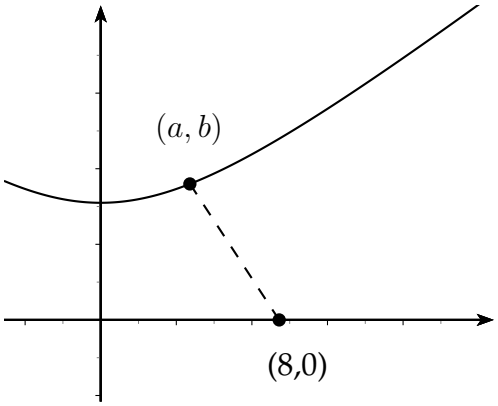


(Not drawn to scale)

Possibilities:

(a) 44
(b) 65
(c) 88
(d) 21
(e) 41

14. Let (a, b) be the point on the hyperbola $y^2 - x^2 = 3$ in the first quadrant that is closest to the point $(8, 0)$. Determine a. (HINT: a and b satisfy $b = \sqrt{3 + a^2}$)



Possibilities:

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

15. Suppose that the integral $\int_{11}^{51} f(x)\ dx$ is estimated by the sum $\sum_{k=1}^{N} f(11 + k\,\Delta x) \cdot \Delta x$. The terms in the sum equal areas of rectangles obtained using right endpoints of the subintervals of length Δx as sample points. If $N = 800$ equal subintervals are used, what is the value of Δx ?

Possibilities:

(a) $\Delta x = 0.03$

(b) $\Delta x = 0.04$

(c) $\Delta x = 0.05$

(d) $\Delta x = 0.06$

(e) $\Delta x = 0.07$

---

16. Suppose that the integral $\int_{9}^{41} x^3\ dx$ is estimated by the sum $\sum_{k=1}^{N} (9 + k\,\Delta x)^3 \cdot \Delta x$. The terms in the sum equal areas of rectangles obtained using right endpoints of the subintervals of length Δx as sample points. If $N = 64$ equal subintervals are used, what is area of the second rectangle?

Possibilities:

(a) 500

(b) $6859/16$

(c) 1000

(d) $6859/8$

(e) $729/2$

---

17. Suppose $f(x)$ is the greatest integer function. Find

$$\int_{4}^{8} f(x)dx$$

Possibilities:

(a) 12

(b) 4

(c) 32

(d) 22

(e) 8

---

18. Evaluate the sum

$$\sum_{k=1}^{42} \left(k^2 + k\right)$$

Possibilities:

(a) 26478
(b) 26488
(c) 26498
(d) 26508
(e) 26518

---

19. Evaluate the sum

$$\sum_{k=5}^{7} \left(4\,k^2 + k\right)$$

Possibilities:

(a) 458
(b) 459
(c) 460
(d) 461
(e) 462

---

20. Evaluate the sum

$$35 + 40 + 45 + 50 + \ldots + 205 + 210$$

Possibilities:

(a) 4410
(b) 4515
(c) 4440
(d) 4375
(e) 882

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

4. **Distance:**

   (a) Distance between (x_1, y_1) and (x_2, y_2)

$$D = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$