MA 123 — Elem. Calculus Fall 2010
EXAM 4 12/15/2010

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. If you are enrolled in a lecture with recitation, then your section number is determined by your recitation time and location.

Section #	Instructor	Lectures
001	T. Chapman	MWF 8:00 am - 8:50 am, CB 118
002	D. Leep	MWF 12:00 pm - 12:50 pm, KAS 213
003	M. Shaw	TR 8:00 am - 9:15 am, CP 155
004	J. Schmidt	TR 12:30 am- 1:45 am, CP 155
005	M. Music	T 3:30 pm - 4:45 pm, CP 345
006	M. Music	R 3:30 pm - 4:45 pm, CP 208
007	W. Robinson	T 3:30 pm - 4:45 pm, CP 208
008	W. Robinson	R 3:30 pm - 4:45 pm, CB 204
009	M. Music	T 12:30 pm - 1:45 pm, NURS 214
010	W. Robinson	R 12:30 pm - 1:45 pm, NURS 504
011	S. Taylor	T 9:30 am - 10:45 am, BE 248
012	S. Taylor	R 9:30 am - 10:45 am, CB 214
013	B. Fox	T 9:30 am - 10:45 am, MMRB 243
014	B. Fox	T 9:30 am - 10:45 am, FB B3
015	C. Taylor	T 11:00 am - 12:15 pm, CB 347
016	B. Fox	T 11:00 am - 12:15 pm, CB 243
017	C. Taylor	T 2:00 pm - 3:15 pm, NURS 511
018	C. Taylor	R 2:00 pm - 3:15 pm, DH 323
019	G. Tiser	T 2:00 pm - 3:15 pm, CB 213
020	S. Taylor	R 2:00 pm - 3:15 pm, FB B8
021	G. Tiser	T 12:30 pm - 1:45 pm, FPAT 255
022	G. Tiser	R 12:30 pm - 1:45 pm, DH 323
401	S. Foege	TR 6:00 pm-7:15 pm, CB 347
402	S. Foege	TR 7:30 pm-8:45 pm, 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. Let $y = (2x^2 + 14)^{3/2}$. Find the equation of the tangent line at $x = 1$.

Possibilities:

(a) $y = 20x + 44$
(b) $y = 21x + 43$
(c) $y = 22x + 42$
(d) $y = 23x + 41$
(e) $y = 24x + 40$

2. Let $f(x) = 6x^2 + 52x - 2$. For what value of x is the slope of the tangent line to the graph of $y = f(x)$ at x equal to 4?

Possibilities:

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

3. The number of a bacteria in a culture doubles every 15 hours. How many hours will it take before 7 times the original amount is present?

Possibilities:

(a) $15/7$
(b) $15 \ln(2)/\ln(7)$
(c) $15 \ln(7)/\ln(2)$
(d) $105/2$
(e) $15/2$

4. Evaluate the limit as n tends to infinity. Note that you will have to use the summation formulas to first simplify.

$$\lim_{n\to\infty} \frac{1}{n}\sum_{k=1}^{n}\left(\frac{5k}{n}\right)^2$$

If the limit tends to $\pm\infty$, select "Limit does not exist".

Possibilities:

(a) $25/6$
(b) 0
(c) $5/3$
(d) $25/3$
(e) Limit does not exist

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5. Find the second derivative, $f''(x)$, where

$$f(x) = e^{x^3}$$

Possibilities:

(a) $x^3\, e^{x^3-1}$
(b) $x^3\,(x^3-1)\, e^{x^3-2}$
(c) $6\,x\, e^{x^2} + 6\,x\, e^{x}$
(d) $6\,x\, e^{x^3} + 9\,x^4\, e^{x^3}$
(e) $3x^2\, e^{x^3}$

---

6. Compute $\lim_{t\to 4} \dfrac{t^2-2t-8}{t-4}$

Possibilities:

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

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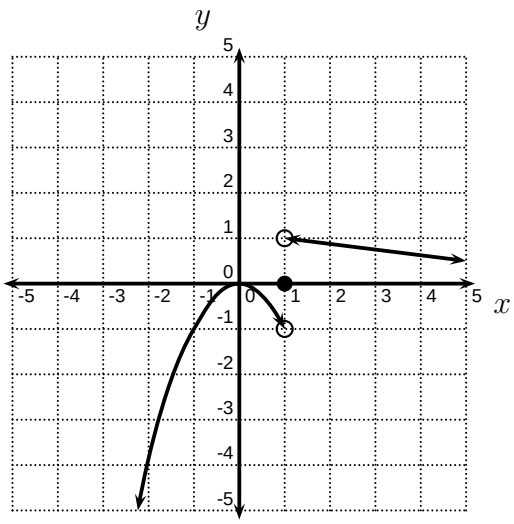
7. The graph of $y = f(x)$ is shown below. Compute $\lim_{x \to 1^-} f(x)$.



Possibilities:

(a) -4
(b) -2
(c) -1
(d) 0
(e) 1

---

8. Evaluate the sum

$$42 + 48 + 54 + 60 + \ldots + 264 + 270$$

Possibilities:

(a) 6042
(b) 6210
(c) 6084
(d) 6120
(e) 1014

---

9. Evaluate the integral

$$\int_0^9 4t^3 + 2t^2 + \frac{4}{\sqrt{t}}\, dt$$

Possibilities:

(a) 7071
(b) 7072
(c) 7073
(d) 7074
(e) 7075

---

10. Evaluate the integral

$$\int_{-3}^{3} |t| \, dt$$

Possibilities:

(a) 9

(b) 10

(c) 11

(d) 12

(e) 13

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11. Use the Fundamental Theorem of Calculus to compute the derivative of $F(x)$, if

$$F(x) = \int_{9}^{x} \frac{4}{\sqrt{t}} \, dt$$

Your answer should be an expression involving the variable x.

Possibilities:

(a) $4/\sqrt{x}$

(b) $2\sqrt{x} - 6$

(c) $(4/\sqrt{x}) - (4/3)$

(d) $4x^{-3/2} - (4/27)$

(e) $8\sqrt{x} - 24$

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12. A rock is thrown down from a cliff with an initial speed of 10 feet per second. The speed of the rock after t seconds is $s(t) = 32\,t \; + \; 10$. If the object lands after 4 seconds, determine the height of the cliff.

Possibilities:

(a) The cliff is 216 feet high.

(b) The cliff is 296 feet high.

(c) The cliff is 128 feet high.

(d) The cliff is 256 feet high.

(e) The cliff is 10 feet high.

---

13. Evaluate the integral

$$\int_6^{12} \frac{8}{t-5}\,dt$$

Possibilities:

(a) $-96/7$

(b) $96/7$

(c) $8\ln(12) - 8\ln(6)$

(d) $8\ln(7)$

(e) 7

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14. Suppose $f(-2) = 7$, $f'(-2) = -3$, $g(-2) = -6$, and $g'(-2) = -9$. Find $K'(-2)$, given that

$$K(x) = \frac{f(x)}{g(x)}$$

Possibilities:

(a) $1/3$

(b) $-27/2$

(c) $-9/4$

(d) $27/2$

(e) $9/4$

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15. 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 right endpoint of each subinterval as the sample point.

Possibilities:

(a) 675

(b) 200

(c) 1080

(d) 135

(e) 560

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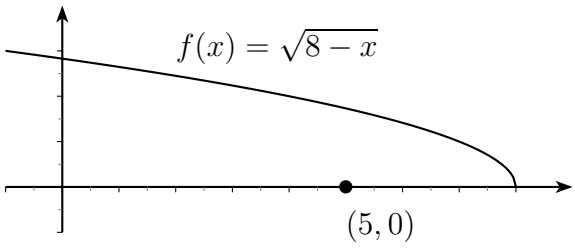
16. Suppose you want to find the shortest distance between the point $(5, 0)$ on the x-axis and a point on the parabola $y = \sqrt{8 - x}$. Solving which of the equations below will help?



Possibilities:

(a) Solve $D = 0$, where $D = \sqrt{x^2 + (\sqrt{8 - x} - 5)^2}$, for $x \leq 8$

(b) Solve $D = 0$, where $D = \sqrt{(x - 5)^2 + 8 - x}$, for $x \leq 8$

(c) Solve $D' = 0$, where $D = \sqrt{x^2 + (\sqrt{8 - x} - 5)^2}$, for $x \leq 8$

(d) Solve $D' = 0$, where $D = \sqrt{(x - 5)^2 + 8 - x}$, for $x \leq 8$

(e) Solve $D' = 0$, where $D = \sqrt{(x - 5)^2 + \sqrt{8 - x}}$, for $x \leq 8$

---

17. The area of a circle is increasing at a rate of 3 square inches per minute. Determine the rate at which the radius of the circle is increasing when the radius of the circle is 4

Possibilities:

(a) $\dfrac{3}{8\,\pi}$ inches per minute

(b) $\dfrac{11}{8\,\pi}$ inches per minute

(c) $\dfrac{19}{8\,\pi}$ inches per minute

(d) $\dfrac{27}{8\,\pi}$ inches per minute

(e) $\dfrac{35}{8\,\pi}$ inches per minute

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18. Assume that $f(x)$ is a differentiable function for all values of x. Furthermore, assume that

$f'(x) > 0$ on the intervals $(-\infty, -1)$, $(1, 7)$, and $(9, \infty)$
$f'(x) < 0$ on the intervals $(-1, 1)$ and $(7, 9)$

The local minimum points of $f(x)$ occur at

Possibilities:

(a) $x = -1$ and $x = 9$
(b) $x = -1$ and $x = 7$
(c) $x = 1$ and $x = 7$
(d) $x = 1$ and $x = 9$
(e) $x = -1$ and $x = 1$

---

19. $f(x) = 243\,x^2 - 256\,x^{-2}$ has a single inflection point whose x coordinate is positive. Determine the x-coordinate of this inflection point.

Possibilities:

(a) 0
(b) $1/3$
(c) $2/3$
(d) 1
(e) $4/3$

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20. Suppose

$$g(x) = \begin{cases} 3\,x + 7, & x \le 0; \\ e^{-x} + 6, & x > 0; \end{cases}$$

Determine the absolute maximum value of $g(x)$ on the interval $[-2, 3]$

Possibilities:

(a) $6 + e^{-3}$
(b) 16
(c) $6 + e^2$
(d) 3
(e) 7

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