MA 123 — Elementary Calculus Spring 2010
FINAL EXAM 05/06/2010

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	M. Shaw	MWF 12:00 pm - 12:50 pm, CP 153
002	T. Chapman	MWF 2:00 pm - 2:50 pm, CP 139
003	P. Koester	TR 12:30 pm - 1:45 pm, CP 153
004	M. Shaw	MWF 9:00 am- 9:50 am, BS 116
005	P. Koester D. Moore	MWF 1:00 pm - 1:50 pm, CB 122 T 11:00 am - 12:15, CB 303
006	P. Koester J. Polly	MWF 1:00 pm - 1:50 pm, CB 122 R 11:00 am - 12:15, DH 301
007	P. Koester D. Moore	MWF 1:00 pm - 1:50 pm, CB 122 T 9:30 am - 10:45, CB 243
008	P. Koester J. Polly	MWF 1:00 pm - 1:50 pm, CB 122 R 9:30 am - 10:45, CB 243
009	D. Leep A. Barra	MWF 10:00 am - 10:50 am, CP 320 T 1:00 pm - 2:15, CP 397
010	D. Leep A. Barra	MWF 10:00 am - 10:50 am, CP 320 R 1:00 pm - 2:15, CB 304
011	D. Leep A. Barra	MWF 10:00 am - 10:50 am, CP 320 T 2:30 pm - 3:45, CP 246
012	D. Leep A. Barra	MWF 10:00 am - 10:50 am, CP 320 R 2:30 pm - 3:45, CP 235
013	A. Corso	MWF 12:00 pm - 12:50 pm, CB 110
401	D. Little	TR 6:00 pm-7:15 pm, CB 339
402	D. Little	TR 7:30 pm-8:45 pm, 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. $f(x)$ has a single inflection point whose x coordinate is positive. Find the x coordinate of this inflection point.

$$f(x) = x^4 - 30x^2 + 17x - 13$$

Possibilities:

(a) $\sqrt{3}$
(b) $\sqrt{5}$
(c) $\sqrt{7}$
(d) 7
(e) 5

---

2. Find the average rate of change of the function $g(t) = t^2 - 3t + 4$ on the interval $[2, 4]$

Possibilities:

(a) 6
(b) 8
(c) 4
(d) 10
(e) 3

---

3. A ball is thrown downward from the top of Patterson Office Tower. The height of the ball (in feet) t seconds after the ball is thrown is given by

$$h(t) = -16t^2 - 15t + 240$$

Find the instantaneous speed (in feet per second) of the ball after two seconds. (Note: Your answer should be a positive number since we are asking for *speed*, not *velocity*)

Possibilities:

(a) 76 feet per second
(b) 74 feet per second
(c) 70 feet per second
(d) 72 feet per second
(e) 79 feet per second

---

4. Find $f'(20)$, provided that

$$f(x) = e^{3x^2-4}$$

Possibilities:

(a) $120\, e^{1192}$

(b) e^{1196}

(c) $596\, e^{1196}$

(d) $120\, e^{1196}$

(e) $120\, e^{1195}$

---

5. Suppose $g(4) = 4$, $g'(4) = -2$ and

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

Find $f\,'(4)$.

Possibilities:

(a) $-\dfrac{5}{8}$

(b) $-\dfrac{7}{8}$

(c) $-\dfrac{3}{4}$

(d) $-\dfrac{5}{4}$

(e) $-\dfrac{11}{8}$

---

6. Find the equation of the tangent line at $x = 2$ to the curve $y = x^2$.

Possibilities:

(a) $y = 6(x - 3) + 9$

(b) $y = 10(x - 5) + 25$

(c) $y = 4(x - 2) + 4$

(d) $y = 4x + 8$

(e) $y = 4(x - 2) - 4$

---

7. Find the area of the largest rectangle which has one corner at the origin, opposite corner in the first quadrant and on the curve $f(x) = 27 - x^2$, and has sides parallel to the coordinate axes. (**Hint:** Let x denote the width of the rectangle. First, express the area of the rectangle in terms of x.)

Possibilities:

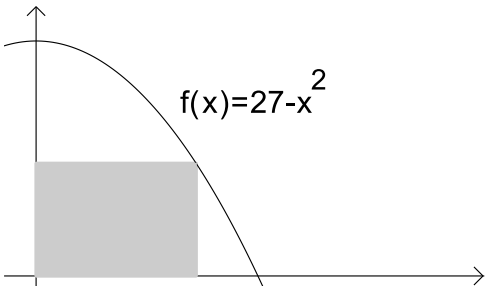
(a) 3

(b) 54

(c) 16

(d) 128

(e) 18



---

8. Suppose the derivative of $f(x)$ is given by $f'(x) = (x^2 - 9)(x^2 + 5)$. Determine the largest interval on which $f(x)$ is decreasing.

Possibilities:

(a) $(3, -\infty)$

(b) $(-\infty, -3)$

(c) $(-3, 3)$

(d) $(-9, 9)$

(e) $(9, \infty)$

---

9. Let P denote the pressure on a gas and V the volume of the gas. According to Boyle's Law, $PV = c$ where c is a constant. Currently, the pressure is 120 kPa, the volume is 40 cubic meters, and the pressure is increasing at rate of 15 kPa per minute. Find the rate at which the volume is decreasing. (**Note:** Just give the numeric answer without a positive or negative sign.)

Possibilities:

(a) 5 cubic meters per minute

(b) 2 cubic meters per minute

(c) 6 cubic meters per minute

(d) 7 cubic meters per minute

(e) 3 cubic meters per minute

---

10. Compute the limit:

$$\lim_{n\to\infty} \frac{5+10+15+\cdots+5n}{n^2}$$

Possibilities:

(a) $\frac{5}{2}$

(b) 0

(c) $\frac{3}{2}$

(d) $\frac{7}{2}$

(e) Limit does not exist

---

11. Compute the integral

$$\int_1^4 9\sqrt{x}\,dx$$

Possibilities:

(a) 18

(b) 42

(c) 28

(d) 63

(e) 14

---

12. Evaluate the integral

$$\int_0^{25} 2x\,e^{x^2}\,dx$$

Possibilities:

(a) $e^{625}-1$

(b) e^{529}

(c) $50e^{625}-50$

(d) $e^{400}-1$

(e) $50e^{625}-1$

---

13. Find the derivative $F'(x)$ given that

$$F(x) = \int_1^x 3t^2 \, dt$$

Possibilities:

(a) $5x^4$

(b) $4x^3$

(c) $6x$

(d) $3x^2$

(e) $x^3 - 1$

---

14. Evaluate the integral

$$\int_{-4}^{5} |\, t| \, dt$$

(**Hint:** Drawing a graph will help)

Possibilities:

(a) $\frac{29}{2}$

(b) $\frac{17}{2}$

(c) $\frac{23}{2}$

(d) $\frac{13}{2}$

(e) $\frac{41}{2}$

---

15. Compute the one-sided limit

$$\lim_{x \to 3^+} g(x)$$

for the function

$$g(x) = \begin{cases} x^2 - 1, & x < 3; \\ 4, & x = 3; \\ -x + 6, & x > 3 \end{cases}$$

Possibilities:

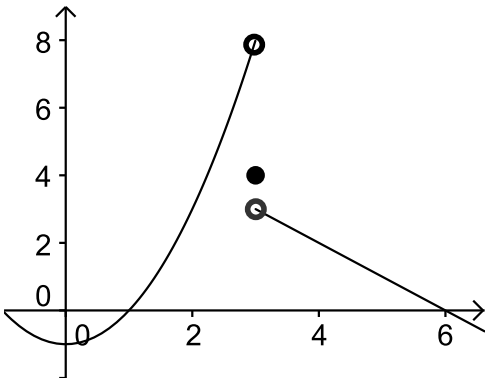
(a) 4

(b) 1

(c) 8

(d) 3

(e) 2



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