

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

9. ☐ a ☐ b ☐ c ☐ d ☐ e

2. ☐ a ☐ b ☐ c ☐ d ☐ e

10. ☐ a ☐ b ☐ c ☐ d ☐ e

3. ☐ a ☐ b ☐ c ☐ d ☐ e

11. ☐ a ☐ b ☐ c ☐ d ☐ e

4. ☐ a ☐ b ☐ c ☐ d ☐ e

12. ☐ a ☐ b ☐ c ☐ d ☐ e

5. ☐ a ☐ b ☐ c ☐ d ☐ e

13. ☐ a ☐ b ☐ c ☐ d ☐ e

6. ☐ a ☐ b ☐ c ☐ d ☐ e

14. ☐ a ☐ b ☐ c ☐ d ☐ e

7. ☐ a ☐ b ☐ c ☐ d ☐ e

15. ☐ a ☐ b ☐ c ☐ d ☐ e

8. ☐ 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	A. Corso	MWF 12:00 pm-12:50 pm, CB 106
002	M. Shaw	MWF 2:00 pm-2:50 pm, KAS 213
003	T. Chapman	TR 12:30 pm-1:45 pm, CB 118
004	M. Shaw	TR 9:30 am-10:45 am, FB 213
005	M. Shaw	TR 12:30 pm-1:45 pm, CB 217
401	T. Muldoon	TR 6:00 pm-7:15 pm, CB 339
402	T. Muldoon	TR 7:30 pm-8:45 pm, CB 339

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### 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. Suppose that  $f(x) = \frac{1}{3}(x^2 - 8)^7$ . Find  $f'(3)$ .

**Possibilities:**

- (a) 7
- (b) 14
- (c) 28
- (d) 42
- (e) 56

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2. Suppose that  $f(x) = \frac{3x - 4}{2x + 5}$ . Find  $f'(-1)$ .

**Possibilities:**

- (a)  $-23/9$
- (b)  $23/3$
- (c)  $-23/3$
- (d)  $23/9$
- (e)  $3/23$

- 
3. Suppose that  $f(x) = \ln(x^2 + 2x + 4)$ . Find  $f'(1)$ .

**Possibilities:**

- (a)  $4/7$
  - (b)  $5/7$
  - (c)  $2/5$
  - (d)  $3/5$
  - (e)  $5/6$
-

- 
4. Suppose that  $h(x) = f(g(x))$ . Assume that  $f(4) = 5$ ,  $f'(4) = 3$ ,  $g(3) = 4$ , and  $g'(3) = 4$ . Find  $h'(3)$ .

**Possibilities:**

- (a) 6
- (b) 10
- (c) 12
- (d) 14
- (e) 15

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5. Suppose that  $f(x) = 2\sqrt{x^2 + 1}$ . Find the limit

$$\lim_{h \rightarrow 0} \frac{f(3+h) - f(3)}{h}.$$

(Hint: Relate the limit to a derivative.)

**Possibilities:**

- (a)  $3/\sqrt{10}$
- (b)  $4/\sqrt{10}$
- (c)  $5/\sqrt{10}$
- (d)  $6/\sqrt{10}$
- (e)  $7/\sqrt{10}$

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6. Find the equation of the tangent line to the graph of  $f(x) = x^3 - 6x + 2$  at  $x = 2$ .

**Possibilities:**

- (a)  $y = 6x - 14$
  - (b)  $y = 5x + 8$
  - (c)  $y = 7x - 16$
  - (d)  $y = 8x + 10$
  - (e)  $y = -6x + 10$
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7. Find the maximum value of  $f(x) = x^3 + 3x^2 - 9x + 8$  on the interval  $[-4, 2]$ .

**Possibilities:**

- (a) 33
- (b) 34
- (c) 35
- (d) 36
- (e) 37

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8. Find the interval(s) where  $f(x) = x^3 + 3x^2 - 9x + 8$  is decreasing.

**Possibilities:**

- (a)  $(-\infty, -3)$  and  $(1, \infty)$
- (b)  $(-\infty, -1)$  and  $(3, \infty)$
- (c)  $(-3, 1)$
- (d)  $(-1, 3)$
- (e)  $(0, \infty)$

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9. Suppose that  $Q(t) = Q_0 e^{rt}$ . Assume that  $(0, 3)$  lies on the graph of  $Q(t)$ . Assume also that the slope of the tangent line to the graph of  $Q(t)$  at  $t = 0$  is 36. Find  $r$ .

**Possibilities:**

- (a) 24
  - (b) 8.5
  - (c)  $e$
  - (d) 12
  - (e)  $8e$
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10. Suppose that  $g(x) = \frac{1}{f(x)}$  and the equation of the tangent line to the graph of  $f(x)$  at  $x = 3$  is  $y = 2 + 8(x - 3)$ . Find  $g'(3)$ .

**Possibilities:**

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

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11. Assume that  $f(x) = xe^{-x}$ . Find  $f''(2)$ .

- (a)  $e^2$
- (b)  $e^{-2}$
- (c)  $-e^{-2}$
- (d)  $2e$
- (e) 0

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12. Find the maximum of  $g(t) = |t + 4| - 4$  on the interval  $[-20, 10]$ .

**Possibilities:**

- (a) 12
  - (b) 14
  - (c) 16
  - (d) 18
  - (e) 20
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13. If the number of bacteria in a culture doubles in 3 hours, how many hours will it take before 5 times the original number is present.

**Possibilities:**

- (a)  $15/2$
- (b)  $5/2$
- (c)  $5/3$
- (d)  $3 \ln 5 / \ln 2$
- (e)  $3 \ln 2 / \ln 5$

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14. Suppose that  $g(x) = x^2 - 4x + 7$ . Find a value  $c$  in the interval  $[2, 6]$  such that  $g'(c)$  equals the average rate of change of  $g(x)$  on the interval  $[2, 6]$ .

**Possibilities:**

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

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15. Find a value of  $x$  where the function  $f(x) = x \ln x$  has a minimum.

**Possibilities:**

- (a)  $1/e$
- (b)  $e$
- (c) 1
- (d)  $1/2$
- (e)  $f(x)$  has no minimum.