

**Exam 2**  
Form A

Name: \_\_\_\_\_ Section and/or TA: \_\_\_\_\_

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 16 multiple choice questions and 4 free response questions. Record your answers to the multiple choice questions on this page by filling in the circle corresponding to the correct answer.

Show all work to receive full credit on the free response problems.

Multiple Choice Questions

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| <p><b>1</b>    <input type="radio"/> A    <input type="radio"/> B    <input type="radio"/> C    <input type="radio"/> D    <input type="radio"/> E</p> <p><b>2</b>    <input type="radio"/> A    <input type="radio"/> B    <input type="radio"/> C    <input type="radio"/> D    <input type="radio"/> E</p> <p><b>3</b>    <input type="radio"/> A    <input type="radio"/> B    <input type="radio"/> C    <input type="radio"/> D    <input type="radio"/> E</p> <p><b>4</b>    <input type="radio"/> A    <input type="radio"/> B    <input type="radio"/> C    <input type="radio"/> D    <input type="radio"/> E</p> <p><b>5</b>    <input type="radio"/> A    <input type="radio"/> B    <input type="radio"/> C    <input type="radio"/> D    <input type="radio"/> E</p> <p><b>6</b>    <input type="radio"/> A    <input type="radio"/> B    <input type="radio"/> C    <input type="radio"/> D    <input type="radio"/> E</p> <p><b>7</b>    <input type="radio"/> A    <input type="radio"/> B    <input type="radio"/> C    <input type="radio"/> D    <input type="radio"/> E</p> <p><b>8</b>    <input type="radio"/> A    <input type="radio"/> B    <input type="radio"/> C    <input type="radio"/> D    <input type="radio"/> E</p> | <p><b>9</b>    <input type="radio"/> A    <input type="radio"/> B    <input type="radio"/> C    <input type="radio"/> D    <input type="radio"/> E</p> <p><b>10</b>    <input type="radio"/> A    <input type="radio"/> B    <input type="radio"/> C    <input type="radio"/> D    <input type="radio"/> E</p> <p><b>11</b>    <input type="radio"/> A    <input type="radio"/> B    <input type="radio"/> C    <input type="radio"/> D    <input type="radio"/> E</p> <p><b>12</b>    <input type="radio"/> A    <input type="radio"/> B    <input type="radio"/> C    <input type="radio"/> D    <input type="radio"/> E</p> <p><b>13</b>    <input type="radio"/> A    <input type="radio"/> B    <input type="radio"/> C    <input type="radio"/> D    <input type="radio"/> E</p> <p><b>14</b>    <input type="radio"/> A    <input type="radio"/> B    <input type="radio"/> C    <input type="radio"/> D    <input type="radio"/> E</p> <p><b>15</b>    <input type="radio"/> A    <input type="radio"/> B    <input type="radio"/> C    <input type="radio"/> D    <input type="radio"/> E</p> <p><b>16</b>    <input type="radio"/> A    <input type="radio"/> B    <input type="radio"/> C    <input type="radio"/> D    <input type="radio"/> E</p> |
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## SCORE

Multiple Choice	17	18	19	20	Total Score
64	9	9	9	9	100

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### Trigonometric Identities

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$$\sin^2(x) + \cos^2(x) = 1$$

$$\sin(x + y) = \sin(x) \cos(y) + \cos(x) \sin(y)$$

$$\cos(x + y) = \cos(x) \cos(y) - \sin(x) \sin(y)$$

$$\sin(2x) = 2 \sin(x) \cos(x)$$

$$\cos(2x) = \cos^2(x) - \sin^2(x)$$

## Multiple Choice Questions

- Find  $f(3)$  and  $f'(3)$ , assuming that the tangent line to  $y = f(x)$  at  $x = 3$  has equation  $y = 4x - 3$ .
  - $f(3) = -3, f'(3) = 4$
  - $f(3) = 3, f'(3) = 4$
  - $f(3) = 4, f'(3) = -3$
  - $f(3) = 9, f'(3) = 4$
  - $f(3) = 15, f'(3) = 4$
  
- Determine coefficients  $a$  and  $b$  such that  $p(x) = x^2 + ax + b$  satisfies  $p(2) = 9$  and  $p'(2) = 8$ .
  - $a = 0, b = 5$
  - $a = 1/4, b = 4$
  - $a = 4, b = -3$
  - $a = 4, b = 3$
  - $a = 12, b = -19$

3. Find a formula for  $\frac{dy}{dx}$  in terms of  $x$  and  $y$ , where  $x^3y + 3xy^3 = 26$ .

A.  $\frac{dy}{dx} = -\frac{x^3 + 9xy^2}{3x^2y + 3y^3}$

B.  $\frac{dy}{dx} = \frac{3x^2y + 3y^3}{x^3 + 9xy^2}$

C.  $\frac{dy}{dx} = \frac{x^3 + 9xy^2}{3x^2y + 3y^3}$

D.  $\frac{dy}{dx} = \frac{26}{3x^2 + 9y^2}$

E.  $\frac{dy}{dx} = -\frac{3x^2y + 3y^3}{x^3 + 9xy^2}$

4. Suppose  $f(2) = 3$  and  $f'(2) = 5$  and let  $g(x) = f(x)/x$ . Find  $g'(2)$ .

A.  $g'(2) = -13/2$

B.  $g'(2) = -7/2$

C.  $g'(2) = -7/4$

D.  $g'(2) = 7/4$

E.  $g'(2) = 7/2$

5. Find the slope of the tangent line to the graph of  $f(x) = x^2e^{2x}$  at  $x = 2$

- A.  $4e^2$
- B.  $8e^2$
- C.  $4e^4$
- D.  $8e^4$
- E.  $12e^4$

6. Find the derivative of  $g(x) = x^3 \ln(x^2)$ .

- A.  $g'(x) = 3x^2 \ln(x^2) + 2x^2$
- B.  $g'(x) = 3x^2 \ln(2x)$
- C.  $g'(x) = 6x$
- D.  $g'(x) = 3x^2 \ln(x^2) + 2x^4$
- E.  $g'(x) = 3x^2 \cdot \frac{1}{2x}$

7. Let  $f(x) = x^4 + 3x - 1$  and let  $g$  be the inverse of  $f$ . Find  $g(3)$  and  $g'(3)$ .

A.  $g(3) = -1, g'(3) = 3$

B.  $g(3) = 1, g'(3) = 1/7$

C.  $g(3) = 1, g'(3) = 7$

D.  $g(3) = 89, g'(3) = 1/111$

E.  $g(3) = 89, g'(3) = 111$

8. Find the equation of the tangent line to  $3x^2 + 5y^3 = 8$  at  $(4, -2)$ .

A.  $y = -\frac{3}{5}x + \frac{2}{5}$

B.  $y = -\frac{2}{5}x - \frac{2}{5}$

C.  $y = -\frac{1}{5}x - \frac{6}{5}$

D.  $y = \frac{1}{5}x - \frac{14}{5}$

E.  $y = \frac{2}{5}x - \frac{18}{5}$

9. Let  $h(x) = \frac{\cos(x)}{2 + x + x^2}$ . What is  $h'(0)$ ?
- A.  $-1/2$
  - B.  $-1/4$
  - C. 0
  - D.  $1/4$
  - E.  $1/2$
10. A watermelon is dropped off a tall building so that its height in meters at time  $t$  in seconds is  $h(t) = -4.9t^2 + 200$ . Find the velocity when it hits the ground. Give your answer correctly rounded to one decimal place.
- A.  $-62.4$  meters per second.
  - B.  $-62.6$  meters per second.
  - C.  $-62.8$  meters per second.
  - D.  $-63$  meters per second.
  - E.  $-63.2$  meters per second.

11. Find the points  $c$  (if any) such that  $f'(c)$  does not exist where  $f(x) = |2x - 4|$ .

A.  $c = -2$

B.  $c = -\frac{1}{2}$

C.  $c = \frac{1}{2}$

D.  $c = 2$

E. There are no such points for this function.

12. Let  $f$  and  $g$  be two function and let  $h(x) = f(g(x))$ . If  $g(2) = 3$ ,  $g'(2) = 5$ ,  $f(2) = 7$ ,  $f'(2) = 1$ ,  $f(3) = -1$ , and  $f'(3) = -2$ , what is  $h'(2)$ ?

A.  $-10$

B.  $-1$

C.  $3$

D.  $5$

E.  $38$

13. Find all the values of  $x$  where  $f''(x) = 0$  when  $f(x) = 3xe^x$ .

- A.  $-2$
- B.  $-1/2$
- C.  $0$
- D.  $1/2$
- E.  $2$

14. Find the derivative of  $g(x) = \tan(\sin(3x))$ .

- A.  $g'(x) = -3 \cos(3x) \sec^2(\sin(3x))$
- B.  $g'(x) = \cos(3x) \sec^2(\sin(3x))$
- C.  $g'(x) = \sec^2(3 \cos(3x))$
- D.  $g'(x) = 3 \cos(3x) \sec^2(\sin(3x))$
- E.  $g'(x) = 3 \sec^2(\cos(3x))$

15. If  $g(0) = 4$  and  $g'(0) = 2$ , then find the derivative of  $f(x) = e^{xg(x)}$  when  $x = 0$ .

A.  $f'(0) = 1/4$

B.  $f'(0) = 1/2$

C.  $f'(0) = 0$

D.  $f'(0) = 2$

E.  $f'(0) = 4$

16. Strontium-90 has a half-life of 28 days. A sample has a mass of 100 mg initially. Find the mass remaining after 50 days rounded to two decimal places.

A. 8.41 mg

B. 28.00 mg

C. 29.00 mg

D. 50.00 mg

E. 68.04 mg

Free Response Questions  
**Show all of your work**

17. (a) Find all points on  $y^2 + 2xy + 2x^2 = 8$  with  $x = 2$ .

(b) Find  $dy/dx$  for  $y^2 + 2xy + 2x^2 = 8$

(c) Find the slope of the tangent line to  $y^2 + 2xy + 2x^2 = 8$  at each point with  $x = 2$ .

18. Suppose that  $A_0 = 1000$  dollars in principal is invested in an account earning 4% interest, compounded continuously. Recall that the value of the account after  $t$  years is  $A(t) = A_0e^{rt}$ .

(a) What is the value of the account after 5 years?

(b) What is the rate of change of the value  $A(t)$  at  $t = 5$ ?

(c) What is the rate of change of the value  $A(t)$  when  $A(t) = 1500$ ?

19. Find the derivatives of the following functions

(a)  $f(x) = \ln(\sin(3x))$

(b)  $g(x) = \frac{4}{x^3} - \frac{3}{x^2} + \frac{2}{x} + 4$

(c)  $h(x) = 2 \ln \left( \frac{x^2}{e^{3x}} \right)$

20. Let  $f(x) = \sqrt{3x + 1}$ .

(a) Find the instantaneous rate of change of  $f(x)$  when  $x = 5$ .

(b) Find the equation of the tangent line to  $f(x)$  when  $x = 5$ .

(c) Find  $f''(5)$ .