

Name: _____

Section: _____

Last 4 digits of student ID #: _____

This exam has ten multiple choice questions (five points each) and five free response questions (ten points each). Additional blank sheets are available if necessary for scratch work. No books or notes may be used. Turn off your cell phones and do not wear ear-plugs during the exam. You may use a calculator, but not one which has symbolic manipulation capabilities.

On the multiple choice problems:

1. You must give your *final answers* in the *multiple choice answer box* on the front page of your exam.
2. Carefully check your answers. No credit will be given for answers other than those indicated on the *multiple choice answer box*.

On the free response problems:

1. Clearly indicate your answer and the reasoning used to arrive at that answer (*unsupported answers may not receive credit*),
2. Give exact answers, rather than decimal approximations to the answer (unless otherwise stated).

Each free response question is followed by space to write your answer. Please write your solutions neatly in the space below the question. You are not expected to write your solution next to the statement of the question.

Multiple Choice Answers

Question					
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

Exam Scores

Question	Score	Total
MC		50
11		10
12		10
13		10
14		10
15		10
Total		100

Record the correct answer to the following problems on the front page of this exam.

1. $f(x) = \sec^2(4x)$. Find $f'(x)$.

- (A) $4 \sec(4x) \tan(4x)$
- (B) $8 \sec^2(4x) \tan(4x)$
- (C) $2 \sec^2(4x) \tan(4x)$
- (D) $8 \sec(4x) \tan(4x)$
- (E) $8 \sec(4x)$

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

- (A) $\frac{11}{16}$
- (B) $\frac{12}{16}$
- (C) $\frac{13}{16}$
- (D) $\frac{14}{16}$
- (E) $\frac{15}{16}$

3. The expression $\lim_{h \rightarrow 0} \frac{(2+h)^3 - 8}{h}$ is the derivative $f'(a)$ of:

- (A) $f(x) = x^3$ at $a = 2$
- (B) $f(x) = (x+h)^3$ at $a = 2$
- (C) $f(x) = (x+h)^3 - 8$ at $a = 2$
- (D) $f(x) = x^3$ at $a = x$
- (E) $f(x) = (x+h)^3 - 8$ at $a = h$

Record the correct answer to the following problems on the front page of this exam.

4. Let $f(x) = \ln(\cos(x))$. Find $f'(x)$.

(A) $-\tan(x)$

(B) $\frac{1}{\cos(x)}$

(C) $\frac{1}{-\sin(x)}$

(D) $\tan(x)$

(E) $\frac{1}{\sin(x)\cos(x)}$

5. Let $f(x) = x^2$ and $g(x) = \sin(x)$. Find the derivative of $g(f(x))$.

(A) $\sin(2x)$

(B) $\cos(2x)$

(C) $2x \sin(x^2)$

(D) $2x \cos(x^2)$

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

Record the correct answer to the following problems on the front page of this exam.

6. Suppose that a function $y = f(x)$ satisfies the equation $x^2 + y^2 = 325$. If $f(10) = 15$, find the value of $\frac{dy}{dx}$ when $x = 10$.

- (A) 25
- (B) 5
- (C) $\frac{3}{2}$
- (D) $\frac{-2}{3}$
- (E) 150

7. $f(x) = e^{5x} \tan(7x - 5)$. Find $f'(x)$.

- (A) $e^{5x}(\sec^2(7x - 5) + 5 \tan(7x - 5))$
- (B) $e^{5x}(7 \sec^2(7x - 5) + \tan(7x - 5))$
- (C) $e^{5x}(7 \sec(7x - 5) + 5 \tan(7x - 5))$
- (D) $e^{5x}(\sec(7x - 5) + 5 \tan(7x - 5))$
- (E) $e^{5x}(7 \sec^2(7x - 5) + 5 \tan(7x - 5))$

Record the correct answer to the following problems on the front page of this exam.

8. $f(x) = \frac{\sin(2x)}{e^{3x^2}}$. Find $f'(x)$.

(A) $\frac{e^{3x^2} \cos(2x) - 6xe^{3x^2} \sin(2x)}{e^{6x^2}}$

(B) $\frac{2e^{3x^2} \cos(2x) - 2xe^{3x^2} \sin(2x)}{e^{6x^2}}$

(C) $\frac{-e^{3x^2} \cos(2x) - 6xe^{3x^2} \sin(2x)}{e^{6x^2}}$

(D) $\frac{2e^{3x^2} \cos(2x) - 6xe^{3x^2} \sin(2x)}{e^{6x^2}}$

(E) $\frac{-2e^{3x^2} \cos(2x) + 6xe^{3x^2} \sin(2x)}{e^{6x^2}}$

9. $f(x) = \ln(\sqrt{x^2 + 1})$. Find $f'(x)$.

(A) $\frac{x}{x^2 + 1}$

(B) $\frac{2x}{\sqrt{x^2 + 1}}$

(C) $\frac{1}{\sqrt{x^2 + 1}}$

(D) $\frac{x}{\sqrt{x^2 + 1}}$

(E) $\frac{2x}{x^2 + 1}$

10. The volume V of a sphere of radius r is $\frac{4}{3}\pi r^3$. Assume that the volume of a sphere increases at a rate of 300 cubic meters per second. Find the rate of increase of the radius when the radius is 5 meters.

(A) $\frac{1}{\pi}$ meters per second

(B) $\frac{1.5}{\pi}$ meters per second

(C) $\frac{2}{\pi}$ meters per second

(D) $\frac{2.5}{\pi}$ meters per second

(E) $\frac{3}{\pi}$ meters per second

Free Response Questions: Show your work!

11. Let $f(x) = xe^{2x}$.

(a) Find $f'(x)$.

(b) Find $f''(x)$.

Free Response Questions: Show your work!

12. The area of a triangle is given by the formula $A = \frac{1}{2}bh$, where A is the area, b is the length of the base, and h is the height (or altitude) of the triangle.

(a) If the height is 10 cm and the area is 100 cm^2 , what is the length of the base?

(b) Express $\frac{dA}{dt}$ in terms of $b, h, \frac{db}{dt}, \frac{dh}{dt}$.

(c) Assume that the height of a triangle is increasing at a rate of 1 cm per minute while the area of the triangle is increasing at a rate of 2 cm^2 per minute. At what rate is the base of the triangle changing when the height is 10 cm and the area is 100 cm^2 ?

Free Response Questions: Show your work!

13. A ball is tossed in the air vertically from ground level and returns to earth 4 seconds later. Assume that the motion of the ball satisfies the Galileo equation

$$s(t) = s_0 + v_0t - \frac{1}{2}gt^2,$$

where $g = 9.8 \text{ m/s}^2$, s_0 is the initial height, and v_0 is the initial velocity. Express your answers below using the correct units.

- (a) Find the initial velocity of the ball. (Suggestion: Compute $s(4)$.)

- (b) When does the ball reach its maximum height?

- (c) Find the maximum height of the ball.

Free Response Questions: Show your work!

14. Consider the graph of the equation $e^{x+y} + xy^2 + y^3 = 4x^2 - 3$.

(a) Find the slope of the tangent line to the graph at the point $(1, -1)$. (Make sure to show your work to receive full credit.)

(b) Find the equation of the tangent line to the graph at the point $(1, -1)$.

Free Response Questions: Show your work!

15. Suppose that $g(x)$ is the inverse function of $f(x)$ and assume that the domains of both f and g are all real numbers. Suppose that $f(2) = 7$, $f(7) = 13$, $f'(2) = 4$, and $f'(7) = 8$.

(a) Find $g(7)$ and $g'(7)$.

(b) Find the equation of the tangent line to the graph of $g(x)$ at $x = 7$.