

Name: _____

Section: _____

Last 4 digits of student ID #: _____

This exam has five true/false questions (two points each), ten multiple choice questions (five points each) and four 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 true/false and multiple choice problems:

1. You must give your *final answers* in the *front page 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 *front page 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.

True/False		
1	T	F
2	T	F
3	T	F
4	T	F
5	T	F

Multiple Choice					
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

Overall Exam Scores

Question	Score	Total
TF		10
MC		50
16		10
17		10
18		10
19		10
Total		100

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

1. True or False: $\int_{-\pi}^{\pi} \frac{1}{\sin(x)} dx = 0$.
2. True or False: Every polynomial of degree three has exactly one local maximum and one local minimum.
3. True or False: L'Hopital's rule can be repeatedly applied to show that $\lim_{x \rightarrow \infty} \frac{x^{10}}{e^x} = 0$.
4. True or False: The domain of $\sqrt{1 + 2x}$ is $[0, \infty)$.
5. True or False: If $f(t)$ is a polynomial, then $g(x) = \int_0^x f(t) dt$ is also a polynomial.
6. A bug is located at the point $(10, 0)$ at time $t = 0$ and crawls at a rate of 3 meters per minute in the counterclockwise direction along the circle centered at the origin of radius 10 meters. Find the coordinates (x, y) which give the location of the bug after t minutes.
 - (a) $(10 \cos(3t), 10 \sin(3t))$
 - (b) $(30 \cos(3t/10), 30 \sin(3t/10))$
 - (c) $(3 \cos(t/10), 3 \sin(t/10))$
 - (d) $(10 \cos(3t/10), 10 \sin(3t/10))$
 - (e) None of the above

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

7. Use Part 1 of the Fundamental Theorem of Calculus to find $\frac{df}{dx}$ for the function

$$f(x) = \int_0^{3x^2-1} e^{-t^2} dt$$

on the interval $(-\infty, \infty)$.

- (a) $e^{-(3x^2-1)^2}$
 - (b) e^{-x^2}
 - (c) $6xe^{-x^2}$
 - (d) $6xe^{-(3x^2-1)^2}$
 - (e) None of the above
8. The velocity of a car in meters per second is recorded every 0.25 seconds and is given in the following table. Using the right endpoint approximation, what is the resulting estimate of the total distance traveled by the car during the first 1.5 seconds?

t	0.00	0.25	0.50	0.75	1.00	1.25	1.50
$v(t)$	3	5	6	9	12	13	15

- (a) 15 meters
 - (b) 12 meters
 - (c) 15.75 meters
 - (d) 13.5 meters
 - (e) None of the above
9. Use the linear approximation of $\sqrt[3]{x}$ at $a = 8$ to approximate $\sqrt[3]{8.5}$.
- (a) $193/24$
 - (b) $1/24$
 - (c) $1/12$
 - (d) 2
 - (e) None of the above

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

10. For which x is $f(x) = x^4 - x^2 + 1$ concave down?

- (a) x in $(-\sqrt{6}, \sqrt{6})$
- (b) x in $(-\infty, -1/\sqrt{6}) \cup (1/\sqrt{6}, \infty)$
- (c) x in $(-1/\sqrt{6}, 1/\sqrt{6})$
- (d) x in $(-1/6, 1/6)$
- (e) None of the above

11. Find $\int_x^{x^2} \sin(2t) dt$.

- (a) $(1/2) \cos(2x) - (1/2) \cos(2x^2)$
- (b) $(-1/2) \cos(2x^2) + (1/2) \cos(2x)$
- (c) $-\cos(2x^2) + \cos(2x)$
- (d) $\cos(2x^2 - 2x)$
- (e) None of the above

12. Each side of a square is increasing at a rate of 3 cm/s. At what rate is the area of the square increasing when the area is 16 cm²?

- (a) 24 cm²/sec
- (b) 96 cm²/sec
- (c) 12 cm²/sec
- (d) 8 cm²/sec
- (e) None of the above

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

13. Find a function f and a number a so that the following limit represents a derivative $f'(a)$.

$$\lim_{h \rightarrow 0} \frac{\ln(e+h) - 1}{h}$$

- (a) $f(x) = \ln(x)$, $a = 1$
 - (b) $f(x) = \ln(x)$, $a = e$
 - (c) $f(x) = \ln(x + e)$, $a = 1$
 - (d) $f(x) = \ln(x + 1)$, $a = e$
 - (e) None of the above
14. The function $f(x) = |x^3 + 8|$ is not continuous at:

- (a) 2
 - (b) 0
 - (c) -2
 - (d) -1
 - (e) None of the above.
15. If $P(t) = 4e^{2t}$, for what value of t is $P(t) = 15$?

- (a) $(1/2) \ln(15/4)$
- (b) $(1/4) \ln(15/2)$
- (c) $\ln(15/8)$
- (d) $15/8$
- (e) None of the above

Free Response Questions: Show your work!

16. Find the value of the following integrals.

(a) $\int_1^3 \frac{7}{(1+3x)^4} dx$

(b) $\int 3x^5\sqrt{1+x^3} dx$

Free Response Questions: Show your work!

17. Suppose the velocity of a particle traveling along the x -axis is given by $v(t) = t^2 - 5t + 4$ m/sec at time t seconds. The particle is initially located 5 meters left of the origin.

(a) After 5 seconds, how far is the particle from the origin?

(b) What is the total distance traveled by the particle between $t = 3$ and $t = 5$ seconds?

Free Response Questions: Show your work!

18. Consider the curve given by the equation $x^2y + xy^2 = x^3 + y^3$.

(a) Express dy/dx as a function of x and y .

(b) There is one point on this curve of the form $(-1, b)$ where $b > 0$. Find this point and show that it is on the curve.

(c) Find the equation of the tangent line to the curve at the point you found in the previous part. You do not need to simplify your answer.

Free Response Questions: Show your work!

19. (a) Find the fifth-degree Taylor polynomial at $a = 0$ for $\sin(x)$. You must explain your work.

(b) Use the polynomial you found in part (a) to estimate the value of $\sin(1/4)$. Show your work. You do not need to simplify your answer.