MAC 2311
Final A

A. Sign your scantron sheet in the white area on the back.

B. Write and code in the spaces indicated:
   1) Name (last name, first initial, middle initial)
   2) UF ID number
   3) Discussion Section number

C. Under “special codes”, code in the test number 1, 3.
   • 2 3 4 5 6 7 8 9 0
   1 2 • 4 5 6 7 8 9 0

D. At the top right of your answer sheet, for “Test Form Code” encode A.
   • B C D E

E. This test consists of 22 multiple choice questions. Make sure you check for errors. The time allowed is 120 minutes.

F. WHEN YOU ARE FINISHED:

   1) Before turning in your test check for transcribing errors. Any mistakes you leave in are there to stay.

   2) You must turn in your scantron to your proctor. Be prepared to show your picture ID with a legible signature.
1. What is the value of \( \int_{-2}^{2} |x| - x \, dx \)?

A. 0  B. -8  C. -4  D. 8  E. 4

2. If \( -5 \leq f(x) \leq -1 \) on the interval \([-2, 5]\), then \( \int_{-2}^{5} f(x) \, dx \leq -7 \).

A. true  B. false

3. Approximate the area under the curve \( f(x) = 4x^2 - 2 \), \( 1 \leq x \leq 3 \) using \( n = 4 \) and letting \( x_i^* \) equal the left end point of each subinterval. This approximation is equal to:

A. 6  B. 23  C. 15  D. 7  E. 14
4. If \( f(x) \) is an odd continuous function and \( g(x) \) is an even continuous function then how many of the following are necessarily true?

i. \( \int_{-a}^{a} f(x) + g(x) \, dx = 2 \int_{0}^{a} g(x) \, dx \)

ii. \( \int_{-a}^{a} f(x) \, dx = 0 \)

iii. \( \int_{-a}^{a} g(x) \, dx = 2 \int_{-a}^{0} g(x) \, dx \)

iv. \( \int_{0}^{a} f(x) \, dx = 0 \)

A. 0 B. 1 C. 2 D. 3 E. 4

5. For how many of the following functions is \( \int_{-a}^{a} f(x) \, dx = 0? \)

i. \( e^x \)

ii. \( \cos x \)

iii. \( \sin x \)

iv. \( x^3 - 4x^2 \)

A. 0 B. 1 C. 2 D. 3 E. 4
6. A bacterial population is 1000 at \( t = 0 \) and its rate of growth is \( 2000 \cdot 2^t \) bacteria after \( t \) hours. What is the population after two hours?

A. \((4000/\ln 2) + 1000\)  
B. \((6000/\ln 2) + 1000\)  
C. \((4000/\ln 2) - 1000\)  
D. \((4000/\ln 2) - 2000\)  
E. \((2000/\ln 2) - 1000\)

7. A closed cylinder \((V = \pi r^2 h)\) with volume of 18\( \pi \) cubic feet is to be constructed. If the material for the top and bottom costs one dollar per square foot and the material for the side costs three dollars per square foot, what should the radius of the cylinder be in order to minimize the cost?

A. 5 ft  
B. 2 ft  
C. 3 ft  
D. 1 ft  
E. 4 ft

8. The value of \(\int_2^4 2e^{2x} \, dx\) is:

A. 0  
B. \((2/3)(e^3 - e^{-3})\)  
C. \((2/3)(e^6 + e^{-6})\)  
D. \(3e^6\)  
E. none of the above
9. If \( f'(x) = \frac{6x+6}{(x^2+2x)^2} \) and \( f(1) = 1 \), what is \( f(3) \)?

A. 3/5  B. 2/5  C. 6/5  D. 9/5  E. 7/5

10. Evaluate the following: \( \int_0^{\pi/4} 24 \sin^3(2x) \cos(2x) \, dx \).

A. 0  B. 6  C. 12  D. 3  E. 15
11. Which of the following is the derivative of \( F(x) = \int_{3x}^{x} 6t^2 - 4t \, dt \)?

A. \( 48x^2 - 8x \)  
B. \( 36x^2 - 6x \)  
C. \( 24x^2 - 6x \)  
D. \( 156x^2 - 32x \)  
E. \( 124x^2 - 32x \)

12. On the interval \([0, \ln 4]\), what is the area bounded by the function \( f(x) = 3e^x \) and the x-axis?

A. 0  
B. 9  
C. 3  
D. 12  
E. 18

13. A bacterial population is 1000 at \( t = 0 \) and its rate of growth is \( 2000 \cdot 2^t \) bacteria after \( t \) hours. What is the change in the population between the first and third hour?

A. \( \frac{16000}{\ln 2} + 1000 \)  
B. \( \frac{14000}{\ln 2} \)  
C. \( \frac{12000}{\ln 2} \)  
D. \( \frac{12000}{\ln 2} + 1000 \)  
E. \( \frac{14000}{\ln 2} + 1000 \)
14. Evaluate the following: \( \int_{1}^{e} \frac{3\ln x}{x} \, dx \).

A. \( \frac{3}{2} \)  
B. \( \frac{5}{(2e)} \)  
C. \( \frac{5}{2} \)  
D. \( \frac{3}{4} \)  
E. \( \frac{3}{4e} \)

15. Approximate the area under the curve \( f(x) = x^2 \), \(-3 \leq x \leq 12\) using \( n = 5 \) and letting \( x_i^* \) equal the right end point of each subinterval. This approximation is equal to:

A. 270  
B. 540  
C. 640  
D. 810  
E. 240

16. Evaluate the following: \( \int_{0}^{\pi/4} 3\sin(4x - \pi) \, dx \).

A. 0  
B. \( \frac{5}{2} \)  
C. \( \frac{3}{4} \)  
D. \( \frac{7}{4} \)  
E. \( -\frac{3}{2} \)
17. Which of the following is the derivative of \( F(x) = \int_{2}^{1-x} t^2 \, dt \)?

A. \(-2x^4 - x^2 - 4x + 2\)  B. \(-2x^5 - x^2 + 2x + 1\)  C. \(-4x^4 - x^2 - 2x - 1\)

D. \(-2x^5 - x^2 + 2x - 1\)  E. \(-x^5 - x^2 - 1\)

18. Which if the following is equal to \( \int_{0}^{x} \sin x e^{\cos x} \, dx \)?

A. \(-\int_{1}^{x} e^u \, du\)  B. \(\int_{1}^{x} e^u \, du\)  C. \(\int_{0}^{1} e^u \, du\)  D. \(-\int_{-1}^{0} e^u \, du\)

E. \(2\int_{0}^{1} e^u \, du\)

19. If \( f'(x) = x^3 + x - 1 \) and \( f(2) = 1 \), what is \( f(-2) \)?

A. 1  B. -3  C. 3  D. 4  E. 5
20. Letting \( u = \tan x \), which of the following is equal to \( \int_{0}^{\pi/4} \tan^2 x \sec^2 x \, dx \)?

A. \( \int_{0}^{1} u^2 \, du \)  
B. \( 2 \int_{0}^{1} u^2 \, du \)  
C. \( \int_{0}^{\sqrt{2}/2} u^2 \, du \)  
D. \( \int_{0}^{\sqrt{2}/2} 2u^2 \, du \)  
E. none of the above

21. If \( x \) and \( y \) are positive numbers such that \( x + 6y = 84 \), what is the largest possible value of \( xy \)?

A. 248  
B. 132  
C. 464  
D. 294  
E. 164

22. Let \( g(x) \) be a continuous function with domain \( (-\infty, +\infty) \); if \( a \) is any real number then \( \int_{a}^{a} g(x) \, dx = 0 \).

A. true  
B. false