Math 142
Exam 3  VERSION A
April 18, 1997

Name ____________________________
Roster Number ____________________
Section ________  SEAT _________

The work on this exam is my own _____________________________________________

(signature required)

Please read all directions. Be sure any written work to be read by me is legible. There are 2 pages
with writing on both sides of every page. When you are done, turn in your exam and your scantron
in the appropriate envelope. There is a FIVE point deduction for any error in your name, roster
number, section number, version letter (on your scantron) or missing signature. There is a TEN
point deduction if I have to grade the scantron by hand.

Some geometric formulas you MAY need are:

area of a triangle is $\frac{1}{2}b \cdot h$, area of a circle is $\pi r^2$, circumference of a circle is $2\pi r$, volume of a right
circular cylinder is $\pi r^2h$, surface area of a right circular cylinder is $2\pi r^2 + 2\pi rh$.

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the author’s express written consent.
PUT YOUR NAME AND VERSION LETTER (A) ON YOUR SCANTRON! There are 16 multiple choice questions to answer on your scantron. There is no partial credit on this part. The scantrons will not be returned, so please mark your answers on the exam too.

1. Find the value at which \( f(x) = x^4 - 8x^2 + 3 \) attains its absolute maximum on \([0, 3]\).
   (A) \( x = 0 \)  (B) \( x = .62 \)  (C) \( x = 2 \)  (D) \( x = 2.76 \)  (E) \( x = 3 \)

2. \( I = \int \sqrt{x} dx = \)
   (A) \( \sqrt{6x^3} + C \)  (B) \( \sqrt{6x} + C \)  (C) \( \frac{2}{3} \sqrt{6x^3} + C \)  (D) \( \frac{3}{2} \sqrt{6x^3} + C \)  (E) none of the above

3. \( I = \int \frac{1}{3x + 1} dx = \)
   (A) \( 3 \ln |3x + 1| + C \)  (B) \( \frac{1}{3} \ln |3x + 1| + C \)  (C) \( \frac{1}{2} (3x + 1)^{-2} + C \)  (D) \( \frac{1}{6} (3x + 1)^{-2} + C \)  (E) none of the above

4. \( I = \int 8x e^{x^2+1} dx = \)
   (A) \( e^{x^2+1} + C \)  (B) \( 4e^x + C \)  (C) \( 4xe^{x^2+1} + C \)  (D) \( 4e^{x^2+1} + C \)  (E) none of the above

5. We are told that the marginal revenue is given by \( R'(x) = 5 + e^x \). Find the revenue function, \( R(x) \).
   (A) \( 5x + e^x - 1 \)  (B) \( 5x + e^x + C \)  (C) \( 5x + e^x + 1 \)  (D) \( 5 + e^x + C \)  (E) not enough data

6. The rate of production of items is given by \( N'(t) = 100te^t \) where \( t \) is in hours and \( c = .4 \). How many items are produced in the first two hours?
   (A) 117  (B) 140  (C) 188  (D) not enough data  (E) none of the above

7. Given the velocity function \( v(t) = \frac{1}{\ln t} \), use 10 right-hand rectangles to estimate the distance traveled on the interval \([4, 5]\). Is this an over or under estimate?
   (A) 2/3, exactly  (B) .662, under  (C) .672, under  (D) .662, over  (E) .672, over

8. Given the velocity function \( v(t) = at \), find the distance traveled on the interval \([0, 2]\). Assume that \( a > 0 \).
   (A) \( a \)  (B) \( 2a \)  (C) \( 2a^2 \)  (D) \( a^2 \)  (E) none of the above
9. Find the value of \( \int_0^1 \frac{1}{\sqrt{2\pi}} e^{-x^2/2} \, dx \) to four decimal places.

(A) can’t be found  (B) .6827  (C) 1.0724  (D) .3413  (E) none of the above

10. What is \( \int_0^4 \sqrt{16-x^2} \, dx \) exactly? hint - graph it.

(A) 12.56637  (B) 4\pi  (C) 8\pi  (D) 25.13724  (E) can’t be found

11. Given the velocity function \( v(t) = t \), starting at \( t = 0 \), how long will it take to travel 32 units?

(A) not enough data (B) \( \sqrt{32} \)  (C) 64  (D) 8  (E) none of the above

12. \( \int_{-1}^0 (1 + 2x)^3 \, dx = \)

(A) -1/4  (B) -1/8  (C) 1/8  (D) 0  (E) none of the above

13. What is the average cost for the first 100 items if the cost function is given by \( C(x) = 3 + \sqrt{x} \)

(A) 18.00  (B) 9.67  (C) .13  (D) 13.00  (E) none of the above

14. Find the area between the curves \( y = 4 \) and \( y = x^2 \) on [0,2].

(A) 16/3  (B) 0  (C) 8/3  (D) 8  (E) none of the above

15. Given the rate of change of total income per unit time is \( A'(t) = 20e^{-0.05t} \), find the total amount of income after 5 time units, \( A(5) \).

(A) 4.42  (B) 147.41  (C) 15.58  (D) 88.48  (E) none of the above

16. Given the functions \( f = x^3 - 3x \) and \( g = x \), which of the integrals below corresponds to the area between these curves on [0,3]?

(A) \( \int_0^3 [g - f] \, dx \)  (B) \( \int_0^3 [f - g] \, dx \)  (C) \( \int_0^2 [g - f] \, dx + \int_2^3 [f - g] \, dx \)

(D) \( \int_0^2 [f - g] \, dx + \int_2^3 [g - f] \, dx \)  (E) none of the above
WORK OUT PROBLEMS (10 points each) - be sure to show you work to get full credit

1. Find the area enclosed by the curves \( y = |x| \) and \( y = x^2 \) on \([-1, 2]\).

2. A steel can is to hold 1000 cm\(^3\). The material to make the endcaps costs twice as much as the material to make the sides. What are the dimensions of the least costly can? You must define your variables and set up the equations to be minimized to receive full credit.