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Your exam ID #

1. **PLEASE DO NOT TURN THIS PAGE UNTIL TOLD TO DO SO.**
2. No notes, books, or classmates may be used as resources for this exam. You may use a calculator. It is a violation of the University honor code to, in any way, assist another person in the completion of this exam. Please keep your own work covered up as much as possible during the exam so that others will not be tempted or distracted. Thank you for your cooperation.
3. Read directions to each problem carefully. Show all work for full credit. In most cases, a correct answer with no supporting work will not receive full credit. The best way to get maximum partial credit is to write neatly and be organized.
4. Make sure that you have nine (9) pages, including the cover page.
5. Include units on answers where units are appropriate.
6. YOU WILL BE GRADED ON PROPER USE OF integral ( $\int$ ),  $dx$ ,  $du$ , and  $dv$  notation.
7. There are 5280 feet in one mile.

1.) (10 pts. each) Integrate.

a.)  $\int \frac{e^{7x}}{50 + e^{7x}} dx$

b.)  $\int x \sqrt{5-x} dx$

c.)  $\int x \ln(x+1) dx$

d.)  $\int (\cos x + \sec x)^2 dx$

e.)  $\int \tan^3 x \, dx$

f.)  $\int (\ln x)^2 \, dx$

g.)  $\int \frac{1 + x}{x + 3e^{-x}} \, dx$

2.) (10 pts.) SET UP BUT DO NOT EVALUATE the integral(s) which represent the area of the region bounded by the graphs of  $y = 3x^3 - x^2 - 10x$  and  $y = -x^2 + 2x$ .

3.) (8 pts.) If you deposit \$1000 into a savings account earning 5.75% annual interest compounded monthly, how many years will it take for the amount to grow to \$4000 ?

4.) (8 pts.) Find  $y' = dy/dx$  for  $e^{xy} = y^3 + x^2 + \ln y$ .

5.) (8 pts. each) Consider the region bounded by the graphs of  $y = \sqrt{2x}$  and  $y = (1/2)x$ . SET UP BUT DO NOT EVALUATE the integral(s) which represent the volume of the solids formed by revolving this region

a.) about the x-axis.

b.) about the y-axis.

6.) (8 pts.) Compute  $T_4$ , the Trapezoidal Rule with  $n = 4$ , to estimate the value of the following definite integral. Write your answer to three decimal places.

$$\int_{-1}^1 \log_{10}(3 + 2x) \, dx$$

7.) The number  $N$  of wild hogs in a game preserve after  $t$  years is given by

$$N = 500 - \frac{400}{1 + 2t} \quad \text{for } t \geq 0.$$

a.) (3 pts.) What is the initial number of wild hogs? How many wild hogs are there after  $t = 2$  years? What does  $N$  approach as  $t$  approaches infinity?

b.) (5 pts.) At what rate is the number of wild hogs changing when  $t = 2$  years?

c.) (6 pts.) What is the average number of wild hogs in the game preserve from  $t = 0$  years to  $t = 2$  years?

8.) Let  $f(x) = \frac{1}{4\sqrt{x}}$  for  $1 \leq x \leq 9$  be a probability density function with continuous random variable  $x$  representing the number of hours per week that Davis commuters spend driving their automobiles to and from work.

a.) (5 pts.) Verify that  $f$  is a probability density function.

b.) (5 pts.) Compute the mean  $\mu = E(x)$  for  $x$ .

c.) (5 pts.) Compute the median  $m$  for  $x$ .

d.) (5 pts.) Compute the variance  $V(x)$  for  $x$ .

e.) (2 pts.) Compute the standard deviation  $\sigma$  for  $x$ .

f.) (4 pts.) Compute the probability that  $x$  is greater than or equal to 6.

9.) (10 pts.) You are going to play a lottery game which allows you to randomly select a ticket from a fish bowl containing 300 tickets. Thirty (30) tickets are \$25 winners, five (5) tickets are \$50 winners, and one (1) ticket is a \$200 winner. If you must pay \$5 for the opportunity to select exactly one ticket, what is your expected net gain (\$) ?

10.) (10 pts.) Find all critical points  $(x, y)$  for the following function and classify them as relative or absolute maximum or minimum points.

$$f(x) = \ln |x| - \ln (x^2 + 4).$$

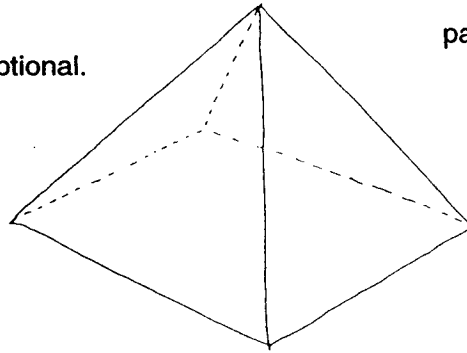
11.) (10 pts.) Assume that while chewing on Double Bubble bubble gum the amount of sugar in the gum decreases exponentially. If, after 1 minute of chewing, 75% of the original amount of sugar remains, what percent of the original amount of sugar will remain after 10 minutes ?

12.) (10 pts.) A large hailstone falls from a cloud at 15,000 feet elevation with initial velocity zero. What is the hailstone's velocity in miles per hour when it passes an airplane flying at 11,864 feet elevation ? Assume that the acceleration due to gravity is  $-32 \text{ ft./sec.}^2$



EXTRA CREDIT-- The following problems are optional.

Consider the given symmetrical  
4-sided pyramid of height 3 ft.  
and with square base of area  $16 \text{ ft.}^2$



a.) (5 points) Compute the total surface area  
of the pyramid.

b.) (10 pts.) Find the radius of the largest sphere which can be inscribed inside the pyramid.