Math 16B
Final Exam

Printed Name _____
(FIRST) (LAST)

Signature _____

ID Number _____

Please Show All Your Work, and Mark Your Answers Clearly.

No Calculators – No Scratch Paper – No Cell Phones

There are **8 pages** of problems. (#17 and #19 are for extra credit.)

You are expected to do your own work, and to adhere to the UCD Code of Academic Conduct.

Simplify all numerical answers, except in #2.

Give units in your answers to #6, #15, and #16.

Please indicate clearly if you continue work on the back of a page.

Please stop working **immediately** when time is called.
(You are subject to a deduction from your test score if you do not.)

Have a Good Break!

① FIND THE FUNCTION f WITH $f'(x) = \dfrac{6x-5}{x^2}$ FOR $x>0$ WHOSE GRAPH PASSES THROUGH THE POINT $(1,9)$.

8 PTS

② APPROXIMATE $\displaystyle\int_2^{18} \frac{1}{x+5}\,dx$ USING $n=4$ AND

A) THE MIDPOINT RULE. (DO NOT SIMPLIFY NUMERICALLY.)

5 PTS

B) SIMPSON'S RULE.

5 PTS

③ FIND $\displaystyle\int \frac{4x^2-15x+32}{x(x-2)^2}\,dx$.

10 PTS

④ FIND $f'(x)$ IF $f(x) = \ln\left(e^{x^5} + 2^x\right)$.

8 PTS

⑤ FIND $\int x^2 \cos 3x \, dx$.

10 PTS

⑥ THE SPEED OF A PARTICLE MOVING ALONG A LINE AFTER t SEC. IS GIVEN BY $f(t) = \dfrac{5\sqrt{t}}{(t^2+2)^2}$ CM/SEC. FIND ITS AVERAGE SPEED FOR THE FIRST 4 SECONDS.

10 PTS

⑦ EVALUATE THE FOLLOWING DEFINITE INTEGRALS:

A) $\int_1^e \frac{4\ln x}{x^3}\,dx$

10 PTS

B) $\int_4^{25} \frac{16}{4x - 5\sqrt{x}}\,dx$

9 PTS

C) $\int_0^1 \frac{72x}{(2x+1)^3}\,dx$

10 PTS

(8) Evaluate $\int_{5/3}^{\infty} \frac{35}{3x^2+5x}\,dx$, or show that it diverges.

12 pts

(9) The time T (in days) required to finish a project is a random variable with probability density function $f(t) = \frac{1}{16} t e^{-t/4}$, $[0, \infty)$.
Find the probability that a project will take less than 8 days to finish.

10 pts

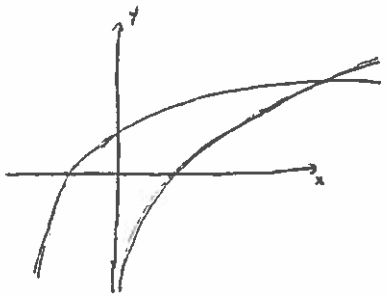
(10) FIND THE AREA ENCLOSED BY THE GRAPHS OF $Y = \sqrt[3]{X}$ AND $Y = \frac{X}{4}$.

10
P3

(11) THE WAITING TIME T AT A STORE IS EXPONENTIALLY DISTRIBUTED WITH A MEAN OF 5 MIN. FIND THE PROBABILITY THAT A CUSTOMER WILL WAIT AT LEAST 10 MINUTES.

8
P3

(12) FIND THE AREA OF THE REGION BOUNDED BY THE GRAPHS OF $Y = 2\ln X$ AND $Y = \ln(2X+3)$ AND THE X-AXIS.



10
P3

(13) A) FIND THE VOLUME OF THE SOLID GENERATED BY REVOLVING THE REGION BOUNDED BY THE GRAPHS OF $Y = X^2$ AND $Y = 4X - X^2$ AROUND THE X-AXIS.

10 PTS

B) FIND THE VOLUME OF THE SOLID GENERATED BY REVOLVING THE REGION BOUNDED BY THE GRAPHS OF $Y = 5X^2$ AND $Y = 10X$ AROUND THE Y-AXIS.

10 PTS

(14) FIND $\int X^5 \csc X^3 \cot X^3 \, dX$.

10 PTS

(15) A SAMPLE OF A RADIOACTIVE SUBSTANCE DECREASES FROM 8mg TO 5mg IN 11 YEARS. HOW LONG DOES IT TAKE FOR 60% OF THE SAMPLE TO DISINTEGRATE?

10 PTS

(16) THE TIME T IN DAYS UNTIL RECOVERY AFTER A MEDICAL PROCEDURE IS A RANDOM VARIABLE WITH PROBABILITY DENSITY FUNCTION $f(T) = \dfrac{1}{2\sqrt{3T+1}}$, $1 \le T \le 8$.

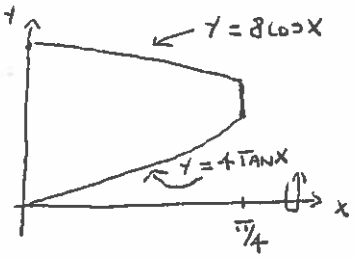
FIND THE EXPECTED TIME FOR RECOVERY.

12 PTS

(17) FIND $\int \csc^2\theta \sec\theta \, d\theta$, AND SIMPLIFY YOUR ANSWER.

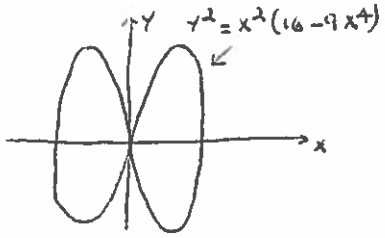
9 PTS (EXTRA CRED.T)

(18) FIND THE VOLUME OF THE SOLID GENERATED BY REVOLVING THE REGION BOUNDED BY THE GRAPHS OF $Y = 8\cos X$ AND $Y = 4\tan X$ FOR $0 \le X \le \frac{\pi}{4}$ ABOUT THE X-AXIS.



13 PTS

(19) FIND THE AREA OF THE REGION BOUNDED BY THE CURVE $Y^2 = X^2(16 - 9X^4)$.



12 PTS (EXTRA CREDIT)