

No books, notes, or calculators. **TURN OFF YOUR CELL PHONE. ANYONE CAUGHT WITH THEIR CELL PHONE ON WILL BE GIVEN A 10 POINT DEDUCTION.** Cross out what you do not want us to grade. You **must** show work to receive full credit. Please try to write neatly. You need not simplify your answers unless asked to do so. You should evaluate standard trigonometric functions like $\tan(\pi/3)$. You **are not allowed to** use reduction formulas. You may not use the tabular method for integration by parts problems. Even when told not to simplify, you are not allowed to leave answers in unsimplified forms like $\cos^{-1}(\sin(2x))$. You are not allowed to quote results about growth rates. You are required to **sign** your exam on the last page. With your signature, you pledge that you have neither given nor received assistance on this exam.

On the inside of the last page there is a blank side of paper for scratch work that is not to be graded.

Problem	Point Value	Points
1	10	
2	10	
3	10	
4	10	
5	10	
6	10	
7	16	
8	10	
9	14	
	100	

1. (10 points) Let R be the region next to the y -axis whose three sides are bounded by the curves $y = \sin x$, $y = \cos x$, and $x = 0$.

(a) Sketch the region R and the horizontal line $y = -2$. Set up but *do not evaluate* a single integral that gives the volume of the solid obtained by rotating the region R about the horizontal line $y = -2$.

(b) For the same region R , set up but *do not evaluate* a single integral that gives the volume of the solid obtained by rotating the region R about the y -axis.

Evaluate the following integrals. **Do not simplify your answers.**

2. (10 points) $\int (5 + \sin^2 3x) dx$

3. (10 points) $\int x \sec(x) \tan(x) dx$

4. (10 points) $\int_0^1 x^3 \sqrt{1-x^2} dx$

5. (10 points)

$$\int e^x \tan^3(e^x) dx$$

6. (10 points) $\int \frac{6}{(x+2)(x^2+2)} dx$

7. (16 points) Evaluate each of the following improper integrals or show that it diverges.

(a) $\int_0^{\infty} \frac{(\tan^{-1} x)^2}{1+x^2} dx$

(b) $\int_1^{e^7} \frac{1}{x \ln x} dx$

8. (10 points) Solve for y in the following initial value problem. Show all work.

$$y' = e^{-t} \sqrt{1 - y^2}, t \geq 0 \quad \text{and} \quad y(0) = 1/2.$$

9. (14 points)

(a) (6 points) If $x = 3 \tan \theta$, express each of the following in terms of x (i.e. no θ 's in your answer):

i) $\theta =$

ii) $\sec \theta =$

iii) $\sin(2\theta) =$

(b) (4 points) Find the form of the partial fractions decomposition of the rational function $\frac{x^7 + 1}{x^5 + 4x^3}$, but
DO NOT SOLVE FOR THE CONSTANTS.

Problem 9 continued on next page

Problem 9 continued

(c) (4points)

i) Does $b_n = \frac{2n + (-1)^n n}{2n}$ converge or diverge? Why?

ii) Find a recurrence relation that generates the sequence: $\{1/1, 1/2, 1/6, 1/24, 1/120, 1/720, \dots\}$

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Name _____

Circle your section:

34-01 Molly Hahn TThF 8:30-9:20

34-02 Melody Takeuchi TWF 9:30-10:20

34-03 Mary Glaser TThF 12-12:50

32-04 Molly Hahn TTh1:30-2:45

I pledge that I have neither given nor received assistance on this exam.

Signature _____

TURN THE EXAM OVER TO THE FRONT PAGE AND READ THE INSTRUCTIONS!