

Math 2300, Midterm 1

June 18, 2017

PRINT YOUR NAME: _____

PRINT INSTRUCTOR'S NAME: _____

Mark your section/instructor:

<input type="checkbox"/>	Section 400	Brendt Gerics	9:15-10:35
<input type="checkbox"/>	Section 401	Michael Roy	11:00-12:20
<input type="checkbox"/>	Section 402	Albert Bronstein	12:45-1:05
<input type="checkbox"/>	Section 403	Braden Balentine	11:00-12:20

Question	Points	Score
1	10	
2	10	
3	10	
4	14	
5	14	
6	14	
7	14	
8	14	
Total:	100	

- No calculators or cell phones or other electronic devices allowed at any time.
- Show all your reasoning and work for full credit, except where otherwise indicated. Use full mathematical or English sentences.
- You have 90 minutes and the exam is 100 points.
- You do not need to simplify numerical expressions. For example leave fractions like $100/7$ or expressions like $\ln(3)/2$ as is.
- When done, give your exam to your instructor, who will mark your name off on a photo roster.
- We hope you show us your best work!

1. Evaluate the integral.

(a) (5 points) $\int x^3 \ln(x) dx$

(b) (5 points) $\int e^{2x} \cos(x) dx$

2. **Multiple Choice:** Circle **the** correct answer.

(a) (5 points) $\int_0^1 \arctan(x) dx$

I) $-\frac{1}{2}$

II) $\frac{\pi}{4} - \frac{\ln(2)}{2}$

III) $\sec^2(1) - 1$

IV) $\frac{\pi}{4} + \frac{\ln(2)}{2}$

V) $\frac{1}{2}$

(b) (5 points) A trigonometric substitution can be used to convert $\int_2^5 \frac{dx}{\sqrt{x^2 - 4x + 13}}$ into which of the following definite integrals?

I) $\int_0^{\pi/4} \sec \theta d\theta$

II) $\int_0^{\pi/4} \cos \theta d\theta$

III) $\int_0^{\pi/3} \sin \theta d\theta$

IV) $\int_0^{\pi/3} \cos \theta d\theta$

V) $\int_0^{\pi/3} \sec \theta d\theta$

3. **Multiple Choice:** Circle **the** correct answer.

(a) (5 points) $\int_2^3 \frac{2}{t^2 - 1} dt$

I) $\ln\left(\frac{1}{6}\right)$ II) $\ln\left(\frac{2}{3}\right)$ III) $\ln\left(\frac{3}{2}\right)$

IV) $\ln\left(\frac{8}{3}\right)$ V) $\ln(6)$

(b) (5 points) Evaluate $\int_0^\infty \frac{x}{1+x^4} dx$.

I) $\frac{\pi}{8}$ II) $\frac{\pi}{6}$ III) $\frac{\pi}{4}$

IV) $\frac{\pi}{2}$ V) This integral diverges.

4. (14 points) Evaluate $\int \frac{x^2}{\sqrt{4-x^2}} dx$

5. (14 points) Evaluate $\int \sin^5 x \cos^2 x \, dx$.

6. (14 points) $\int \frac{10x - 20}{(x - 1)(x^2 + 9)} dx$

7. (14 points) Determine whether the following integral converges or diverges:

$$\int_1^{\infty} \frac{1}{e^x} dx.$$

8. Consider the function $h(x) = \frac{2}{x}$ on the interval $[1, 5]$.
- (a) (7 points) Use the Trapezoidal Rule with $n = 4$ subdivisions to estimate $\int_1^5 \frac{2}{x} dx$. Do NOT simplify your answer once you set up the calculation.

- (b) (7 points) Let E_T denote the error in the Trapezoidal approximation. How large should we take n so that $|E_T| < \frac{1}{192}$? Recall that if $|h''(x)| < K$ for some positive number K on $[a, b]$, then the error E_T has the bound

$$|E_T| \leq \frac{K(b-a)^3}{12n^2}$$