Math 193

Calc II * Fall, 2019 *

Monday	Wednesday
Oct 21 Review Improper Integrals Intro to Differential Equations **No HW**	Oct 23 **HW** **7.9** 9, 11, 14, 15, 19, 23, 25, 31, 33, 37 **8.1** 9–37 Odd

Oct 28	Oct 30
1. Infinite Series: Geometric, Telescoping, Harmonic 2. Maclaurin Series - Intro **Quiz #1 (on 7.9 and 8.1)** You may have one page of notes. **HW** **<u>8.3</u>** 19, 21, 25, 27, 29, 31, 35, 39, 55, 57, 59 – Just find the sum the way we did in class. Prove that the harmonic series diverges (sum = ∞). $\sum_{k=1}^{\infty} \frac{10}{k}$ = ______ **T/F:** Let $\{a_n\}$ be a sequence such that $\lim_{n\to\infty} \{a_n\} = 0$. [That is, the terms of the sequence approach 0.] Then $\sum_{n=1}^{\infty} a_n$ converges.	New Material (not on Test #3) Maclaurin Series: e^x $\sin x$ Review for Test #3 **Quiz #2 (on 8.3)** You may have one page of notes.

Nov 4	Nov 6
New Material **TEST #3** **HW** Derive the Maclaurin Series for $f(x) = \cos x$, using the technique we used to find the series for sin x (the "table" method). Page 679: Study Example 3 - Ignore "interval of convergence" **<u>9.2</u>** 29, 31, 33, 69, 71	Series, Part 1 **Quiz #3 -- on HW from Nov 4.** **HW** Located at the end of this Schedule.

Nov 11  	Nov 13 Series, Part 2 **Quiz #4** **HW** The Homework is located at the end of this Schedule.  **Nov 15**: Last Day to Drop with a W
Nov 18 Series, Part 3 **Quiz #5** The **Homework** is located at the end of this Schedule.	Nov 20 Parametric Equations, Part 1 **Quiz #6** The **Homework** is located at the end of this Schedule.

Nov 25	Nov 27
Parametric Equations, Part 2 Polar, Part 1 **Quiz #7** **HW** **<u>10.1</u>** 59, 61, 67, 69 **<u>10.2</u>** 9, 11, 15–31 Odd, 35, 37, 39	**<u>OPTIONAL DAY</u>** Review HW from 11/25 Begin Reviewing for Test #4 and the Final *Happy Thanksgiving!!* 

Dec 2 Polar, Part 2 Review for Test #4 **Quiz #8**	Dec 4 No new material TEST #4
Dec 9 NO new material *Review for Final*	Dec 11 FINAL

HW for Nov 6

A. $\int x^2 \ln x \, dx$ Ans: $\frac{1}{3}x^3 \ln x - \frac{1}{9}x^3 + C$

B. $\int_1^e \ln x \, dx$ Ans: 1

C. $\int \sin^5 x \, dx$ Ans: $-\cos x + \frac{2}{3}\cos^3 x - \frac{1}{5}\cos^5 x + C$

D. $\int \cos^4 x \, dx$ Ans: $\frac{3}{8}x + \frac{1}{4}\sin 2x + \frac{1}{32}\sin 4x + C$

E. $\int \frac{dx}{\sqrt{x^2 + 4x + 5}}$ Ans: $\ln\left|\sqrt{x^2 + 4x + 5} + x + 2\right| + C$

Hint: Complete the Square

F. $\int \frac{x^4 + 1}{x^2 - 1} dx$ Ans: $\frac{1}{3}x^3 + x + \ln\left|\frac{x-1}{x+1}\right| + C$

Hint: Long Division

G. Page 627 -- Study Theorem 8.8

8.4 -- 1, 2, 9, 11, 13

H. $\int_1^2 e^{-x^2} \, dx$ [Use anything in your lecture notes.]

I. **9.3** -- 29, 31, 37

J. a. Find the first **4** terms of the Taylor Series for $f(x) = \sqrt{x}$ expanded around $a = 9$. [Use your notes on the series for $f(x) = \sqrt[3]{x}$.]

b. Let $x = 9$ in the Taylor Series you found in part a. You should get a result of 3.

c. Use your series to estimate $\sqrt{10}$.

d. Compare your answer in part c. to the calculator's version of $\sqrt{10}$. Does your series work well?

HW for Nov 13

8.4 -- 19, 21, 23,
25 (hard -- hint: the integral = 2/e),
29, 31, 33

8.5 -- 27, 31

1. $\int x e^x \, dx$ [Check by differentiation]

2. $\int_0^{e^{-2}} x e^4 dx$ Ans: $\frac{1}{2}$

3. Prove that $\int \cos^2 \theta \, d\theta = \dfrac{\theta + \sin\theta\cos\theta}{2} + C$

4. $\int \sin^2 \theta \, d\theta$ [Check by differentiation]

5. What does The Divergence Test say about each series?

   a. $\displaystyle\sum_{k=1}^{\infty} \frac{3k}{k-2}$ b. $\displaystyle\sum_{k=0}^{\infty} \frac{1}{\pi^k}$

6. Rewrite the series $\displaystyle\sum_{k=0}^{\infty} \frac{(-1)^k}{2k!} x^{2k+1}$ so that the series starts at $k = 3$.

7. The Harmonic Series is a special case of a _____ series, with ___ = ____.

8. Which geometric series converges: $\sum 0.9^k$ or $\sum 1.1^k$? Why?

9. Determine whether each series converges or diverges. If it's a geometric series, find its sum.

a. $\sum_{k=12}^{\infty}\left(\frac{1}{\sqrt{k}}\right)$

b. $\sum_{k=3}^{\infty}\left(\frac{1}{2}\right)^k$

c. $\sum_{k=1}^{\infty}\left(\frac{e}{2\pi}\right)^k$

d. $\sum_{k=1}^{\infty}\left(\frac{1}{k}\right)^{5/2}$

10. Basic Comparison Test:

a. $\sum_{k=1}^{\infty}\frac{1}{k^3+8}$

b. $\sum_{k=1}^{\infty}\frac{1}{\sqrt[3]{k-5}}$

c. Why doesn't the Basic Comparison Test easily apply to the series $\sum_{k=1}^{\infty}\frac{1}{k\sqrt{k}-7}$?

11. Use The Integral Test to prove that the p-series $\sum_{k=1}^{\infty}\frac{1}{k^2}$ converges.

12. For each problem, the answer is either

i) Converges, ii) Diverges, or iii) Cannot be determined

a. If $\sum_{k=1}^{\infty} a_k$ diverges, then $\sum_{k=123}^{\infty} a_k$ _____

b. If $\sum a_k$ diverges, and $a_n \le b_n$, then $\sum b_k$ _____

c. If $\sum a_k$ converges, and $a_n \le b_n$, then $\sum b_k$ _____

d. If $\sum b_k$ diverges, and $a_n \le b_n$, then $\sum a_k$ _____

e. If $\sum b_k$ converges, and $a_n \le b_n$, then $\sum a_k$ _____

HW for Nov 18

A. The Divergence Test

1. Version 1: If $\sum a_k$ converges, then $\lim a_k$ = __________

2. Version 2: If $\lim a_k \neq 0$, then $\sum a_k$ __________

3. T/F: If $\sum a_k$ diverges, then $\lim a_k \neq 0$.

   PROVE your answer.

4. T/F: If $\lim a_k = 0$, then $\sum a_k$ converges.

   PROVE your answer.

B. Prove, in two different ways, that the Harmonic Series diverges. [No need for all that stuff with the fractions 1/2, 1/4, etc.]

C. 8.5 -- 9, 11, 13, 15, 17

1. a. Use The Ratio Test to analyze $\sum \frac{k}{k^2+4}$

   b. Now prove that the series diverges.

2. Use The Ratio Test to analyze $\sum \frac{k^2+4}{e^k}$.

D. The Basic Comparison Test

1. $\sum \frac{1}{k^3+\pi}$
2. $\sum \frac{1}{\sqrt{k-7}}$
3. $\sum \frac{1}{\sqrt[3]{k-e}}$
4. $\sum \frac{1}{k^3+k}$
5. $\sum \frac{1}{k+10}$

E. Prove: If $\boldsymbol{r} = 1$ in The Ratio Test, no conclusion can be drawn.

F. 1. Use the table method to find the Maclaurin Series for

$f(x) = \ln(1+x)$.

2. Use your series above to express $\mathbf{\ln 4}$ as an infinite series.

3. Use the first five terms to approximate $\mathbf{\ln 4}$.

G. Prove that the **area** of the region enclosed by the functions

$$y = 2x^2 - 3 \text{ and } y = 9 - x^2$$

is **32** square units.

H. The acceleration of an object moving on the x-axis is given by

$$\boldsymbol{a(t) = 12t + 6}$$

Find the position function $\boldsymbol{s}$ if $s(0) = 0$ and $v(0) = 6$ (where v is the velocity).

HW for Nov 20

10.1 11–23 Odd, 37, 39, 45

1. Does the pair of parametric equations

$$x = e^t$$
$$y = e^{2t} \qquad -\infty < t < \infty$$

represent the parabola $y = x^2$? PROVE your answer.

2. $\int \frac{1}{1-\sin 2x}\,dx$ Ans: $\frac{1}{2}(\sec 2x + \tan 2x) + C$

Hint: ***conjugate***

3. $\int_{-2}^{0} \frac{x^2 - 10}{x+3}\,dx$ Ans: $-8 - \ln 3$

4. The position function is $s(t) = \sin^2 t + e^{5t}$. Find the acceleration function $a(t)$.

5. Show that $\int_0^{\pi/2} \frac{\sin^3 x}{\sqrt{\cos x}}\,dx = \frac{8}{5}$.

6. Let $y = x^{3/2}$. Find the arc length (the length of the curve) over the interval $1 \le x \le 4$.

Ans: $\frac{1}{27}\left(80\sqrt{10} - 13\sqrt{13}\right)$