Student: ____________________ **Date:** ____________________	**Instructor:** Sheila Tabanli **Course:** Math 136	**Assignment:** Midterm#3

I pledge that I will not use any notes, text, or other reference materials during this assignment. I pledge that I will neither give nor receive any aid from any other person during this assignment, and that the work presented here is entirely my own.

______________________________ Signature ______________________________ Date

1. RUTGERS UNIVERSITY MIDTERM#3 COPYRIGHT 2020

You must show work and submit your scrap work to earn credit for this question.

Jason evaluated the following improper integral and stated that it converges to -6. Show work and explain in your own words (by using mathematical concepts, symbols and notations taught in Math 136) if Jason is correct or not.

$$\int_8^{\infty} \frac{dx}{\sqrt[3]{x}}$$

I understand that I must submit my scrap work to earn credit for this question.

- ○ He is not correct and my scrap work shows the series diverges.
- ○ He is correct and my scrap work shows the series converges to -6.

2. RUTGERS UNIVERSITY MIDTERM#3 COPYRIGHT 2020

No scrap work is needed for this question.

Determine whether $\sum_{k=2}^{\infty} \frac{1}{\sqrt{k}-1}$ converges using the Comparison Test with the comparison series $\sum_{k=1}^{\infty} \frac{1}{\sqrt{k}}$.

The given series $\sum_{k=2}^{\infty} \frac{1}{\sqrt{k}-1}$ (1) __________ because $\frac{1}{\sqrt{k}-1}$ (2) __________ $\frac{1}{\sqrt{k}}$ for $k > 2$ and the series $\sum_{k=1}^{\infty} \frac{1}{\sqrt{k}}$ (3) __________ by the (4) __________

(1) ○ converges ○ diverges

(2) ○ $\le$ ○ $\ge$

(3) ○ converges ○ diverges

(4) ○ properties of the p-series. ○ properties of telescoping series. ○ Integral Test. ○ properties of geometric series. ○ Divergence Test.

3. RUTGERS UNIVERSITY MIDTERM#3 COPYRIGHT 2020

You must show work and submit your scrap work to earn credit for this question.

Consider the following infinite series. Complete parts (a) through (c) below.

$$\sum_{k=1}^{\infty} \frac{4}{(2k-1)(2k+1)}$$

a. Find the first three partial sums S_1, S_2, and S_3 of the series.

$S_1 =$ ______ $S_2 =$ ______ $S_3 =$ ______

(Type integers or simplified fractions.)

b. Find a formula for the nth partial sum S_n of the infinite series.

$S_n =$ ______, $n \geq 1$

Use the formula to find the next three partial sums S_5, S_6, and S_7 of the infinite series.

$S_5 =$ ______ $S_6 =$ ______ $S_7 =$ ______

(Type integers or simplified fractions.)

c. Make a conjecture for the value of the series. Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

- **A.** The value of the infinite series is ______. (Type an integer or a simplified fraction.)
- **B.** The infinite series has no value.

4. RUTGERS UNIVERSITY MIDTERM#3 COPYRIGHT 2020

No scrap work is needed or this question.

If $\sum_{k=1}^{\infty} a_k = 10{,}000$ is true, then what can be said about $\lim_{k \to \infty} a_k$?

Choose the correct answer below.

- **A.** By the divergence test, $\lim_{k \to \infty} a_k = 0$.
- **B.** By the divergence test, the series diverges.
- **C.** The series only has positive terms.
- **D.** By the divergence test, $\lim_{k \to \infty} a_k \neq 0$.

5. RUTGERS UNIVERSITY MIDTERM#3 COPYRIGHT 2020

You must show work and submit your scrap work to earn credit for this question.

For what values of b, does the series $\sum_{k=1}^{\infty} \left(\frac{1}{k}\right)^{\frac{b}{5}}$ converge?

My scrap paper clearly shows the correct answer as below.

- **A.** 2Π, 8
- **B.** 5, $\frac{1}{2}$
- **C.** 0, 12
- **D.** $\frac{1}{5}$, e^{-1}

6. RUTGERS UNIVERSITY MIDTERM#3 COPYRIGHT 2020

No scrap work is needed or this question.

Explain how the Limit Comparison Test works.

Choose the correct answer below.

- **A.** Find an appropriate comparison series. Then evaluate the ratio of the terms of the given series and the comparison series. This value determines whether the series converges.
- **B.** Find an appropriate comparison series. Then determine whether the terms of the given series are less than or equal to or greater than or equal to for all large values of k. This comparison determines whether the series converges.
- **C.** Find an appropriate comparison series. Then determine whether the terms of the given series are less than or equal to or greater than or equal to for all values of k. This comparison determines whether the series converges.
- **D.** Find an appropriate comparison series. Then take the limit of the ratio of the terms of the given series and the comparison series as $k \to \infty$. The series converges if the limit is 0 and the comparison series converges.
- **E.** Find an appropriate comparison series. Then take the limit of the ratio of the terms of the given series and the comparison series as $k \to \infty$. The value of the limit determines whether the series converges.

7. RUTGERS UNIVERSITY MIDTERM#3 COPYRIGHT 2020

You must show work and submit your scrap work to earn credit for this question.

Use the integral test to determine whether the series converges or diverges.

$$\sum_{n=1}^{\infty} \frac{5}{\sqrt{n}}$$

My scrap paper clearly shows the work to support my correct answer as below.

- diverges
- converges

In addition to the integral test there is at least one more divergence/convergence test that can be used to draw the same conclusion.

- True
- False

If you answered "True" to the previous question, on your scrap paper, write down the name of this "other" test and explain in 2-3 sentences how this test can be used to draw the same conclusion.

8. RUTGERS UNIVERSITY MIDTERM#3 COPYRIGHT 2020

You must show work and submit your scrap work to earn credit for this question.

Determine if the series converges or diverges. If the series converges, find its sum.

$$\sum_{n=1}^{\infty} \left(\frac{1}{\sqrt{n+1}} - \frac{1}{\sqrt{n+2}} \right)$$

My scrap paper clearly shows the work to support my correct answer as below.

- **A.** The series converges. Its sum is $\frac{1}{\sqrt{3}}$.
- **B.** The series converges. Its sum is $\frac{1}{\sqrt{6}}$.
- **C.** The series converges. Its sum is $\frac{1}{\sqrt{2}}$.
- **D.** The series diverges.

9. RUTGERS UNIVERSITY MIDTERM#3 COPYRIGHT 2020

You must show work and submit your scrap work to earn credit for this question.

Find the limit of the following sequence or determine that the sequence diverges.

$$\left\{\left(1+\frac{2}{n}\right)^{4n}\right\}$$

My scrap paper clearly shows the work to support my correct answer as below.

- **A.** The limit of the sequence is __________. (Type an exact answer.)
- **B.** The sequence diverges.

10. RUTGERS UNIVERSITY MIDTERM#3 COPYRIGHT 2020

You must show work and submit your scrap work to earn credit for this question.

Answer the following questions about the series below:

$$\sum_{k=0}^{\infty} (-1)^k \frac{8}{3^k}$$

I found out that the series converge (or diverge) by using the test of:

- **A.** Root Test
- **B.** Divergence Test
- **C.** Alternating Series
- **D.** p-series

The terms of the series are:

- **A.** nondecreasing in magnitude
- **B.** increasing in magnitude
- **C.** decreasing in magnitude
- **D.** bounded

The limit of a_k as *k* approaches to infinity is

- **A.** $-\infty$
- **B.** ∞
- **C.** 0

Evaluate the series (if applicable).

- **A.** None of the other choices since this is a divergent series
- **B.** 2
- **C.** 12
- **D.** 4
- **E.** 6

11. RUTGERS UNIVERSITY MIDTERM#3 COPYRIGHT 2020

You must show work and submit your scrap work to earn credit for this question.

Determine how many terms of the following convergent series must be summed to be sure that the remainder is less than 10^{-2} in magnitude.

$$\sum_{k=1}^{\infty} \frac{(-1)^{k+1}}{k^6}$$

My scrap paper clearly shows the correct answer as below.

The number of terms that must be summed is _________.
(Round up to the nearest integer as needed.)

1. He is not correct and my scrap work shows the series diverges.

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2. (1) diverges

   (2) ≥

   (3) diverges

   (4) properties of the p-series.

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3. $\frac{4}{3}$

   $\frac{8}{5}$

   $\frac{12}{7}$

   $\frac{4n}{2n+1}$

   $\frac{20}{11}$

   $\frac{24}{13}$

   $\frac{28}{15}$

   A. The value of the infinite series is **2**. (Type an integer or a simplified fraction.)

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4. A. By the divergence test, $\lim_{k \to \infty} a_k = 0$.

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5. A. 2Π, 8

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6. E.
   Find an appropriate comparison series. Then take the limit of the ratio of the terms of the given series and the comparison series as $k \to \infty$. The value of the limit determines whether the series converges.

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7. diverges

   True

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8. C. The series converges. Its sum is $\frac{1}{\sqrt{2}}$.

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9. A. The limit of the sequence is e^{8}. (Type an exact answer.)

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10. C. Alternating Series

C. decreasing in magnitude

C. 0

E. 6

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11. 2
