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001

Math 113 Exam 3

Nov 18, 2016
(Late Day: Nov 22, 2016)

Name: _____

Section: _____

Instructor: _____

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Instructions

- I) Do not write on the barcode area at the top of each page, or near the four circles on each page.
- II) Fill in the correct boxes for your BYU ID and for the correct answer on the multiple choice completely. Multiple choice questions are 5 points each.
- III) For questions which require a written answer, show all your work in the space provided and justify your answer.
- IV) Simplify your answers.
- V) No books, notes, or calculators of any type are allowed.
- VI) There is no time limit on this exam.



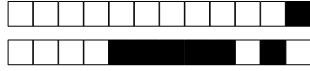
Part I: Multiple Choice Questions: *Mark the correct answer. (5 points each)*

1 Determine the radius of convergence of the power series $\sum_{n=0}^{\infty} \frac{nx^{2n-1}}{4^n}$

- 4
- $\frac{1}{4}$
- 1
- ∞
- 3
- $\frac{1}{2}$
- 2
- 0

2 Determine which **ONE** of the following series is conditionally convergent (i.e. convergent but not absolutely convergent).

- $\sum_{n=2}^{\infty} \frac{(-1)^{2n}}{n+1}$
- $\sum_{n=3}^{\infty} \frac{(-1)^n}{n^2 - n}$
- $\sum_{n=1}^{\infty} \ln\left(\frac{1}{n}\right)$
- $\sum_{n=1}^{\infty} \frac{\sin(n)}{3^n}$
- $\sum_{n=1}^{\infty} \frac{n(-1)^n}{n^2 + 5n + 1}$



3 Find all the values of p for which the series

$$\sum_{n=2}^{\infty} \frac{1}{n(\ln n)^p}$$

is convergent.

- $p \geq 1$
- Diverges for all p
- $p \geq 2$
- $p > 1$
- $p > 2$
- $p > e$
- $0 < p \leq 1$
- $0 < p < 1$

4 For the series $\sum_{n=1}^{\infty} \frac{(-1)^{n-1}}{(2n)!}$ find the smallest n such that the alternating series estimation theorem ensures a remainder less than .001.

- 3
- 1
- 5
- None, since the series diverges.
- 2
- 4
- 6

5 Let $\sum_{n=0}^{\infty} c_n(x-3)^n$ be a power series. Suppose we know that the series converges at $x = 6$ and divergent when $x = -2$. Then at which of the following points do we know the series converges?

- $x=7$
- $x=9$
- $x=0$
- $x=1$
- $x=-1$



6 Which of the following is a **false** statement?

- If $\sum a_n$ and $\sum b_n$ have positive terms and $\lim_{n \rightarrow \infty} \frac{a_n}{b_n} = 1$, then either both series converge or both diverge.
- Let $\sum a_n$ and $\sum b_n$ have positive terms. If $\sum a_n$ is divergent and $a_n \leq b_n$ for all n , then $\sum b_n$ is divergent.
- Let $\sum a_n$ and $\sum b_n$ have positive terms. If $\sum b_n$ is divergent and $a_n \leq b_n$ for all n , then $\sum a_n$ is convergent.
- If $\lim_{n \rightarrow \infty} a_n$ does not exist or if $\lim_{n \rightarrow \infty} a_n \neq 0$, then the series $\sum_{n=1}^{\infty} a_n$ is divergent.
- If $\lim_{n \rightarrow \infty} \frac{|a_{n+1}|}{|a_n|} = L > 1$, then the sequence $\{a_n\}$ is divergent.

7 Exactly one of the following **sequences** diverges. Determine which one. In each case, the n -th term of the sequence is given.

- $a_n = \frac{5n^3 + 2}{n^3 - n}$
- $a_n = \frac{4^n}{1 + 7^n}$
- $a_n = \cos\left(\frac{n\pi}{n+3}\right)$
- $a_n = \frac{\ln n}{\ln 2n}$
- $a_n = \frac{\tan^{-1} n}{n}$
- $a_n = \frac{2n^2 - n}{\sqrt{n^3 + 3n^2}}$



8 Find a power series representation for $f(x) = \ln(1 - 3x)$.

$\sum_{n=0}^{\infty} \frac{x^{n+1}}{3^{n-1}(n+1)}$

$\sum_{n=0}^{\infty} \frac{x^{n+1}}{(-3)^n(n+1)}$

$\sum_{n=0}^{\infty} \frac{x^{n+1}}{3(n+1)}$

$\sum_{n=0}^{\infty} \frac{-(3^{n+1})x^{n+1}}{n+1}$

$\sum_{n=0}^{\infty} \frac{(-3)^n x^{n+1}}{n+1}$

$\sum_{n=0}^{\infty} \frac{3^n x^{n+1}}{n+1}$



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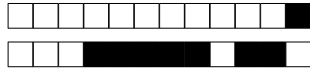
Part II: *Justify your answer and show all work for full credit.*

9 0 1 2 3 4 5 6 7 8 9 10 **DON'T MARK**

Below are two geometric series. Determine for each one, whether it **converges or diverges**, and, if convergent, **calculate the sum**.

1.
$$\sum_{n=1}^{\infty} \frac{4^{2n}}{6^{n-1}}$$

2.
$$\sum_{n=1}^{\infty} \frac{5 \cdot 2^{n-1}}{3^n}$$

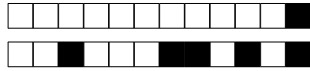


+1/7/54+

10 0 1 2 3 4 5 6 7 8 9 10 DON'T MARK

Estimate an upper bound of the error for the sum of the first 100 terms for the series

$$\sum_{n=1}^{\infty} \frac{3}{5 + n^5}$$



+1/8/53+

11 0 1 2 3 4 5 6 7 8 9 10 DON'T MARK

Below are series. Determine for each one, whether it **converges** or **diverges**. State the test you use and show your work.

1.
$$\sum_{n=1}^{\infty} \frac{2^n}{3^n n^3}$$

2.
$$\sum_{n=1}^{\infty} \left(\frac{-2n}{n+3} \right)^{5n}$$



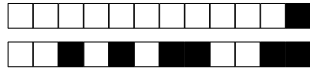
+1/9/52+

12 0 1 2 3 4 5 6 7 8 9 10 DON'T MARK

Below are series. Determine for each one, whether it **converges** or **diverges**. State the test you use and show your work.

1.
$$\sum_{n=1}^{\infty} ne^{-n^2}$$

2.
$$\sum_{n=2}^{\infty} \frac{n+1}{n^3-1}$$

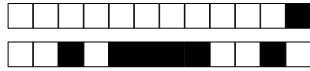


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Find the **interval** of convergence of the power series $\sum_{n=2}^{\infty} \frac{(x-2)^n}{\sqrt{n}-1}$.



+1/11/50+

14 0 1 2 3 4 5 6 7 8 9 10 DON'T MARK

Find a power series representation for

$$f(x) = \frac{1}{(2x - 1)^2}$$

and find the **radius** of convergence for the series.