

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 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. There is a blank page at the end of the exam. Be sure to indicate any work on it that you want graded.

Problem	Point Value	Points
1	15	
2	16	
3 (a)	8	
3 (b)	8	
3 (c)	8	
4	18	
5	7	
6	10	
7	10	
	100	

1. (15 points) Determine whether each of the following sequences converges or diverges. If the sequence converges, find the limit.

(a) $a_n = \frac{n^2 + 1}{(n + 1)^2}$

(b) $a_n = \frac{\cos(n)}{n}$

(c) $a_n = n^{2/n}$

2. (16 points) Determine the convergence or divergence of the following series. Justify your answer. State and check hypotheses of any test, rules or theorems you use. *If the series converges, find its sum.*

(a)
$$\sum_{k=1}^{\infty} \frac{3^k}{4^{k-1}}$$

(b)
$$\sum_{k=1}^{\infty} (\sqrt{k+1} - \sqrt{k})$$

3. (24 points) Determine the convergence or divergence of the series below. Justify your answer. State and check hypotheses of any test, rules or theorems you use. (8 point each)

(a)
$$\sum_{k=1}^{\infty} \frac{3 + \tan^{-1}(k)}{e^k}$$

(b)
$$\sum_{k=1}^{\infty} \frac{5^{k+1}}{k!}$$

Determine the convergence or divergence of the series below. Justify your answer. State and check hypotheses of any test, rules or theorems you use.

(c) $\sum_{k=1}^{\infty} \left(\frac{k+2}{5k-1} \right)^k$

4. (18 points) Determine whether each of the following series converges absolutely, conditionally, or diverges. Justify your answer. State and check hypotheses of any test, rules or theorems you use.

(a)
$$\sum_{k=1}^{\infty} (-1)^k \frac{k}{7k+1}$$

Determine whether the following series converges absolutely, conditionally, or diverges. Justify your answer. State and check hypotheses of any test, rules or theorems you use.

(b)
$$\sum_{k=1}^{\infty} (-1)^k \frac{\ln k}{k}$$

5. (7 points) The alternating series $\sum_{k=1}^{\infty} \frac{(-1)^k}{k^2+1}$ satisfies the conditions of the alternating series theorem. Estimate the value of the alternating series with an absolute error less than 0.1. Justify your work and simplify your answer.

6. (10 points) Quadratic Approximation

(a) Find the 2nd-order Taylor polynomial $p_2(x)$ for $f(x) = \sqrt{x+1}$ centered at $a = 0$.

(b) Use the polynomial you found to approximate $f(0.1)$. You do not have to simplify your answer.

7. (10 points) Find the radius of convergence and interval of convergence of the power series. You must show all work to receive full credit.

$$\sum_{k=1}^{\infty} \frac{2^k x^k}{\sqrt{k}}$$

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Name _____

Circle your section:

34-01 Xiaozhe Hu TWF 9:30-10:20

34-02 Cail Kaufmann TWF 9:30-10:20

34-03 Mary Glaser TThF 12-12:50

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

Signature _____