NAME (please print legibly): __________________________________________
Your University ID Number: _________________________________________
Your University email ________________________________________________

Pledge of Honesty
I affirm that I will not give or receive any unauthorized help on this exam and that all work
will be my own.

Signature: __________________________________________________________

• The use of calculators, cell phones, iPods and other electronic devices at
  this exam is strictly forbidden.

• Show your work and justify your answers. You may not receive full credit
  for a correct answer if insufficient work is shown or insufficient justification
  is given.

• Put your answers in the spaces provided.

• You are responsible for checking that this exam has all 9 pages.

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1. (9 points) Determine whether the following sequences converge. If they converge find their limit. **Justify and show all your work.**

(a) 
\[ a_n = \cos(n) \]

(b) 
\[ a_n = \sin \left( \frac{1}{n} \right) \]

(c) 
\[ a_n = \ln (2n + 3) - \ln (3n + 2) \]
2. (12 points) Determine whether the following sequences converge. If they converge find their limit. Justify and show all your work.

(a) 
\[ a_n = \frac{\sin(n)}{n^2} \]

(b) 
\[ a_n = \frac{\ln(n)}{n} \]

(c) 
\[ a_n = \frac{e^n}{n^2 + 1} \]
3. (10 points) Determine whether the following series converge or diverge and justify your answer. If they converge find their sum. **Justify and show all your work.**

(a) \[ \sum_{n=0}^{\infty} \left( -\frac{9}{5} \right)^n \]

(b) \[ \sum_{n=0}^{\infty} \frac{3^n + 4^n}{5^n} \]
4. (10 points) Determine whether the following series converge or diverge and justify your answer. If they converge find their sum. **Justify and show all your work.**

(a) \[
\sum_{n=1}^{\infty} \frac{1}{n(n + 1)}
\]

(b) \[
\sum_{n=1}^{\infty} e^{-n} - e^{-(n+1)}
\]
5. **(15 points)** Use the integral test to determine whether the following series converges or diverges. **To get full credit you must use the integral test.**

(a) \[ \sum_{n=1}^{\infty} \frac{1}{n} \]

(b) \[ \sum_{n=1}^{\infty} 3n^2 e^{-n^3} \]
6. **(16 points)** Use the comparison test or the limit comparison test to determine whether the following series converge or diverge. **To get full credit you must use the comparison test or the limit comparison test.**

(a) $$\sum_{n=1}^{\infty} \frac{5^n - n}{6^n + 9}$$

(b) $$\sum_{n=1}^{\infty} \frac{\arctan(n)}{n^{1.2}}$$
7. (14 points) Determine whether the following series converge or diverge. **Justify and show all your work.**

(a) 
\[ \sum_{n=1}^{\infty} \frac{n}{2n + 5} \]

(b) 
\[ \sum_{n=2}^{\infty} \frac{\sqrt{n}}{n - \sqrt{n}} \]
8. (14 points) Determine whether the following series converge or diverge. **Justify and show all your work.**

(a) 
\[ \sum_{n=1}^{\infty} \frac{n}{n^3 + 5n} \]

(b) 
\[ \sum_{n=1}^{\infty} \frac{\ln(n)}{n} \]