

# Calculus II

## Homework on Lecture 17

1. Find whether the series is convergent or divergent using an appropriate test. Some of the problems require the alternating series test. The test states the following.

**Alternating series test.** Suppose  $b_n \searrow 0$ . Then  $\sum (-1)^n b_n$  is convergent.

Here,  $b_n \searrow 0$  means the following.

- The sequence of numbers  $b_n$  is decreasing.
- The sequence decreases to 0, that is,

$$\lim_{n \rightarrow \infty} b_n = 0.$$

(a)  $\sum_{n=1}^{\infty} (-1)^n \ln n.$

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

(b)  $\sum_{n=2}^{\infty} \frac{(-1)^n}{\ln n}.$

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

2. (The last problem will NOT appear on the quiz) Use the integral test, the comparison test or the limit comparison test to determine whether the series is convergent or divergent. Justify your answer.

(a)  $\sum_{n=1}^{\infty} \frac{1}{2n+1}.$

(f)  $\sum_{n=2}^{\infty} \frac{1}{(2n+1) \ln(n)}.$

(b)  $\sum_{n=1}^{\infty} \frac{1}{2n^2 + n^3}.$

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

(c)  $\sum_{n=1}^{\infty} \frac{n^2 + 3}{3n^5 + n}$

(h)  $\sum_{n=2}^{\infty} \frac{1}{(2n+1)(\ln(n))^2}.$

(d)  $\sum_{n=0}^{\infty} \frac{1}{3^n + 5}.$

- (i) Determine all values of  $p, q, r$  for which the series

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

$$\sum_{n=30}^{\infty} \frac{1}{n^p (\ln n)^q (\ln(\ln n))^r}$$

is convergent.