

8. [12 points] For the following questions, determine if the statement is ALWAYS true, SOMETIMES true, or NEVER true, and circle the corresponding answer. Justification is not required.

a. [2 points] If a sequence  $a_n$  is monotone and bounded, then it converges.

Circle one:      **ALWAYS**                      **SOMETIMES**                      **NEVER**

b. [2 points] If a sequence  $b_n$  is bounded, then it is monotone.

Circle one:      **ALWAYS**                      **SOMETIMES**                      **NEVER**

c. [2 points] Let  $c_n$  be a sequence and  $g(x)$  be a function with  $g(n) = c_n$  for all  $n \geq 1$ . If  $\int_1^\infty g(x) dx$  diverges, then  $\sum_{n=1}^\infty c_n$  diverges.

Circle one:      **ALWAYS**                      **SOMETIMES**                      **NEVER**

d. [2 points] The sequence  $d_n$  has  $d_n \geq 0$  for  $n \geq 1$ . If  $\lim_{n \rightarrow \infty} d_n = 0$ , then  $\sum_{n=1}^\infty (-1)^n d_n$  converges.

Circle one:      **ALWAYS**                      **SOMETIMES**                      **NEVER**

e. [2 points] If  $a > 0$ , then the series  $\sum_{n=1}^\infty \ln(n^a)$  converges.

Circle one:      **ALWAYS**                      **SOMETIMES**                      **NEVER**

f. [2 points] The sequence  $k_n$  has  $k_n > 0$  for all  $n \geq 1$ . If  $\sum_{n=1}^\infty k_n$  converges, then  $\sum_{n=1}^\infty \ln(k_n)$  converges.

Circle one:      **ALWAYS**                      **SOMETIMES**                      **NEVER**