

Name: \_\_\_\_\_

ID: \_\_\_\_\_

1. (8 marks) Determine whether the sequence  $\{a_n\}$  converges or diverges. Find the limit of each convergent sequence.

(a)  $a_n = n \sin\left(\frac{\pi}{n}\right)$

(b)  $a_n = \frac{1}{n} \int_1^n \frac{1}{t} dt$

2. (12 marks) Determine whether the series converges or diverges. Find the sum of each convergent series.

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

(b)  $\sum_{n=1}^{\infty} \left( \tan^{-1}(n+1) - \tan^{-1}(n) \right)$

3. (Bonus) (5 marks) Find the value of  $b$  for which the series  $\sum_{n=0}^{\infty} 3^n(2+b)^{-n}$  converges to 4.