

1. [5 points] Let  $a_n$  be a sequence of positive numbers such that  $\sum_{n=1}^{\infty} a_n = 4$ , and let  $S_n$  be a sequence defined by  $S_n = a_1 + a_2 + \cdots + a_n$ . **No justification necessary.**
- a. [2 points] Find the following limits. Write DNE if the limit does not exist or is  $\infty$  or  $-\infty$ .

i.  $\lim_{n \rightarrow \infty} a_n =$  \_\_\_\_\_

ii.  $\lim_{n \rightarrow \infty} S_n =$  \_\_\_\_\_

- b. [3 points] Circle all statements which **must be true**.

i.  $a_n$  is increasing

iii.  $S_n$  is increasing

v.  $S_n$  is bounded

ii.  $a_n$  is decreasing

iv.  $S_n$  is decreasing

vi. None of these

2. [5 points] Calculate  $\int_0^{\infty} \frac{2}{1+x^2} dx$ . **Show all your work using correct notation.**  
Evaluation of integrals must be done **without a calculator**.