- **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 ∞ or $-\infty$.

i. $\lim_{n \to \infty} a_n =$ 0ii. $\lim_{n \to \infty} S_n =$ b. [3 points]
Circle <u>all</u> statements which **must be true**.i. a_n is increasingiii. S_n is increasingv. S_n is boundedii. a_n is decreasingiv. S_n is decreasingvi. 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.

Solution:

$$\int_0^\infty \frac{2}{1+x^2} dx = \lim_{b \to \infty} \int_0^b \frac{2}{1+x^2} dx$$
$$= \lim_{b \to \infty} 2 \arctan(x) \Big|_0^b$$
$$= \lim_{b \to \infty} 2 \arctan(b) - 2 \arctan(0)$$
$$= 2 \cdot \frac{\pi}{2} - 0$$
$$= \pi$$

page 2