7. [6 points] Determine whether the following improper integral converges or diverges. **Fully justify** your answer including using **proper notation**, and showing mechanics of any tests or theorems you use.

$$\int_0^1 \frac{\pi}{x^3 + \sqrt{x}} \, dx$$

8. [9 points] Consider the following 4 sequences.

$$(A) \quad a_n = (-1)^n, \qquad\qquad\qquad (B) \quad b_n = 3 \cdot (0.5)^n,$$

$$(C) \quad c_n = \sum_{k=1}^n \frac{1}{k}, \qquad\qquad\qquad (D) \quad d_n = \int_0^n \frac{x}{e^x} \, dx$$

For each of the following, write down the CAPITAL LETTER corresponding to each of the sequences that satisfy the given property. **No justification is required.**

a. [3 points] Which sequence(s) is/are bounded?

b. [3 points] Which sequence(s) is/are monotone?

c. [3 points] Which sequence(s) is/are convergent?