Name: _____              PID: _____        Section: _____

**Instructions.** Grading is based on method. SHOW ALL WORK.

1. (10 points) Prove that for all $n \geq 2$, $\dfrac{1}{\sqrt{1}} + \dfrac{1}{\sqrt{2}} + \cdots + \dfrac{1}{\sqrt{n}} > \sqrt{n}$. (*Hint:* To show the base case ($n = 2$), you must show that $1 + 1/\sqrt{2} > 2$. Recall that if $a, b$ are positive, then $a > b$ iff $a^2 > b^2$. So try showing that $a^2 - b^2 > 0$ for the appropriate choice of $a$ and $b$.)

2. (10 points) Use an $\varepsilon$-$N$ argument to prove

$$\lim_{n \to \infty} \frac{5n^2 - n}{n^2 + 2} = 5$$

3. (10 points) Suppose that $\{a_n\}$ is a convergent sequence, say $\lim_{n \to \infty} a_n = a$. If $a_n \leq b$ for all $n \in \mathbb{N}$, prove the following:

$$\text{(i)} \quad a \leq b$$

$$\text{(ii)} \quad a \leq \sup_n a_n$$