Problem 1. Let \( g(x) \) equal to \( \frac{1}{\sqrt{x}} \) on \([0,1]\) and \( g(x) = 0 \) elsewhere, including the point \( x = 0 \). Is \( g(x) \) Riemann integrable (you may want to read about improper integrals). Explain how you would compute the Lebesgue integral of the function. Compare the values of the two integrals.

Problem 2. Let \( W_n \) denote a random variable with mean \( \mu \) and variance \( b/n^p \), where \( p > 0 \), \( \mu \), and \( b \) are constants independent of \( n \). Prove that \( W_n \) converges in probability to \( \mu \).

Problem 3. Prove that almost sure convergence of a sequence of random variables \( X_n, n = 1,2,\ldots \) to a constant \( \mu \) is equivalent to the requirement that for every \( \epsilon > 0 \),

\[
\lim_{n \to \infty} P\{\sup_{k>n} |X_k - \mu| \geq \epsilon\} = 0.
\]

Also, show that

\[
\sum_{n=1}^{\infty} P\{|X_n - \mu| \geq \epsilon\} < \infty
\]

implies almost sure convergence.

Problem 4. Problems 2.5, 2.11, 2.13, 2.15 from the text.