1. Suppose $X_1, \ldots, X_p$ are i.i.d. $N(0,1)$. Let $\mathbf{X} = (X_1, \ldots, X_p)'$. Then $\|\mathbf{X}\| = \mathbf{X}'\mathbf{X} \sim \chi^2_p$. Prove that $E[\|\mathbf{X}\|^{-1}] = 1/(p-2)$.

2. YS (3.12): 3.6

3. YS (3.12): 3.3

4. YS (3.12): 3.13

5. W (12.9): 3

6. Suppose $X_i|\theta_i \sim$ Poisson(θ_i), $\theta_i \sim$ Gamma(k, σ), independently for $i = 1, \ldots, n$, with k known and σ unknown. Suppose that σ is estimated by maximizing the marginal likelihood for $X_1, \ldots, X_n$. Derive the empirical Bayes posterior mean for θ_i.