Homework 2

1. Review Theorem 5.4.6. You do not need to turn in anything for this problem. You will most likely use it for Casella and Berger problem 5.24
2. Refer to Theorem 5.2.11. Prove that the following families of distributions are or are not exponential families:
   a) Poisson
   b) Uniform
3. Exercise 5.17.
   a) Recall that $X = (U/p)/(V/q)$ with $U \sim \chi_p^2, V \sim \chi_q^2$, U, V independent. Start with the joint pdf of U, V. Use the Jacobian method of transformations to get X and a second, trivially transformed second variable. Multiply by 1 to get something inside the integral that looks like a Gamma random variable.
   b) Make heavy use of the fact that $X \sim F_{q,p}$ is equivalent to
   $$X = (U/p)/(V/q)$$
   with $U \sim \chi_p^2, V \sim \chi_q^2$, and U, V independent. Also, use multiplication by 1 (in a special way) to turn the integral of some nasty stuff into a chi-square or gamma distribution.
   c)
   d) Use Theorem 2.1.5.
4. Exercise 5.18 (a, b). You may use the result in b to simplify a.
5. Exercise 5.24
6. (**OPTIONAL**) Exercise 5.36 – this problem is not required, but it is good practice with (a) iterative expectations and variance (theorems 4.4.3 and 4.4.7), (b) an example where the delta method does <u>not</u> apply even though it looks like it should, and (c) calculations with moment generating functions using its mathematical definition (definition 2.3.6)
7. Exercise 5.44