Assignment 3

This assignment is due by the start of class on Tuesday, November 3.

1. Solve problem 4.5 (page 221) in the textbook.

2. Solve problem 4.8 (page 221) in the textbook.


4. Calculate one iteration of the Newton-Raphson method for minimizing the function \( f(x) = 3x_2^2 - 2x_1^3x_2 + x_1 \) where \( x = (x_1, x_2)^T \). Use \( x = (1, 1)^T \) as the initial value.

5. Consider a Bernoulli likelihood function, \( \text{Bern}(x|\mu) \), with a beta prior, \( \text{beta}(\mu|a,b) \), on \( \mu \). Develop a Gaussian approximation to \( p(\mu|x,a,b) \) using the Laplace approximation. First develop the formula in general and then apply it to the case \( a = 4, b = 2, x = 1 \). For this case, plot the approximation and the true function for \( 0 \leq \mu \leq 2 \).

6. Solve problem 2.59 (page 136) in the textbook. Then, starting with equation 4.118 (page 212), derive (i) equation 4.119 and (ii) the corresponding relationship for the variance,

\[
\text{Var}(t|\eta) = -s^2 \frac{d^2}{d\eta^2}\ln g(\eta)
\]