

BayesExam

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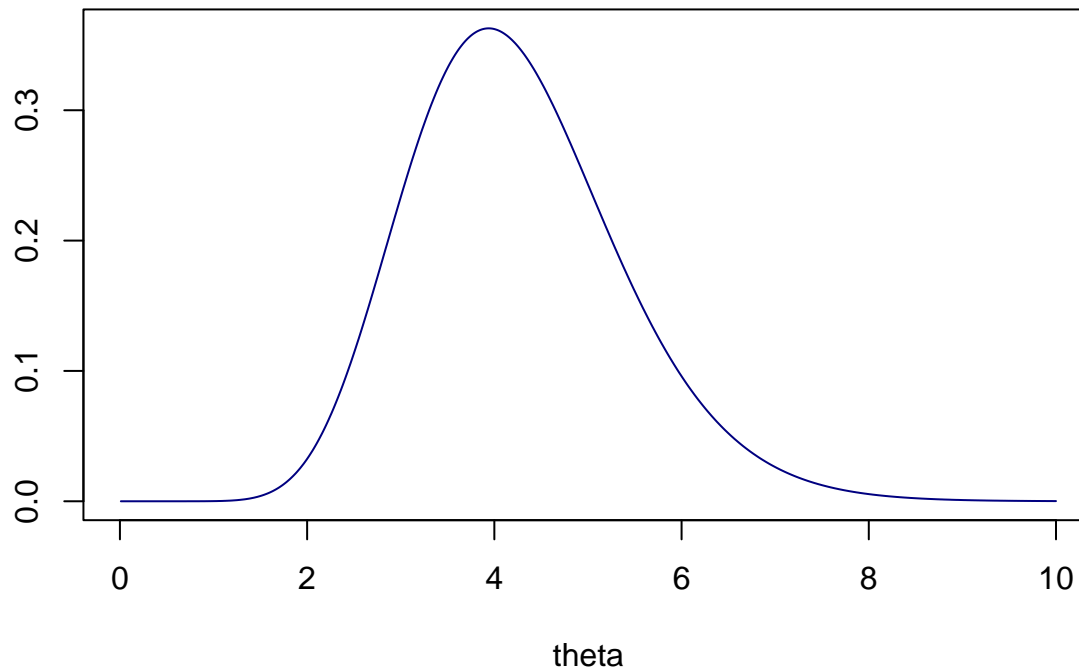
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Problem 2

Task d

```
LogPost <- function(theta,n,sumx2){  
  res <- n*log(theta) - theta*(0.5 + sumx2)  
  return(res)  
}  
  
thetaGrid <- seq(0.01,10,0.01)  
n <- 13  
sumx2 <- 2.8  
  
PostDens_propto <- exp(LogPost(thetaGrid,n,sumx2))  
PostDens <- PostDens_propto/(0.01*sum(PostDens_propto))  
  
plot(thetaGrid, PostDens, type = "l", col = "navy",  
      main = "Posterior Distribution of theta",  
      xlab = "theta", ylab = "")
```

Posterior Distribution of theta



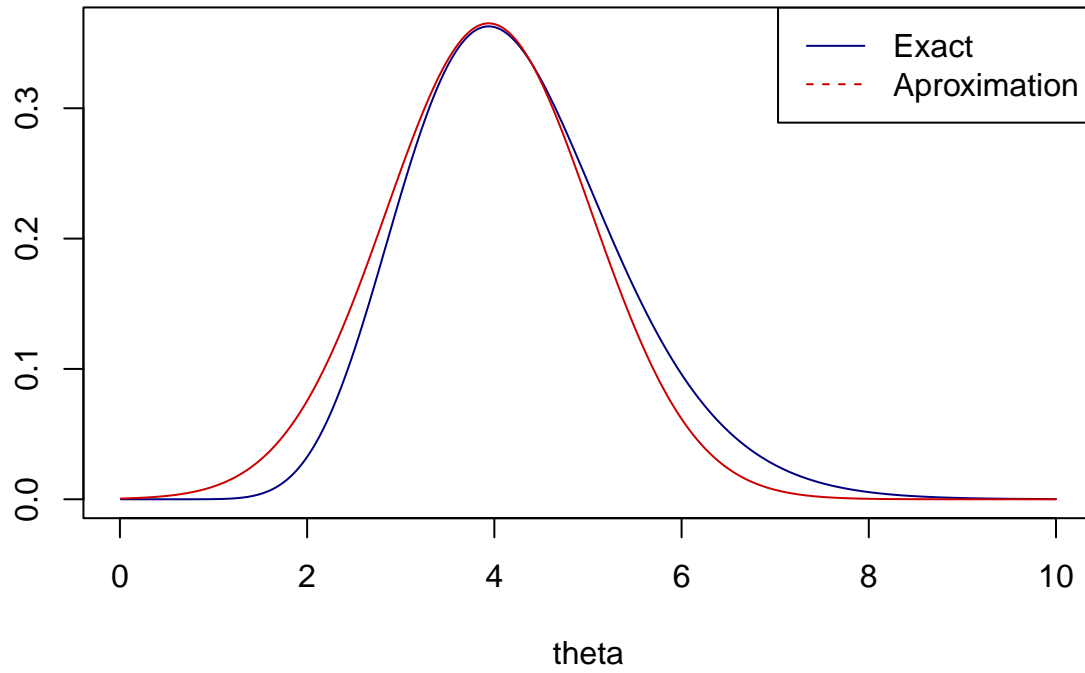
Task e

```
OptimRes <- optim(3, LogPost, gr = NULL, n, sumx2,
                 method = c("L-BFGS-B"), lower = 0.1,
                 control = list(fnscale = -1),
                 hessian = TRUE)

approx <- dnorm(thetaGrid, mean = OptimRes$par, sd = sqrt(diag(-solve(OptimRes$hessian))))

plot(thetaGrid, PostDens, type = "l", col = "navy",
     main = "Posterior Distribution of theta",
     xlab = "theta", ylab = "")
lines(thetaGrid, approx, type = "l", col = "red3")
legend("topright", legend = c("Exact", "Aproximation"),
     col = c("navy", "red3"), lty = 1:2)
```

Posterior Distribution of theta



The posterior approximation is accurated, but the exact posterior is slightly skewed to the right.