HW\_2\_1b.R

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library(ggplot2)  
  
df <- 10   
mean\_W <- df   
var\_W <- 2 \* df   
  
  
n\_sim <- 10000   
n\_samples <- 10   
  
W\_samples <- replicate(n\_sim, {  
 X <- rnorm(n\_samples, mean = 5, sd = sqrt(8))  
 Z <- (X - 5) / sqrt(8)  
 sum(Z^2)  
})  
  
mean\_sim\_W <- mean(W\_samples)  
var\_sim\_W <- var(W\_samples)  
prop\_6\_to\_9 <- mean(W\_samples > 6 & W\_samples < 9)  
  
cat("Simulation results:\n")

## Simulation results:

cat("Mean of sampled W:", mean\_sim\_W, "\n")

## Mean of sampled W: 9.988358

cat("Variance of sampled W:", var\_sim\_W, "\n")

## Variance of sampled W: 19.44834

cat("Proportion of W values between 6 and 9:", prop\_6\_to\_9, "\n\n")

## Proportion of W values between 6 and 9: 0.2876

hist\_data <- data.frame(W = W\_samples)  
  
ggplot(hist\_data, aes(x = W)) +  
 geom\_histogram(aes(y = after\_stat(density)), bins = 50, color = "black", fill = "lightblue", alpha = 0.7) +  
 stat\_function(fun = dchisq, args = list(df = df), color = "red", linewidth = 1) +  
 labs(title = "Histogram of Simulated W with Chi-squared PDF",  
 x = "W",  
 y = "Density")

