ps10\_rmd

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### Q4 part(b)  
orthogonal <- read.csv('Orthogonal.txt', header = FALSE)  
orthogonal <- orthogonal[[1]]  
hist(orthogonal)  
plot(1:length(orthogonal), orthogonal)  
  
q0 <- function(x) {  
 (pi / 2)^(-1/2)  
}  
  
q1 <- function(x) {  
 x \* ((pi / 8)^(-1 / 2))  
}  
  
q2 <- function(x) {  
 ((x^2) - (1 / 4)) / (sqrt(pi / 32))  
}  
  
q3 <- function(x) {  
 ((x^3) - (x / 2)) / sqrt(pi / 128)  
}  
  
c0 <- mean(q0(orthogonal))  
c1 <- mean(q1(orthogonal))  
c2 <- mean(q2(orthogonal))  
c3 <- mean(q3(orthogonal))  
  
f <- function(x) {  
 # c0 \* q0(x) + c1 \* q1(x) + c2 \* q2(x)  
 c0 \* q0(x) + c1 \* q1(x) + c2 \* q2(x) + c3 \* q3(x)  
}  
  
xs <- seq(-1.5, 1.5, length.out = 1e2)  
plot(xs, f(xs), type = 'l', ylim = c(0, 1.5),  
 main = 'Graph of Estimated Function and True Function',  
 xlab = 'x', ylab = 'f(x)')  
lines(xs, dnorm(xs, mean = 0, sd = 0.3), col = 'red')  
legend("topright", legend = c('Estimated Function', 'True Function'),  
 col = c('black', 'red'), lty = c(1,1))  
  
### Q5  
# part (a)  
f <- function(x) {  
 if ((x >= -1) & (x <= 0)) {  
 (x + 1) + (x + 1)^3  
 } else if ((x > 0) & (x <= 1)) {  
 4 + (x - 1) + (x - 1)^3  
 } else {  
 0  
 }  
}  
  
xs <- seq(-1.1, 1.1, length.out = 1e4)  
f\_vec <- Vectorize(f)  
plot(xs, f\_vec(xs), type = 'l')  
  
# part (b)  
s0 <- function(x) {  
 (1 / 12) \* ((x - 1)^3) + (5 / 12) \* (x - 1) + (2 - x)  
}  
  
s1 <- function(x) {  
 (1 /12) \* ((3 - x)^3) + (1 / 3) \* (x - 2) + (5 / 12) \* (3 - x)  
}  
  
s2 <- function(x) {  
 (1 / 4) \* (x - 3) + (1 / 3) \* (4 - x)  
}  
  
s0(1)  
s0(2) == s1(2)  
s1(3) == s2(3)  
s2(4)  
  
b = 0.01  
x = c(seq(1,2,b), seq(2,3,b), seq(3,4,b))  
y = c(s0(seq(1,2,b)), s1(seq(2,3,b)), s2(seq(3,4,b)))  
plot(x,y, type = 'l')  
abline(v = 1, col='red')  
abline(v = 2, col='red')  
abline(v = 3, col='red')  
abline(v = 4, col='red')