```
# MTH 210 Lab 7 #

library(Matrix)

f <- function(x1, x2, gamma1, gamma2) {
  5 * (x1^2 + x2^2) + (gamma1 + gamma2) * x1 * x2
}

hessian <- function(gamma1, gamma2) {
  matrix(c(10, gamma1 + gamma2, gamma1 + gamma2, 10), nrow = 2)
}

is_convex <- function(gamma1, gamma2) {
  hess <- hessian(gamma1, gamma2)
  eigenvalues <- eigen(hess)$values
  all(eigenvalues >= 0)
}

gamma_values <- list(c(3, 3), c(7, 7), c(-3, 3))

results <- lapply(gamma_values, function(g) {
  convex <- is_convex(g[1], g[2])
  if (convex) {
    paste("For gamma1 =", g[1], "and gamma2 =", g[2], "the function is convex.")
  } else {
    paste("For gamma1 =", g[1], "and gamma2 =", g[2], "the function is not
convex.")
  }
})

results

#[[1]]
#[1] "For gamma1 = 3 and gamma2 = 3 the function is convex."
#[[2]]
#[1] "For gamma1 = 7 and gamma2 = 7 the function is not convex."
#[[3]]
#[1] "For gamma1 = -3 and gamma2 = 3 the function is convex."
```