

LAB-7

```
#Define a function to check convexity:
check_convexity <- function(gamma1, gamma2) {
  #Hessian matrix H
  H <- matrix(
    c(10, gamma1 + gamma2,
      gamma1 + gamma2, 10),
    nrow = 2, byrow = TRUE
  )

  #Extract the components of a 2x2 matrix:
  a <- H[1, 1]
  c_ <- H[1, 2]
  b <- H[2, 2]
  det_H <- a * b - c_^2    # = 100 - (gamma1 + gamma2)^2

  # Check conditions:
  # 1) a >= 0
  # 2) det(H) >= 0
  if (a >= 0 && det_H >= 0) {
    return(TRUE) # H is positive semidefinite -> f is convex
  } else {
    return(FALSE) # otherwise, not convex
  }
}

# Test the function for the three given cases:
gamma_values <- list(c(3,3), c(7,7), c(-3,3))

for (g in gamma_values) {
  gamma1 <- g[1]
  gamma2 <- g[2]
  is_cx <- check_convexity(gamma1, gamma2)
  cat(sprintf("gamma1 = %d, gamma2 = %d --> convex? %s\n",
              gamma1, gamma2, is_cx))
}
```

```
gamma1 = 3, gamma2 = 3 --> convex? TRUE
gamma1 = 7, gamma2 = 7 --> convex? FALSE
gamma1 = -3, gamma2 = 3 --> convex? TRUE
```