

1. Determine the value of the variables that will obtain an unconstrained local minimum of the following functions:

(a) $f(x_1, x_2) = (3x_1^2 + 12x_2^2 + 10x_1)^2 + (24x_1x_2 + 4x_2 + 3)^2$

(b) $f(x_1, x_2) = (10x_1^3 - 10x_1 - x_2 - 2)^2 + (2x_2^3 - 10x_2 - x_1 - 3)^2$

(c) $f(x_1, x_2) = (x_1^2 + x_2^2 - 2)^2 + (10x_1^2 - 10x_2 - 5x_1 + 1)^2$

(d) $f(x_1, x_2) = (x_1^2 + x_2 - 11)^2 + (x_1 + x_2^2 - 7)^2$

(e) $f(x_1, x_2) = -(x_1^3 + 12x_1x_2^2 + 2x_2^2 + 5x_1^2 + 3x_2)$