

ESM 1B, Homework 5

Due Date: 14:00 Wednesday, October 12.

Explain your answers! Problems marked (★) are bonus ones.

5.1. Find the local maxima, minima, and saddle points of the functions below:

(a) $f(x, y) = x^4 + y^4 - 4xy + 2$;

(b) $f(x, y) = e^y(y^2 - x^2)$.

5.2. Consider the point $p = (1, 2, 1)$ and the plane Π given by the equation $x + y - z = 1$.

(a) Express the distance of a point on the plane from p as a function of two variables.

(b) Find the point on the plane that is closest (i.e. minimizes the distance) to p and compute this minimum. Compare the result with the distance from p to Π .

5.3. A rectangular box *without* a lid is to be made to have volume 1 m^3 . Find the minimum surface area of this box.

5.4. Find all stationary points of the function

$$f(x, y) = x^3 - 6x^2 + 9x - y^3 + 3y + 4.$$

Determine the nature of the stationary points.