

MA110 - Engineering Mathematics-1
Problem Sheet - 6

Extreme Values and Saddle Points

1. Find all the local maxima, local minima, and saddle points of the following functions.

(a) $f(x, y) = \frac{1}{x^2+y^2-1}$

(c) $f(x, y) = y \sin x$

(b) $f(x, y) = \frac{1}{x} + xy + \frac{1}{y}$

(d) $f(x, y) = e^{2x} \cos y$

2. Find the absolute maxima and minima of the following functions on the given domain.

(a) $f(x, y) = x^2 + y^2$ on the closed triangular plate bounded by the lines $x = 0, y = 0, y + 2x = 2$ in the first quadrant.

(b) $T(x, y) = x^2 + xy + y^2 - 6x$ on the rectangular plate $0 \leq x \leq 5, -3 \leq y \leq 3$.

3. If $f_x(a, b) = f_y(a, b) = 0$, must f have a local maximum or minimum value at (a, b) ? Give reasons for your answer.

4. The temperature at a point (x, y) on a metal plate is $T(x, y) = 4x^2 - 4xy + y^2$. An ant on the plate walks around the circle of radius 5 centered at the origin. What are the highest and lowest temperatures encountered by the ant.

5. Find all the critical and saddle points of the function $f(x, y) = x^2 + xy + 3x + 2y + 5$.
