

Homework 5

Due on 8 August, 2013

You may solve any 4 of the 5 questions below correctly for full credit. But you are strongly encouraged to attempt all problems.

1

Find a parametric equation for the line tangent to the curve of intersection of the surfaces $xyz = 1$, $x^2 + 2y^2 + 3z^2 = 6$ at the point $(1, 1, 1)$.

2

Find the linearization $L(x, y)$ of $f(x, y) = x^2 - 3xy + 5$ at the point $(2, 1)$. Then find an upper bound for the magnitude $|E|$ of the error in the approximation $f(x, y) \approx L(x, y)$ over the rectangle R :

$$R : |x - 2| \leq 0.1, |y - 1| \leq 0.1$$

3

Identify the points of local minimum, local maximum, saddle points for $f(x, y) = 3x^3 + y^2 - 9x + 4y$ over \mathbb{R}^2 . Find the absolute maxima and minima for f on the rectangular region $0 \leq x \leq 5, -1 \leq y \leq 5$.

4

A space probe in the shape of the ellipsoid

$$4x^2 + y^2 + 4z^2 = 16$$

enters Earth's atmosphere and its surface begins to heat. After 1 hour, the temperature at the point (x, y, z) on the probe's surface is

$$T(x, y, z) = 8x^2 + 4yz - 16z + 600.$$

Find the hottest point on the probe's surface.

5

Sketch the region of integration on \mathbb{R}^2 and write an equivalent double integral with the order of integration reversed.

$$\text{i) } \int_0^2 \int_{y-2}^y dx \, dy, \quad \text{ii) } \int_0^1 \int_y^{\sqrt{y}} dx \, dy, \quad \text{iii) } \int_0^3 \int_1^{e^y} (x+y) \, dx \, dy$$