Calculus III Midterm II

April 6, 2001
9:00am

1. Let
$$F(x, y, z) = 3xz + ye^{-xz}.$$
a) In which direction is that directional derivative at $(1, 0, -1)$ maximal?
b) What is the directional derivative in that direction?

2. Find the critical points of the function
$$f(x, y) = x^3 + y^2 - 6xy - 6x^2$$
and classify as maximum, minimum or saddle points.

3. a) Find the volume of the solid in the first octant bounded by the planes
$$x = 0,\ y = 0,\ z = 0,\ x + 2y + z = 6.$$
b) Suppose the solid has density function $\rho(x, y, z) = 6 - x$. Find an integral to calculate mass of the solid. DO NOT EVALUTE.

4. Sketch the region of integration and change the order of integration, but DO NOT EVALUATE:
$$\int_0^3 \int_{\sqrt{y}}^3 f(x, y)dxdy$$

5. Find the surface area of the part of the paraboloid
$$z = x^2 + y^2$$
that lies under the plane $z = 9$.