Math 210 (Lesieutre)
Exam 2 review
March 15, 2017

Problem 1. Find the point on the plane $4x + 3y + z = 10$ nearest to $(2, 0, 1)$.

Problem 2. Write down an iterated triple integral that expresses the volume of the tetrahedron bounded by the xy-plane, the yz-plane, the xz-plane, and the plane $2x+4y+6z = 8$. Do not evaluate the integral.

Problem 3. Find the maximum value of the function x^2y such that (x, y) lies on the unit circle.

Problem 4. a) What is the tangent plane to the surface $x^2 + y^2 + z^2 = 9$ at the point $(1, 2, 2)$?

b) Consider the function $f(x, y) = x\sqrt{y}$. Use a linear approximation centered at $(1, 1)$ to approximate the value of $f(1.1, 1.2)$.

Problem 5. Let C be a cylinder between $z = 1$ and $z = 3$ with radius 2 and centered around the z-axis, and let R be the portion of this cylinder that lies above the second quadrant in the xy-plane. Suppose you want to integrate the function $2xyz$ over R. Set up the corresponding integral in cylindrical coordinates (you need not evaluate it).

Problem 6. Consider the double integral

$$\int_{x=0}^{1} \int_{y=x^2}^{x} 2y \, dy \, dx.$$

a) Evaluate the integral directly.

b) Sketch the region of integration, and switch the order of integration. (You do not need to evaluate the new integral.)

Problem 7. Consider the function $f(x, y) = x^2 - 2x + y^2$.

a) Find the critical points of $f(x, y)$ and classify the types of each.

b) Find the absolute maximum and minimum of $f(x, y)$ on or inside a circle of radius 2 centered at the origin.

Problem 8. Consider the cardioid $r = 1 + \cos\theta$. Use an integral in polar coordinates to compute the area of the portion of the cardioid that lies to the right of the y-axis.

Problem 9. Consider the region bounded by the planes $x = 0$, $x = 2$, $y = 1$, $y = 2$, and $z - 4x = 5$. Use a triple integral to compute the valume of the region.