

Third Examination
Thursday, October 8, 2009

Instructions: This exam should be done on your own paper. Your name should be on each sheet and on the back of the last sheet; the answers should appear written carefully and in order. If in doubt, show intermediate steps: Full credit may not be given, even for correct answers, unless work is arranged clearly and explained. This exam is closed book. You may leave after handing in your exam paper, but be sure to check your answers carefully. Each entire problem is worth 25 points. You may keep this question sheet.

1. For

$$f(x, y) = y^2 \cos(xy),$$

compute

$$(a) \frac{\partial f}{\partial x}, \quad (b) \frac{\partial f}{\partial y}, \quad (c) \frac{\partial^2 f}{\partial x^2}, \quad (d) \frac{\partial^2 f}{\partial y^2}, \quad \text{and} \quad (e) \frac{\partial^2 f}{\partial x \partial y}.$$

2. Suppose altitudes are being measured on the Great Plains, and that the elevation is measured to be 775 feet at point A , while at a point B 5 miles due north, the altitude is measured to be 800 feet, and at a point C 5 miles due east the altitude is measured to be 760 feet. What would you expect the altitude to be 10 miles southwest of point A ? Use gradient and dot product notation to write down your answer.

3. Write down an equation for the tangent plane to the function

$$f(x, y) = 775 - \frac{3}{2}(x + 1)^2 + 5(x + 1)y$$

at $(x, y) = (0, 0)$ and compute the value of z on the graph of the tangent plane at the point $(-10/\sqrt{2}, -10/\sqrt{2})$.

4. Write down an equation for the tangent plane to the surface

$$xyz = 1$$

at the point $(x, y, z) = (1, 1, 1)$.