Math 2313, Test II

Name _____

1. If $f(x,y,z) = e^{3x+3y-z^2}$,

   a. Find the gradient of f at $(1,2,3)$.
   answer: $< 3, 3, -6 >$

   b. Find the derivative of f at $(1,2,3)$ in the direction of the vector $< 0, 3, 4 >$.
   answer: -3

   c. In what direction is the directional derivative smallest, at the point $(1,2,3)$?
   answer: $(-3,-3,6)$

   d. Find the equation of the tangent plane to the surface $f(x,y,z) = 1$ at $(1,2,3)$.
   answer: $3x + 3y - 6z + 9 = 0$

2. If $f(x,y,z) = ln(x^2 + y^3 + z^4)$ find f_{xyz}.

   answer: $48xy^2z^3/(x^2 + y^3 + z^4)^3$

3. A cone initially has radius $r = 4$ and height $h = 5$, then the radius is increased to 4.01 and the height is decreased to 4.98. Given that the volume of a cone is $V = \frac{1}{3}\pi r^2 h$, calculate both

   a. The exact change in volume, ΔV, and

   answer: 0.08262

   b. The approximate change in volume, dV.

   answer: 0.08377

4. If $(U_x, U_y, U_z) = (3, 4, -1)$ at the point $(-3, 0, 2)$, find U_θ at this point. For cylindrical coordinates,

$$\begin{aligned} x &= r\ cos(\theta) \\ y &= r\ sin(\theta) \\ z &= z \end{aligned}$$

   answer: -12