SI Session: March 9th, 10th, & 11th, 2009
Mondays: 4:50 PM – 6:20 PM
Tuesdays: 1:30 PM – 3:00 PM
Wednesdays: 4:50 PM – 6:20 PM
Room 1245 SNAD

Prof. Stockton : Calculus III
Spring 2009
SI Leader : Neil Jody

[1] Find the directional derivative of the function at P in the direction of $\vec{v}$.

(a) $g(x,y)=\arccos xy,\ P(1,0),\ \vec{v}=\hat{i}+5\hat{j}$

(b) $h(x,y)=e^{-\left(x^2+y^2\right)},\ P(0,0),\ \vec{v}=\hat{i}+\hat{j}$

(c) $h(x,y,z)=xyz,\ P(2,1,1),\ \vec{v}=\langle 2,1,2\rangle$

[2] Find the directional derivative of the function at P in the direction of Q.

(a) $f(x,y)=\cos(x+y),\ P(0,\pi),\ Q\left(\frac{\pi}{2},0\right)$

(b) $g(x,y,z)=xye^{z},\ P(2,4,0),\ Q(0,0,0)$

[3] Find the direction of maximum increase of the function at the given point.

(a) $g(x,y)=ye^{-x^2},(0,5)$

(b) $w=xy^2z^2,(2,1,1)$

[4] The surface of a mountain is modeled by the equation $h(x,y)=5000-0.001x^2-0.004y^2$. A mountain climber is at the point $(500,300,4390)$. In what direction should the climber move in order to ascend at the greatest rate?

[5] A ground-dwelling cold hairy spider wants to get warm. The temperature at the point (x,y) is given by $T(x,y)=x^2-xy+2y^2$ (degrees Fahrenheit). If the spider is at the point (2,3), in which direction should it move to increase its temperature the fastest?

[6] At time $t = 0$ (seconds), a particle is ejected from the surface $x^2 + y^2 - z^2 = -1$ at the point $(1, 1, \sqrt{3})$ in a direction normal to the surface at a speed of 10 units per second. When and where does the particle cross the xy-plane?

[7] Find an equation of the tangent plane at the given point.

(a) $z = x^2 - 2xy + y^2, (1,2,1)$

(b) $x = y(2z-3), (4,4,2)$

[8] Find an equation of the plane tangent to the surface $xyz - 4xz^3 + y^3 = 10$ at the point $(-1, 2, 1)$. Then find the angle between this tangent plane and the xy-plane.

[9] Find the directional derivative of the function $f(x,y,z) = 3xz - 2xy^2$ at the point $(-1,1,2)$ in the direction from $(-1,1,2)$ to $(1,3,3)$.

[10] Let $f(x,y) = \sqrt{x^2 + y}$. Find an equation of the plane tangent to the graph of f at the point (–1, 3, 2).

[11] Find an equation of the tangent plane to the surface at the given point.

(a) $z = \arctan\left(\frac{y}{x}\right)$, $\left(1,1,\frac{\pi}{4}\right)$

[13] Find the gradient and the direction of maximum decrease at the given point.

(a) $z = e^{-x} \cos y, \quad \left(0, \frac{\pi}{4}\right)$

(b) $z = \frac{x^2}{x - y}, \quad (2,1)$

[14] Find an equation of the tangent plane and parametric equations of the line normal to the surface at the given point.

(a) $z = -9 + 4x - 6y - x^2 - y^2, \quad (2,-3,4)$

(b) $z=\sqrt{9-x^2-y^2},\ \left(1,2,2\right)$

[15] Find the critical points of the following functions.

(a) $f\left(x,y\right)=x^3-3xy+y^2$

(b) $f\left(x,y\right)=2x^2+6xy+9y^2+8x+14$

(c) $f(x,y) = xy + \frac{1}{x} + \frac{1}{y}$