MA 213 Worksheet #12

Sections 14.6-14.7
2/21/19

1 *14.6.10* $f(x,y,z) = y^2 e^{xyz}, \quad P(0,1,-1), \quad \mathbf{u} = \langle \frac{3}{13}, \frac{4}{13}, \frac{12}{13} \rangle$

(a) Find the gradient of f.

(b) Evaluate the gradient at the point P.

(c) Find the rate of change of f at P in the direction of the vector $\mathbf{u}$.

2 Find the directional derivative of the function at the given point in the direction of vector $\mathbf{v}$.
14.6.13 $g(s,t) = s\sqrt{t}, \quad (2,4), \quad \mathbf{v} = 2\mathbf{i} - \mathbf{j}$
14.6.15 $f(x,y,z) = x^2y + y^2z, \quad (1,2,3), \quad \mathbf{v} = \langle 2,-1,2 \rangle$

3 *14.6.33* Suppose that over a certain region of space the electrical potential V is given by $V(x,y,z) = 5x^2 - 3xy + xyz$.

(a) Find the rate of change of the potential at $P(3,4,5)$ in the direction of the vector $\mathbf{v} = \mathbf{i}+\mathbf{j}-\mathbf{k}$.

(b) In which direction does V change most rapidly at P?

(c) What is the maximum rate of change at P?

4 Find equations of (a) the tangent plane and (b) the normal line to the given surface at the specific point.
14.6.42 $x = y^2 + z^2 + 1, \qquad (3,1,-1)$
14.6.44 $xy + yz + zx = 5, \qquad (1,2,1)$

5 Find the local maximum and minimum values and saddle point(s) of the function.
14.7.5: $f(x,y) = x^2 + xy + y^2 + y$
14.7.7: $f(x,y) = (x-y)(1-xy)$
14.7.15: $f(x,y) = e^x \cos y$

6 Find the local maximum and minimum values and saddle point(s) of the function precisely, using calculus.
14.7.23: $f(x,y) = x^2 + y^2 + x^{-2}y^{-2}$
14.7.25: $f(x,y) = \sin x + \sin y + \sin(x+y), \qquad 0 \le x \le 2\pi, 0 \le y \le 2\pi$