

Math 21C
Vogler
Discussion Sheet 9

- 1.) Compute the derivative of $f(x, y) = x^2 + xy$ at the point $P = (1, -1)$ in the direction of vector $\vec{A} = \vec{i} - 2\vec{j}$.
- 2.) Compute the derivative of $f(x, y, z) = x - y^2 + z^3$ at the point $P = (2, 0, -1)$ in the direction of vector $\vec{A} = \vec{i} - \vec{j} + \vec{k}$.
- 3.) Consider the function $f(x, y) = xy^3$ and the point $P = (2, 1)$. Determine all unit vectors $\vec{u}$ so that $D_{\vec{u}}f(2, 1)$ is
 - a.) as large as possible.
 - b.) as small as possible.
 - c.) equal to zero.
 - d.) equal to 1.
- 4.) Consider the surface given by $x^2 + 2y^2 + 3z^2 = 3$ and the point $P = (1, -1, 0)$ on the surface. Find equations for
 - a.) the plane tangent to the surface at point P .
 - b.) the line normal (perpendicular) to the surface at point P .
- 5.) Consider the surface (hyperbolic paraboloid or saddle) given by $f(x, y) = 3x^2 - 2y^2 + 5$ and the point $P = (2, 3, -1)$ on the surface. Find equations for
 - a.) the plane tangent to the surface at point P .
 - b.) the line normal (perpendicular) to the surface at point P .
- 6.) Consider the function $f(x, y) = xe^{xy}$ and the point $P = (0, 1)$. Use a differential to estimate the change in the values of f if
 - a.) point P moves a distance of $ds = 0.15$ in the direction of vector $\vec{A} = 3\vec{i} - 4\vec{j}$.
 - b.) point P moves in a straight line to point $Q = (1, 0)$.
- 7.) Consider the function $f(x, y, z) = xy^2 + yz - x^3z$ and the point $P = (1, -1, 2)$. Use a differential to estimate the change in the values of f if point P moves a distance of $ds = 0.2$ in the direction of vector $\vec{A} = -\vec{i} - 2\vec{j} + 2\vec{k}$.
- 8.) Find and classify critical points as determining relative maximums, relative minimums, or saddle points.
 - a.) $z = 3x^2 - 6xy + y^2 + 12x - 16y + 1$
 - b.) $z = x^2y - x^2 - 2y^2$
 - c.) $z = x^2 - 8\ln(xy) + y^2$
 - d.) $z = 3x^2y - 6x^2 + y^3 - 6y^2$

“An education isn’t how much you have committed to memory, or even how much you know. It’s being able to differentiate between what you know and what you don’t.” – Anatole France