Math 21C
Kouba
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 $\overrightarrow{A} = \overrightarrow{i} - 2\overrightarrow{j}$.

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 $\overrightarrow{A} = \overrightarrow{i} - \overrightarrow{j} + \overrightarrow{k}$.

3.) Consider the function $f(x,y) = xy^3$ and the point $P = (2,1)$. Determine all unit vectors $\overrightarrow{u}$ so that $D_{\overrightarrow{u}} f(2,1)$ 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 $\overrightarrow{A} = 3\overrightarrow{i} - 4\overrightarrow{j}$.
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 $\overrightarrow{A} = -\overrightarrow{i} - 2\overrightarrow{j} + 2\overrightarrow{k}$.

8.) Consider the function given by $f(x,y) = xy^2 - x^2y$ and the point $P = (1,-1)$. Compute

a.) the exact change of f and
b.) use a differential to estimate the exact change of f

if point P moves in a straight line to point $Q = (1.5,-0.7)$.

9.) Consider the function given by $f(x,y) = \ln(3x + 4y^2)$ and the point $P = (5,2)$. Compute

a.) the exact change of f and
b.) use a differential to estimate the exact change of f

if point P moves a distance of $ds = 1.4$ in the direction of vector $\overrightarrow{A} = 5\overrightarrow{i} + 12\overrightarrow{j}$.

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"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