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MACHINE LEARNING
2019/04/04

HOMEWORK: PARTIAL DERIVATIVES

1. Find first partial derivatives f_x, f_y and f_z of the function $f(x, y, z) = e^{xy} \ln(z)$.

2. Find the second partial derivatives of the function $f(x, y) = x^3 + x^2y^3 - 2y^2$.

3. Find equation of the tangent line to the function $f(x, y) = x \cdot e^{xy}$ at the point $P(1, 0, f(1, 0))$.

4. Calculate Δz and dz for the function $z = x^2 + 3xy - y^2$
if x changes from 2.0 to 2.05 and y changes from 3.0 to 2.96.

5. The dimension of a rectangular box are 75, 60 and 40 centimeters.
If error of measurement is ± 0.2 cm, use total differential to estimate the error in volume.

6. If $z = e^x \cdot \sin(y)$, where $x = s \cdot t^2$ and $y = s^2tm$ find $\partial z/\partial s$ and $\partial z/\partial t$.

7. Find dy/dx if $x^3 + y^3 = 6xy$.

8. Find directional derivative $D_{\vec{u}} f(x, y)$ if $f(x, y) = x^3 - 3xy + 4y^2$ and $\vec{u}$ is given in polar coordinates as $\vec{u} = (1, \pi/6)$.

9. For function $f(x, y, z) = x \cdot \sin(yz)$ find gradient vector ∇f and
find directional derivative at point $P(1, 3, 0)$ in direction of $\vec{v} = \begin{bmatrix} 1 & 2 & -1 \end{bmatrix}^T$.

10. Find critical points of the function $f(x, y) = y^2 - x^2$.

11. Find the shortest distance of the point $A(1, 0, -2)$ to the plane $x + 2y + z = 4$.

12. Find the absolute maximum and minimum values of the function
$f(x, y) = x^2 - 2xy + 2y$ on the rectangle $R = \{(x, y) : 0 \leq x \leq 3, 0 \leq y \leq 2\}$.

13. Find extreme values of the function $f(x, y) = x^2 + 2y^2$
over circumference $x^2 + y^2 = 1$.

14. Find extreme values of the function $f(x, y) = x^2 + 2y^2$
over disc $x^2 + y^2 \leq 1$.

15. Find maximum value of the function $f(x, y, z) = x + 2y + 3z$ on the curve
of intersection of the plane $x - y + z = 1$ and the cylinder $x^2 + y^2 = 1$.