# Partial Derivatives- HW Problems

1. Find the partial derivatives $\frac{\partial f}{\partial x}$ and $\frac{\partial f}{\partial y}$.

a. $f(x, y) = x^2 + xy + y^2$

b. $f(x, y) = xe^{xy} - y\sin(x)$

c. $f(x, y) = xy[\ln(xy)]$

2. Find $\frac{\partial z}{\partial x}$ and $\frac{\partial z}{\partial y}$.

a. $z = \frac{xy}{x^2+y^2}$

b. $z = y\cos(x^2 + y^2)$

3. Find an equation of the tangent plane to $z = \sqrt{xy}$ at the point $(2, 8, 4)$.

4. Find an equation of the tangent plane to $z = \ln(x^2 + y^2)$ at the point $(1, 2, \ln(5))$.

5. Find an equation of the tangent plane to $f(x, y) = e^{xy}$ at $(0,3)$.

6. Calculate the matrix of partial derivatives for the following functions.

a. $f(x,y) = (\sin(xy), x^2 + y^2)$

b. $g(x,y,z) = (x^2 + y^2 + z^2, e^{xyz})$

c. $h(x,y,z) = (x^2 - y^2, y^2 - z^2, z^2 - x^2)$.

7. Find the tangent plane to $f(x,y) = ye^{xy}$ at $(0,1)$ and use it to approximate $f(0.1, 1.1)$.

8. Find an equation of the tangent plane to $f(x,y) = 2x^4 - y^3$ at $(1,2)$ and use it to approximate $f(1.1, 1.8)$.

9. Use the linear approximation to approximate $(0.9e^{0.1})^4$.

Calculate the gradient of the following functions.

10. $f(x,y) = \sin(x^2 + 2y^2)$

11. $g(x,y,z) = (z)[\tan(xy + yz)]$

12. Find $\nabla f(3,1,1)$ if $f(x,y,z) = y^2 e^{(xz - yz)}$.