(1) Find the gradient of $f(x, y) = \sin(2x + 3y)$.

(2) Find the rate of change of $f(x, y, z) = xe^{2yz}$ at the point $(3,0,2)$ in the direction $(2,-2,1)$.

(3) Find the directional derivative of $f(x, y) = x \sin(xy)$ at the point $(2,0)$ in the direction indicated by the angle $\theta = \pi/3$.

(4) Find the maximum rate of change of $f(p, q) = qe^{-p} + pe^{-q}$ at the point $(0,0)$ and the direction in which the maximum rate of change occurs.

(5) Find all points at which the direction of fastest change of the function $f(x, y) = x^2 + y^2 - 2x - 4y$ is $i + j$.

(6) Find all the directions in which the directional derivative of $f(x, y) = ye^{-xy}$ at the point $(0,2)$ has value 1.
(7) Find the equations of the tangent plane and the normal line to the surface $yz = \ln(x + z)$ at the point (0,0,1).

(8) Find the equation of the tangent plane for the surface $x - z = 4 \arctan(yz)$ at the point $(1 + \pi, 1, 1)$.

(9) Suppose you are climbing a hill whose shape is given by the equation $z = 1000 - 0.005x^2 - 0.01y^2$ where $x$, $y$, and $z$ are measured in meters, and you are standing at a point with coordinates $(60, 40, 966)$. The positive $x$-axis points east and the positive $y$-axis points north.

(a) If you walk due south will you start to ascend or descend?

(b) If you walk northwest, will you start to ascend or descend? At what rate?

(c) In which direction is the slope the largest? What is the rate of ascent in that direction? At what angle above the horizontal does that direction begin?

(10) Let $f$ be a function of two variables that has continuous partial derivatives and consider the points $A(1, 3), B(3, 3), C(1, 7), D(6, 15)$. The directional derivative of $f$ at $A$ in the direction of $\vec{AB}$ is 3 and the directional derivative at $A$ in the direction of $\vec{AC}$ is 26. Find the direction derivative of $f$ at $A$ in the direction of the vector $\vec{AD}$.