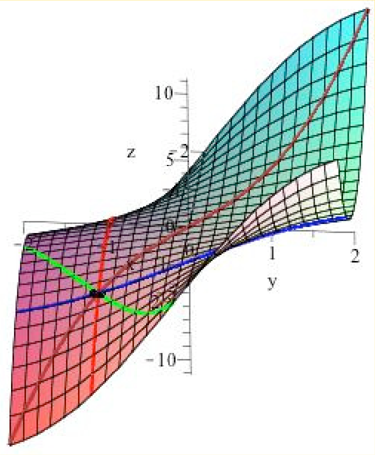
Intuition about Derivatives



Let $z = f(x, y)$.
An object at the point $(x_0, y_0, f(x_0, y_0))$ could move in any direction. If we move in one direction, the function will change in one way; if we move in a different direction, the function will change in a different way.

Thus at any given point, we have infinitely many rates of change, each depending on which direction we move in.

In other words, there will be infinitely many tangent lines, each heading off in different directions.

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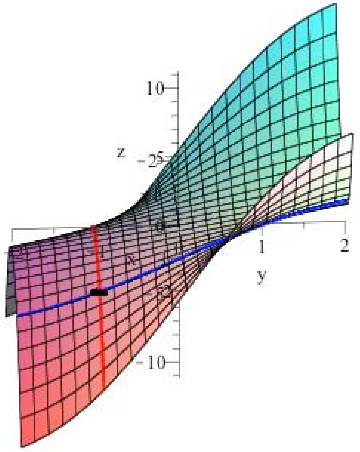
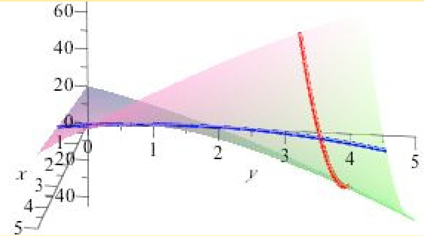


For now, we restrict our attention only to the x and y directions - that is, to moving in directions parallel to the x or the y axes.

Let $g(x, y) = x^2y + 4x + y^2 - 8y + xy + 20$.

1. Find $g_x(3, 4)$ and $g_y(3, 4)$. Look at the graph below and decide whether your results agree with what you're seeing.



2. Find all points where $g_x(x, y)$ and $g_y(x, y)$ are both zero. What is the significance of these points?

3. Find g_{xy} and g_{yx}.