

Math 241 Section 13.5: The Directional Derivative

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1. Recall that f_x means the change in f as x increases (in the \mathbf{i} direction) and likewise for f_y (in the \mathbf{j} direction) and f_z (in the \mathbf{k} direction) and so on. We might ask how f changes if we go in some other direction.
2. Defn: The directional derivative of f in the direction of the unit vector $\mathbf{u} = a\mathbf{i} + b\mathbf{j} + c\mathbf{k}$ is denoted $D_{\mathbf{u}}f$ and is defined by

$$D_{\mathbf{u}}f = af_x + bf_y + cf_z$$

Here the $+cf_z$ only appears in the 3D case.

Note: The phrase "directional derivative in the direction of" is used even when the vector is not a unit vector but you must make it a unit vector before using the formula.

Examples.