1. Recall that $f_x$ means the change in $f$ as $x$ increases (in the $i$ direction) and likewise for $f_y$ (in the $j$ direction) and $f_z$ (in the $k$ 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 $\mathbf{u} = ai + bj + ck$ 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.