1. Derivative

$$rac{df}{dx} = \lim_{\Delta x
ightarrow 0} rac{f(x + \Delta x) - f(x)}{\Delta x}$$

2. Gradient

$$abla = \left[egin{array}{c} rac{\delta f}{\delta x} \ rac{\delta f}{\delta y} \end{array}
ight]$$

 $\nabla \perp contour \ line$

3. Directional Derivative

$$D_u f = rac{\delta f}{\delta x} u_1 + rac{\delta f}{\delta y} u_2 =
abla \cdot u = |
abla||u|cos(heta)$$

$$D_u f = 0 <=> u//contour \, line$$

$$max(D_uf) = |
abla| <=> u//
abla <=> u \perp contour line$$

(as $max(cos\theta)=1$, achieved when $\theta=0$ and $ec{u}$ points in the same direction as the gradient)