

Directional Derivatives and the Gradient Vector

sps $f: \mathbb{R}^n \rightarrow \mathbb{R}$ and $\vec{v} \in \mathbb{R}^n$ is a unit vector.
 (Note: A red asterisk is above $\mathbb{R}^n$ and a blue wavy line labeled "domain" is under $\mathbb{R}^n$ in the original image.)

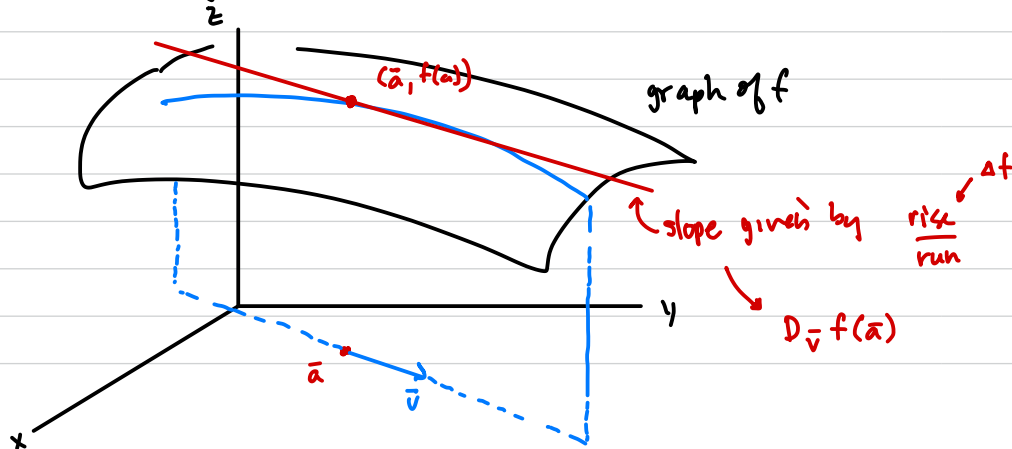
The directional derivative of f in the direction of $\vec{v}$ is:

$$D_{\vec{v}} f(\vec{a}) = \lim_{h \rightarrow 0} \frac{f(\vec{a} + h\vec{v}) - f(\vec{a})}{h}$$

(Note: A blue arrow points from the text "limit gives slope of tangent line." to the limit symbol. To the right, "rise of secant lines." points to the numerator and "run" points to the denominator.)

↳ how does f change as you move from $\vec{a}$ in direction of $\vec{v}$?

Geometrically: (special case $f: \mathbb{R}^2 \rightarrow \mathbb{R}$)



Ex $f: \mathbb{R}^2 \rightarrow \mathbb{R}$

$$\vec{i} = (1, 0)$$

$$\vec{j} = (0, 1)$$

$$D_{\vec{i}} f = \frac{\partial f}{\partial x}$$

$$D_{\vec{j}} f = \frac{\partial f}{\partial y}.$$