

14.5, number 11: Let $f(x, y) = 2xy - 3y^2$, $P = (5, 5)$, and $\vec{v} = 4\vec{i} + 3\vec{j}$. Find $D_{\vec{v}}f|_P$. (That is, find the directional derivative of f in the direction of \vec{v} at the point P .)

Answer:

$$\begin{aligned} D_{\vec{v}}f|_P &= \vec{\nabla} f|_P \cdot \frac{\vec{v}}{|\vec{v}|} \\ &= (2y\vec{i} + (2x - 6y)\vec{j})|_{(5,5)} \cdot \frac{4\vec{i} + 3\vec{j}}{\sqrt{16+9}} \\ &= (10\vec{i} - 20\vec{j}) \cdot \frac{4\vec{i} + 3\vec{j}}{5} \\ &= (2\vec{i} - 4\vec{j}) \cdot (4\vec{i} + 3\vec{j}) \\ &= 8 - 12 = \boxed{-4} \end{aligned}$$