Week 3 Q1

$f(x,y) = x^2y + y + \sin(xy)$ $\quad \vec{a} = (0,0)$ $\quad \vec{u} = (-1,2)\frac{1}{\sqrt{5}}$

$\nabla f = \left(\frac{\partial f}{\partial x}, \frac{\partial f}{\partial y}\right)$

$= (2xy + y\cos(xy),\ x^2 + 1 + x\cos(xy))$

$\nabla f(\vec{a}) = (2(0)(0) + (0)\cos(0(0)),\ (0)^2 + 1 + (0)\cos(0))$

$= (0, 1)$

$\nabla f(\vec{a}) \cdot u = (0,1) \cdot (-1,2)\frac{1}{\sqrt{5}}$

$= \frac{2}{\sqrt{5}}$

$D_{\vec{u}} f(\vec{a}) = \frac{2}{\sqrt{5}}$