1. $f(x) = xy^2z^3$

$v = (2,-1,-1) - (2,1,1)$

$= (0,-2,-2)$

$u = \frac{\langle 0,-2,-2\rangle}{\sqrt{0^2+(-2)^2+(-2)^2}} = \frac{\langle 0,-2,-2\rangle}{2\sqrt{2}}$

$= (0, -\frac{1}{\sqrt{2}}, -\frac{1}{\sqrt{2}})$

$f_x = y^2z^3$

$f_x(0, -\frac{1}{\sqrt{2}}, -\frac{1}{\sqrt{2}}) = (\frac{1}{2})\cdot(-\frac{1}{2\sqrt{2}}) = -\frac{1}{4\sqrt{2}}$

$f_y = 2xyz^3$

$f_y(0, \frac{1}{\sqrt{2}}, -\frac{1}{\sqrt{2}}) = 0$

$f_z = 3xy^2z^2$

$f_z(0, -\frac{1}{\sqrt{2}}, -\frac{1}{\sqrt{2}}) = 0$

$\nabla f = (-\frac{1}{4\sqrt{2}}, 0, 0)$

$\nabla f \cdot u = 0$

2. $f(x,y) = x^2+y^3$

$\nabla f(x,y) = \langle 2x, 3y^2\rangle$

$\nabla f(2,1) = \langle 4, 3\rangle$

$|\nabla f(2,1)| = \sqrt{4^2+3^2} = 5$