8:

$$f(x,y) = x^3 - 3xy + 4y^2 \qquad \vec{u} = (1, \pi/6)$$

$$D_u f(x,y) = f_x(x,y) \cos(\pi/6) + f_y(x,y) \sin(\pi/6)$$

$$f_x = 3x^2 - 3y \qquad f_y = 8y - 3x \qquad \cos(\pi/6) = 0.866$$
$$\sin(\pi/6) = 1/2$$

$$D_u f(x,y) = (3x^2 - 3y)\, 0.866 + \tfrac{1}{2}(8y - 3x)$$

$$= 2.598x^2 - 2.598y + 4y - 1.5x$$

$$\boxed{D_u f(x,y) = 2.598x^2 - 1.5x + 1.402y}$$

9: $f(x,y,z) = x \sin(yz)$

$$f_x = \sin(yz) \qquad f_y = xz\cos(yz) \qquad f_z = xy\cos(yz)$$

$$\boxed{\nabla f = \begin{bmatrix} \sin(yz) \\ xz\cos(yz) \\ xy\cos(yz) \end{bmatrix}} \qquad |\vec{v}| = \sqrt{1^2 + 2^2 (-1)^4} = \sqrt{6}$$

$$\vec{u} = \begin{bmatrix} 1/\sqrt{6} \\ 2/\sqrt{6} \\ -1/\sqrt{6} \end{bmatrix} \qquad P(1,3,0)$$

$$\nabla f(1,3,0) = \begin{bmatrix} \sin(0) \\ x z \cos(0) \\ xy\cos(0) \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 3 \end{bmatrix}$$

$$D_{\vec{u}}(1,3,0) = [0,0,3]\begin{bmatrix} 1/\sqrt{6} \\ 2/\sqrt{6} \\ -1/\sqrt{6} \end{bmatrix} = \frac{-3}{\sqrt{6}}$$

$$\boxed{D_{\vec{u}}(1,3,0) = \frac{-3}{\sqrt{6}}}$$