

$$1. f(x, y) = 5x + 2xy - 3y \quad P(3, 5) \quad \vec{v} = \frac{4}{5}\vec{i} + \frac{3}{5}\vec{j}$$

$$\textcircled{1} \quad \vec{u} = \frac{\vec{v}}{\|\vec{v}\|} = \frac{\frac{4}{5}\vec{i} + \frac{3}{5}\vec{j}}{\sqrt{\left(\frac{4}{5}\right)^2 + \left(\frac{3}{5}\right)^2}} = \frac{\frac{4}{5}\vec{i} + \frac{3}{5}\vec{j}}{\sqrt{\frac{16}{25} + \frac{9}{25}}} = \frac{4}{5}\vec{i} + \frac{3}{5}\vec{j}$$

$$\textcircled{2} \quad \nabla f(x, y) = f_x \vec{i} + f_y \vec{j} \\ = (5 + 2y)\vec{i} + (2x - 3)\vec{j}$$

$$\textcircled{3} \quad \nabla f(3, 5) = (5 + 2 \cdot 5)\vec{i} + (2 \cdot 3 - 3)\vec{j} \\ = 15\vec{i} + 3\vec{j}$$

$$\textcircled{4} \quad D_u f(3, 5) = \nabla f(3, 5) \cdot \vec{u} \\ = (15\vec{i} + 3\vec{j}) \cdot \left(\frac{4}{5}\vec{i} + \frac{3}{5}\vec{j}\right) \\ = 15\left(\frac{4}{5}\right) + 3\left(\frac{3}{5}\right) \\ = \frac{60}{5} + \frac{9}{5} \\ = \left(\frac{69}{5}\right)$$