

$$1. \quad \underbrace{5x - 2y + 3z}_f = \underline{\underline{0}} \quad (2, 5, 0)$$

$$3z = -5x + 2y$$

$$z = -\frac{5}{3}x + \frac{2}{3}y$$

$$\begin{aligned} \textcircled{1} \quad \nabla f(x, y, z) &= f_x \vec{i} + f_y \vec{j} + f_z \vec{k} \\ &= 5\vec{i} + (-2)\vec{j} + 3\vec{k} \\ &= 5\vec{i} - 2\vec{j} + 3\vec{k} \end{aligned}$$

$$\textcircled{2} \quad \nabla f \left(\begin{matrix} x \\ y \\ z \end{matrix} \right) = 5\vec{i} - 2\vec{j} + 3\vec{k}$$

$$\begin{aligned} \textcircled{3} \quad \|\nabla f(2, 5, 0)\| &= \sqrt{5^2 + (-2)^2 + 3^2} \\ &= \sqrt{25 + 4 + 9} \\ &= \sqrt{38} \end{aligned}$$

$$\begin{aligned} \textcircled{4} \quad \vec{n} &= \frac{\nabla f}{\|\nabla f\|} = \frac{5\vec{i} - 2\vec{j} + 3\vec{k}}{\sqrt{38}} = \frac{5}{\sqrt{38}}\vec{i} - \frac{2}{\sqrt{38}}\vec{j} + \frac{3}{\sqrt{38}}\vec{k} \\ &= \frac{5\sqrt{38}}{38}\vec{i} - \frac{2\sqrt{38}}{38}\vec{j} + \frac{3\sqrt{38}}{38}\vec{k} \\ &= \left(\frac{5\sqrt{38}}{38}\vec{i} - \frac{\sqrt{38}}{19}\vec{j} + \frac{3\sqrt{38}}{38}\vec{k} \right) \end{aligned}$$