

Problem 3.16 Given $\mathbf{B} = \hat{\mathbf{x}}(z - 3y) + \hat{\mathbf{y}}(2x - 3z) - \hat{\mathbf{z}}(x + y)$, find a unit vector parallel to \mathbf{B} at point $P = (1, 0, -1)$.

Solution: At $P = (1, 0, -1)$,

$$\mathbf{B} = \hat{\mathbf{x}}(-1) + \hat{\mathbf{y}}(2 + 3) - \hat{\mathbf{z}}(1) = -\hat{\mathbf{x}} + \hat{\mathbf{y}}5 - \hat{\mathbf{z}},$$

$$\hat{\mathbf{b}} = \frac{\mathbf{B}}{|\mathbf{B}|} = \frac{-\hat{\mathbf{x}} + \hat{\mathbf{y}}5 - \hat{\mathbf{z}}}{\sqrt{1 + 25 + 1}} = \frac{-\hat{\mathbf{x}} + \hat{\mathbf{y}}5 - \hat{\mathbf{z}}}{\sqrt{27}}.$$
