3.11 Find an expression for the unit vector directed toward the point P located on the z-axis at a height h above the x–y plane from an arbitrary point $Q = (x, y, -5)$ in the plane $z = -5$.

Solution: Point P is at $(0,0,h)$. Vector $\mathbf{A}$ from $Q = (x, y, -3)$ to $P = (0,0,h)$ is:

$$\mathbf{A} = \hat{\mathbf{x}}(0-x) + \hat{\mathbf{y}}(0-y) + \hat{\mathbf{z}}(h+5) = -\hat{\mathbf{x}}x - \hat{\mathbf{y}}y + \hat{\mathbf{z}}(h+5),$$

$$|\mathbf{A}| = [x^2 + y^2 + (h+5)^2]^{1/2},$$

$$\hat{\mathbf{a}} = \frac{\mathbf{A}}{|\mathbf{A}|} = \frac{-\hat{\mathbf{x}}x - \hat{\mathbf{y}}y + \hat{\mathbf{z}}(h+5)}{[x^2 + y^2 + (h+5)^2]^{1/2}}.$$