

**Problem 3.10** 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:

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

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

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

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