

**3.9** Find an expression for the unit vector directed toward the origin from an arbitrary point on the line described by  $x = 1$  and  $z = -3$ .

**Solution:** An arbitrary point on the given line is  $(1, y, -3)$ . The vector from this point to  $(0, 0, 0)$  is:

$$\mathbf{A} = \hat{\mathbf{x}}(0 - 1) + \hat{\mathbf{y}}(0 - y) + \hat{\mathbf{z}}(0 + 3) = -\hat{\mathbf{x}} - \hat{\mathbf{y}}y + 3\hat{\mathbf{z}},$$

$$|\mathbf{A}| = \sqrt{1 + y^2 + 9} = \sqrt{10 + y^2},$$

$$\hat{\mathbf{a}} = \frac{\mathbf{A}}{|\mathbf{A}|} = \frac{-\hat{\mathbf{x}} - \hat{\mathbf{y}}y + \hat{\mathbf{z}}3}{\sqrt{10 + y^2}}.$$

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