

44. The components of  $\vec{a}$  are  $a_x = 0$ ,  $a_y = 3.20 \cos 63^\circ = 1.45$ , and  $a_z = 3.20 \sin 63^\circ = 2.85$ . The components of  $\vec{b}$  are  $b_x = 1.40 \cos 48^\circ = 0.937$ ,  $b_y = 0$ , and  $b_z = 1.40 \sin 48^\circ = 1.04$ .

(a) The scalar (dot) product is therefore

$$\vec{a} \cdot \vec{b} = a_x b_x + a_y b_y + a_z b_z = (0)(0.937) + (1.45)(0) + (2.85)(1.04) = 2.97 .$$

(b) The vector (cross) product is

$$\begin{aligned} \vec{a} \times \vec{b} &= (a_y b_z - a_z b_y) \hat{i} + (a_z b_x - a_x b_z) \hat{j} + (a_x b_y - a_y b_x) \hat{k} \\ &= ((1.45)(1.04) - 0) \hat{i} + ((2.85)(0.937) - 0) \hat{j} + (0 - (1.45)(0.94)) \hat{k} \\ &= 1.51 \hat{i} + 2.67 \hat{j} - 1.36 \hat{k} . \end{aligned}$$

(c) The angle  $\theta$  between  $\vec{a}$  and  $\vec{b}$  is given by

$$\theta = \cos^{-1} \left( \frac{\vec{a} \cdot \vec{b}}{ab} \right) = \cos^{-1} \left( \frac{2.96}{(3.30)(1.40)} \right) = 48^\circ .$$