

39. The solution to problem 27 showed that each diagonal has a length given by $a\sqrt{3}$, where a is the length of a cube edge. Vectors along two diagonals are $\vec{b} = a\hat{i} + a\hat{j} + a\hat{k}$ and $\vec{c} = -a\hat{i} + a\hat{j} + a\hat{k}$. Using Eq. 3-20 with Eq. 3-23, we find the angle between them:

$$\cos \phi = \frac{b_x c_x + b_y c_y + b_z c_z}{bc} = \frac{-a^2 + a^2 + a^2}{3a^2} = \frac{1}{3}.$$

The angle is $\phi = \cos^{-1}(1/3) = 70.5^\circ$.