62. (Third problem in **Cluster 1**)

(a) Looking at the xy plane in Fig. 3-44, it is clear that the angle to $\vec{A}$ (which is the vector lying *in* the plane, not the one rising out of it, which we called $\vec{G}$ in the previous problem) measured counterclockwise from the $-y$ axis is $90° + 130° = 220°$. Had we measured this *clockwise* we would obtain (in absolute value) $360° - 220° = 140°$.

(b) We found in part (b) of the previous problem that $\vec{A} \times \vec{B}$ points along the z axis, so it is perpendicular to the $-y$ direction.

(c) Let $\vec{u} = -\hat{\jmath}$ represent the $-y$ direction, and $\vec{w} = 3\,\hat{k}$ is the vector being added to $\vec{B}$ in this problem. The vector being examined in this problem (we'll call it $\vec{Q}$) is, using Eq. 3-30 (or a vector-capable calculator),

$$\vec{Q} = \vec{A} \times \left(\vec{B} + \vec{w}\right) = 9.19\,\hat{\imath} + 7.71\,\hat{\jmath} + 23.7\,\hat{k}$$

and is clearly in the first octant (since all components are positive); using Pythagorean theorem, its magnitude is $Q = 26.52$. From Eq. 3-23, we immediately find $\vec{u} \cdot \vec{Q} = -7.71$. Since $\vec{u}$ has unit magnitude, Eq. 3-20 leads to

$$\cos^{-1}\left(\frac{\vec{u} \cdot \vec{Q}}{Q}\right) = \cos^{-1}\left(\frac{-7.71}{26.52}\right)$$

which yields a choice of angles $107°$ or $-107°$. Since we have already observed that $\vec{Q}$ is in the first octant, the the angle measured counterclockwise (as observed by someone high up on the $+z$ axis) from the $-y$ axis to $\vec{Q}$ is $107°$.