92. This is a classic problem involving two-dimensional relative motion; see §4-9. The steps in Sample Problem 4-11 in the textbook are similar to those used here. We align our coordinates so that *east* corresponds to $+x$ and *north* corresponds to $+y$. We write the vector addition equation as $\vec{v}_{BG} = \vec{v}_{BW} + \vec{v}_{WG}$. We have $\vec{v}_{WG} = (2.0 \angle 0°)$ in the magnitude-angle notation (with the unit m/s understood), or $\vec{v}_{WG} = 2.0\,\hat{\mathrm{i}}$ in unit-vector notation. We also have $\vec{v}_{BW} = (8.0 \angle 120°)$ where we have been careful to phrase the angle in the 'standard' way (measured counterclockwise from the $+x$ axis), or $\vec{v}_{BW} = -4.0\,\hat{\mathrm{i}} + 6.9\,\hat{\mathrm{j}}$.

(a) We can solve the vector addition equation for $\vec{v}_{BG}$:

$$\vec{v}_{BG} = \vec{v}_{BW} + \vec{v}_{WG} = (2.0 \angle 0°) + (8.0 \angle 120°) = (7.2 \angle 106°)$$

which is very efficiently done using a vector capable calculator in polar mode. Thus $|\vec{v}_{BG}| = 7.2$ m/s, and its direction is 16° west of north, or 74° north of west.

(b) The velocity is constant, and we apply $y - y_0 = v_y t$ in a reference frame. Thus, in the *ground* reference frame, we have $200 = 7.2 \sin(106°) t \rightarrow t = 29$ s. Note: if a student obtains "28 s", then the student has probably neglected to take the y component properly (a common mistake).