69. We are only concerned with horizontal forces in this problem (gravity plays no direct role). Thus, $\sum \vec{F} = m\vec{a}$ reduces to $\vec{F}_{\text{avg}} = m\vec{a}$, and we see that the magnitude of the force is ma, where $m = 0.20$ kg and

$$a = |\vec{a}| = \sqrt{a_x^2 + a_y^2}$$

and the direction of the force is the same as that of $\vec{a}$. We take *east* as the $+x$ direction and *north* as $+y$. The acceleration is the *average* acceleration in the sense of Eq. 4-15.

(a) We find the (average) acceleration to be

$$\vec{a} = \frac{\vec{v} - \vec{v}_0}{\Delta t} = \frac{(-5.0\,\hat{\text{i}}) - (2.0\,\hat{\text{i}})}{0.50} = -14\,\hat{\text{i}}\ \text{m/s}^2\ .$$

Thus, the magnitude of the force is $(0.20\,\text{kg})(14\,\text{m/s}^2) = 2.8\,\text{N}$ and its direction is $-\,\hat{\text{i}}$ which means *west* in this context.

(b) A computation similar to the one in part (a) yields the (average) acceleration with two components, which can be expressed various ways:

$$\vec{a} = -4.0\,\hat{\text{i}} - 10.0\,\hat{\text{j}} \ \rightarrow\ (-4.0, -10.0) \ \rightarrow\ (10.8\ \angle\ -112^\circ)$$

Therefore, the magnitude of the force is $(0.20\ \text{kg})(10.8\ \text{m/s}^2) = 2.2\ \text{N}$ and its direction is 112° clockwise from east – which means it is 22° west of south, stated more conventionally.