4.6. Solve: **(a)** At $t = 0$ s, $x = 0$ m and $y = 0$ m, or $\vec{r} = (0\hat{i} + 0\hat{j})$ m. At $t = 4$ s, $x = 0$ m and $y = 0$ m, or $\vec{r} = (0\hat{i} + 0\hat{j})$ m. In other words, the particle is at the origin at both $t = 0$ s and at $t = 4$ s. From the expressions for x and y,

$$\vec{v} = \frac{dx}{dt}\hat{i} + \frac{dy}{dt}\hat{j} = \left[\left(\frac{3}{2}t^2 - 4t\right)\hat{i} + (t-2)\hat{j}\right] \text{ m/s}$$

At $t = 0$ s, $\vec{v} = -2\hat{j}$ m/s, $v = 2$ m/s. At $t = 4$ s, $\vec{v} = \left(8\hat{i} + 2\hat{j}\right)$ m/s, $v = 8.3$ m/s.

(b) At $t = 0$ s, $\vec{v}$ is along $-\hat{j}$, or 90° south of $+x$. At $t = 4$ s,

$$\theta = \tan^{-1}\left(\frac{2 \text{ m/s}}{8 \text{ m/s}}\right) = 14° \text{ north of } +x$$