14. (a) Using Eq. 4-16, the acceleration as a function of time is

$$\vec{a} = \frac{d\vec{v}}{dt} = \frac{d}{dt}\left((6.0t - 4.0t^2)\hat{\mathrm{i}} + 8.0\,\hat{\mathrm{j}}\right) = (6.0 - 8.0t)\hat{\mathrm{i}}$$

in SI units. Specifically, we find the acceleration vector at $t = 3.0$ s to be $(6.0 - 8.0(3.0))\hat{\mathrm{i}} = -18\,\hat{\mathrm{i}}$ m/s^2.

(b) The equation is $\vec{a} = (6.0 - 8.0t)\hat{\mathrm{i}} = 0$; we find $t = 0.75$ s.

(c) Since the y component of the velocity, $v_y = 8.0$ m/s, is never zero, the velocity cannot vanish.

(d) Since speed is the magnitude of the velocity, we have $v = |\vec{v}| = \sqrt{(6.0t - 4.0t^2)^2 + (8.0)^2} = 10$ in SI units (m/s). We solve for t as follows:

$$\begin{aligned}
\text{squaring} \quad (6t - 4t^2)^2 + 64 &= 100 \\
\text{rearranging} \quad (6t - 4t^2)^2 &= 36 \\
\text{taking square root} \quad 6t - 4t^2 &= \pm 6 \\
\text{rearranging} \quad 4t^2 - 6t \pm 6 &= 0 \\
\text{using quadratic formula} \quad t &= \frac{6 \pm \sqrt{36 - 4(4)(\pm 6)}}{2(8)}
\end{aligned}$$

where the requirement of a real positive result leads to the unique answer: $t = 2.2$ s.