14. We make use of Eq. 4-16.

(a) The acceleration as a function of time is

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

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

(b) The equation is $\vec{a} = \left(6.0 - 8.0t\right)\hat{\mathrm{i}} = 0$; 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

$$v = |\vec{v}| = \sqrt{\left(6.0t - 4.0t^2\right)^2 + \left(8.0\right)^2} = 10$$

in SI units (m/s). We solve for t as follows:

$$\begin{aligned}
\text{squaring } \left(6.0t - 4.0t^2\right)^2 + 64 &= 100 \\
\text{rearranging } \left(6.0t - 4.0t^2\right)^2 &= 36 \\
\text{taking square root } 6.0t - 4.0t^2 &= \pm 6.0 \\
\text{rearranging } 4.0t^2 - 6.0t \pm 6.0 &= 0 \\
\text{using quadratic formula } t &= \frac{6.0 \pm \sqrt{36 - 4(4.0)(\pm 6.0)}}{2(8.0)}
\end{aligned}$$

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