14.34. **Visualize:** Please refer to Figure P14.34.

**Solve:** The position and the velocity of a particle in simple harmonic motion are

\[ x(t) = A \cos(\omega t + \phi_0) \quad \text{and} \quad v_x(t) = -A \omega \sin(\omega t + \phi_0) = -v_{\text{max}} \sin(\omega t + \phi_0) \]

From the graph, \( T = 12 \) s and the angular frequency is

\[ \omega = \frac{2\pi}{T} = \frac{2\pi}{12 \text{ s}} = \frac{\pi}{6} \text{ rad/s} \]

(a) Because \( v_{\text{max}} = A \omega = 60 \) cm/s, we have

\[ A = \frac{60 \text{ cm/s}}{\omega} = \frac{60 \text{ cm/s}}{\pi/6 \text{ rad/s}} = 114.6 \text{ cm} \]

(b) At \( t = 0 \) s,

\[ v_{x_0} = -A \omega \sin \phi_0 = -30 \text{ cm} \Rightarrow -(60 \text{ cm/s}) \sin \phi_0 = -30 \text{ cm} \]

\[ \Rightarrow \phi_0 = \sin^{-1}(0.5 \text{ rad}) = \frac{\pi}{6} \text{ rad} \text{ (30°) or } \frac{\pi}{3} \text{ rad} \text{ (150°)} \]

Because the velocity at \( t = 0 \) s is negative and the particle is slowing down, the particle is in the second quadrant of the circular motion diagram. Thus \( \phi_0 = \frac{\pi}{3} \text{ rad} \).

(c) At \( t = 0 \) s, \( x_0 = (114.6 \text{ cm}) \cos(\frac{\pi}{3} \text{ rad}) = -99.2 \text{ cm} \).