\[
\begin{align*}
\vec{V}_A &= 20 \hat{z} \\
\vec{V}_B &= \frac{30}{\sqrt{2}} (\hat{x} + \hat{j}) \\
\vec{V}_C &= 40 \hat{z} \\
\vec{a}_{AB} &= \frac{\Delta \vec{V}}{\Delta t} = \frac{\vec{V}_B - \vec{V}_A}{\Delta t} \\
&= \frac{\left(\frac{30}{\sqrt{2}} \hat{x} - 20 \hat{j}\right) + \frac{30}{\sqrt{2}} \hat{j}}{3} = 0.404 \hat{z} + 7.07 \hat{j} \\
\vec{a}_{AC} &= \frac{\vec{V}_C - \vec{V}_A}{\Delta t} = \frac{40 \hat{z} - 20 \hat{j}}{8} = 2.5 \hat{z} \\
\end{align*}
\]

\[\text{x 12 - 76} \]

\[y = x - \frac{x^2}{400}, \quad v_x = 2 \text{ m/s} = \text{const}.\]

Determine \(v_y\) when \(x = 20\text{ m}\):

\[v_y = \frac{dy}{dt} = \dot{x} - \frac{2x}{400} \dot{x} = x(1 - \frac{x}{200}) \quad \text{but} \quad x = v_x \]

\[v_y = 2 - \frac{x}{100} \]

When \(x = 20 \text{ m}\) \(\Rightarrow v_x = 2 \quad v_y = 2 - \frac{20}{100} = 1.8 \text{ m/s}\)

\[v = \sqrt{v_x^2 + v_y^2} = \sqrt{2^2 + 1.8^2} = 2.61 \text{ m/s}\]

\[a_x = \ddot{v}_x = 0 \quad \text{since} \quad v_x = \text{const}\]

\[a_y = \ddot{v}_y = 0 - \frac{1}{100} \dot{x} = 0 - \frac{x}{100} = -0.02 \]

\[a = \sqrt{a_x^2 + a_y^2} = 0.02 \text{ m/s}^2\]
\[ V_A = 12 \text{ km/h} \]
\[ = 3.33 \text{ m/s} \]

\[ V_W = 20 \text{ km/h} \]
\[ = 5.55 \text{ m/s} \]

\[ \vec{V}^2 = \vec{V}_0^2 + 2a \tau (y - y_0) \]
\[ = (3.33)^2 + 2(-9.81)(-50) \]

\[ \Rightarrow V_y = 31.5 \text{ m/s} \]

\[ V_y = V_{0y} + a_c \tau \]
\[ -31.5 = 3.33 - 9.81 \tau \]
\[ \Rightarrow \tau = 3.55 \text{ s} \]

\[ V = V_x + V_y = \sqrt{31.5^2 + 5.55^2} \]
\[ V = 32 \text{ m/s} \]
\[ R(\omega)_{30} = VA(\omega)_{60} + t \quad (1) \]

\[ V_A = 12 \]

\[ (1) \quad R = \frac{12 \omega_{60}}{\cos 30} + t \quad (3) \]

\[ \frac{12 \omega_{60}}{\cos 30} \cdot \sin 30 \cdot t = -12 \sin 60 \cdot t + \frac{1}{2} (9.81) t^2 \]

\[ \Rightarrow t = \frac{2}{9.81} \left[ \frac{\cos 60 \cdot \sin 30}{\cos 30} + \sin 60 \right] = 2.825 s \]

\[ R = \frac{12 \omega_{60}}{\cos 30} (2.825) = 19.572 \text{ m} \]

\[ V_A = 12 \text{ m/s} \]

\[ x = R \cos 30 \]

\[ y = R \sin 30 \]
\[ V_0 = 15 \text{ m/s} \]

\[ a \rightarrow B \quad V_{yB} = 0 \]

\[ V_y^2 = V_{y0}^2 + 2a_y (y - y_0) \]

\[ 0 = (15 \sin \theta)^2 + 2(-9.81)(6 - 1.5) \]

\[ \Rightarrow \sin^2 \theta = \frac{88.29}{15^2} \Rightarrow \theta = 38.786^\circ \]

\[ \Rightarrow x = x_0 + v_{0x} t \quad \text{to reach point C} \]

\[ 18 = 0 + 15 \cos(38.786) t \]

\[ \Rightarrow t = \frac{18}{15 \cos 38.786} = 1.545 \]

\[ \uparrow \quad y = y_0 + v_{0y} t + \frac{1}{2} g t^2 \]

\[ y = 1.5 + 15 \sin(38.786)(1.54) - \frac{1}{2} (9.81)(1.54)^2 \]

\[ y = 4.363 \text{ m} \]