THE GENERAL SOLUTION IS

\[ \Theta(u) = A u^{-1} J_1(u) + B u^{-1} N_1(u) \]  \hspace{1cm} (18.6)

With \( u = \frac{2\sqrt{3}}{V} \). Keeping in mind that \( u \neq 0 \) then at \( t = 0 \), \( u = u_0 = \frac{2\sqrt{3}}{V} \sqrt{u_0} \neq 0 \). Also note that

\[ \frac{d\Theta}{dt} = \frac{d\Theta}{du} \frac{du}{dt} = \frac{d\Theta}{du} \frac{\sqrt{u}}{V} \]  \hspace{1cm} so when \( \frac{du}{dt} = 0 \) \( u \neq 0 \)

\[ \frac{d\Theta}{du} = 0. \]  \hspace{1cm} THE INITIAL CONDITIONS \( \Theta(0) = \Theta_0 \), \( \dot{\Theta}(0) = 0 \) become

\[ \Theta(u_0) = \Theta_0 \]  \hspace{1cm} and \( \frac{d\Theta}{du}(u_0) = 0 \). Now

\[ \frac{d\Theta}{du} = -\left[ A u^{-1} J_2 + B u^{-1} N_2 \right] \]

SINCE \( \left( \frac{1}{2} \frac{d}{dz} \right) \left( z^{-1} C_1 \right) = -z^{-2} C_2 \) \hspace{1cm} [FROM A.7 S 9.1.30]

For any "BESSEL" function \( C_n \).

Therefore the IC's give

\[ \begin{cases} A u_0^{-1} J_1(u_0) + B u_0^{-1} N_1(u_0) = \Theta_0 \\ A u_0^{-1} J_2(u_0) + B u_0^{-1} N_2(u_0) = 0 \end{cases} \]

These can be solved using linear algebra giving

\[ A = \frac{U^{-1}_0 N_2 \Theta_0}{U_0^{-1} \left[ J_1 N_2 - J_2 N_1 \right]} \]  \hspace{1cm} AND \hspace{1cm} \[ B = -\frac{J_2 u_0^{-1} \Theta_0}{U_0^{-1} \left[ J_1 N_2 - J_2 N_1 \right]} \]

But \( U_0^{-1} \left[ J_1 N_2 - N_1 J_2 \right] = U_0^{-1} \left( \frac{-2}{\pi u_0} \right) = -\frac{2}{\pi u_0^2} \)

\[ \Rightarrow A = -\frac{\pi}{2} U_0 N_2(u_0) \Theta_0 \]  \hspace{1cm} AND \hspace{1cm} \[ B = \frac{\pi}{2} U_0 J_2(u_0) \Theta_0 \]