When $G_i'(\tau_i) = 0$, $a_i V_i'(\tau_i) = -\Pi_i'(\tau_i)$.

$$G_i''(\tau_i) = P_i(\tau_i)^{-\alpha} r_i''(\tau_i) - \alpha r_i'(\tau_i) P_i(\tau_i)^{-\alpha} A(\tau_i) - \alpha V_i'(\tau_i) A(\tau_i) - \alpha V_i(\tau_i) A'(\tau_i)$$