PHY 7200, Equations

$$\delta S = 0 \;\Rightarrow\; \frac{d}{dt}\frac{\partial L}{\partial \dot{q}_i} - \frac{\partial L}{\partial q_i} = 0 \tag{1}$$

$$\mathbf{p}_2 = 0 \;\Rightarrow \tan\theta_1 = \frac{m_2 \sin\chi}{m_1 + m_2\cos\chi};\; \theta_2 = \pi - \chi \tag{2}$$

$$U_{eff} = U(r) + \frac{M^2}{2mr^2} \tag{3}$$

$$d\sigma = \frac{b(\theta)}{\sin\theta}\left|\frac{db}{d\theta}\right| d\Omega \tag{4}$$

$$\phi_0 = \int_{r_{min}}^{\infty} \frac{(b/r^2)dr}{\sqrt{1 - b^2/r^2 - 2U/(mv_\infty^2)}}; \tag{5}$$

$$\chi = |\pi - 2\phi_0| \tag{6}$$

$$\theta_1 = -\frac{2b}{mv_\infty^2}\int_\rho^\infty \frac{dU}{dr}\frac{dr}{\sqrt{b^2 - r^2}} \tag{7}$$

$$p_i = \partial L/\partial \dot{q}_i; \tag{8}$$

$$H(p,q,t) = p_i\dot{q}_i - L \tag{9}$$

$$[f,g] \equiv \frac{\partial f}{\partial p_i}\frac{\partial g}{\partial q_i} - \frac{\partial f}{\partial q_i}\frac{\partial g}{\partial p_i} \tag{10}$$

$$\frac{df}{dt} = \frac{\partial f}{\partial t} + [H,f] \tag{11}$$

$$dS = p_i dq_i - H dt \tag{12}$$

$$dF(q,Q) = p_i dq_i - P_i dQ_i + (H' - H)dt \tag{13}$$

$$\frac{\partial S}{\partial t} + H(q, \frac{\partial S}{\partial q}; t) = 0 \tag{14}$$

$$I = \frac{1}{2\pi}\oint p\, dq \tag{15}$$

$$\frac{d}{dx_\mu}\frac{\partial \mathscr{L}}{(\partial u_a/\partial x_\mu)} - \frac{\partial \mathscr{L}}{\partial u_a} = 0 \tag{16}$$

$$T_{\mu\nu} = \frac{\partial \mathscr{L}}{(\partial u_a/\partial x_\nu)}\frac{\partial u_a}{\partial x_\mu} - \mathscr{L}\delta_{\mu\nu} \tag{17}$$

$$\frac{\partial\rho}{\partial t} + \mathrm{div}(\rho\mathbf{v}) = 0 \tag{18}$$

$$\frac{\partial v_i}{\partial t} + v_k\frac{\partial v_i}{\partial x_k} = -\frac{1}{\rho}\frac{\partial p}{\partial x_i} + g_i \tag{19}$$

$$\frac{v^2}{2} + \frac{p}{\rho} + gz = const \tag{20}$$

$$\frac{\partial(\rho v_i)}{\partial t} = -\frac{\partial \Pi_{ik}}{\partial x_k} + \rho g_i \tag{21}$$

$$\Pi_{ij} = p\delta_{ik} + \rho v_i v_k - \tilde{\sigma}_{ik} \tag{22}$$

$$\tilde{\sigma}_{ik} = \eta\left(\frac{\partial v_i}{\partial x_k} + \frac{\partial v_k}{\partial x_i} - \frac{2}{3}\delta_{ik}\frac{\partial v_n}{\partial x_n}\right) + \zeta\delta_{ik}\frac{\partial v_n}{\partial x_n} \tag{23}$$

$$n! \approx \sqrt{2\pi n}e^{-n}n^n \tag{24}$$

$$\int_{-\infty}^{\infty} e^{-x^2}dx = \sqrt{\pi} \tag{25}$$