

$$\{A, B\}^{(Q, P)} = \left(\frac{\partial A}{\partial q_i} \frac{\partial q_i}{\partial Q_k} + \frac{\partial A}{\partial p_i} \frac{\partial p_i}{\partial Q_k} \right) \left(\frac{\partial B}{\partial q_m} \frac{\partial q_m}{\partial P_k} + \frac{\partial B}{\partial p_m} \frac{\partial p_m}{\partial P_k} \right) - (A, B)$$

(1)

$$= \left(\frac{\partial A}{\partial q_i} \frac{\partial B}{\partial q_m} - \frac{\partial B}{\partial q_i} \frac{\partial A}{\partial q_m} \right) \left(\frac{\partial q_i}{\partial Q_k} \frac{\partial q_m}{\partial P_k} \right) \quad (1)$$

$$+ \left(\frac{\partial A}{\partial p_i} \frac{\partial B}{\partial q_m} - \frac{\partial B}{\partial p_i} \frac{\partial A}{\partial q_m} \right) \left(\frac{\partial p_i}{\partial Q_k} \frac{\partial q_m}{\partial P_k} \right) \quad (2)$$

$$+ \left(\frac{\partial A}{\partial q_i} \frac{\partial B}{\partial p_m} - \frac{\partial B}{\partial q_i} \frac{\partial A}{\partial p_m} \right) \left(\frac{\partial q_i}{\partial Q_k} \frac{\partial p_m}{\partial P_k} \right) \quad (3)$$

$$+ \left(\frac{\partial A}{\partial p_i} \frac{\partial B}{\partial p_m} - \frac{\partial B}{\partial p_i} \frac{\partial A}{\partial p_m} \right) \left(\frac{\partial p_i}{\partial Q_k} \frac{\partial p_m}{\partial P_k} \right) \quad (4)$$

$$= \frac{\partial A}{\partial q_i} \frac{\partial B}{\partial q_m} \left(\frac{\partial q_i}{\partial Q_k} \frac{\partial q_m}{\partial P_k} - \frac{\partial q_m}{\partial Q_k} \frac{\partial q_i}{\partial P_k} \right) + \frac{\partial A}{\partial q_i} \frac{\partial B}{\partial p_m} \left(\frac{\partial q_i}{\partial Q_k} \frac{\partial p_m}{\partial P_k} - \frac{\partial p_m}{\partial Q_k} \frac{\partial q_i}{\partial P_k} \right) \\ + \frac{\partial A}{\partial p_i} \frac{\partial B}{\partial q_m} \left(\frac{\partial p_i}{\partial Q_k} \frac{\partial q_m}{\partial P_k} - \frac{\partial p_i}{\partial P_k} \frac{\partial q_m}{\partial Q_k} \right) + \frac{\partial A}{\partial p_i} \frac{\partial B}{\partial p_m} \left(\frac{\partial p_i}{\partial Q_k} \frac{\partial p_m}{\partial P_k} - \frac{\partial p_i}{\partial P_k} \frac{\partial p_m}{\partial Q_k} \right)$$

$$= \frac{\partial A}{\partial q_i} \frac{\partial B}{\partial q_n} \left(\overset{(3.8.11)}{-\frac{\partial q_i}{\partial q_k} \frac{\partial q_k}{\partial p_n}} - \overset{(3.8.12)}{\frac{\partial q_i}{\partial p_k} \frac{\partial p_k}{\partial p_n}} \right) \rightarrow \left(-\frac{\partial q_i}{\partial p_n} \right) \rightarrow 0$$

$$+ \frac{\partial A}{\partial q_i} \frac{\partial B}{\partial p_n} \left(\overset{(3.8.9)}{\frac{\partial q_i}{\partial q_k} \frac{\partial q_k}{\partial p_n}} + \overset{(3.8.15)}{\frac{\partial q_i}{\partial p_k} \frac{\partial p_k}{\partial q_n}} \right) \rightarrow \frac{\partial q_i}{\partial q_n} \rightarrow \delta_{in}$$

$$+ \frac{\partial A}{\partial p_i} \frac{\partial B}{\partial q_n} \left(\overset{(3.8.11)}{-\frac{\partial p_i}{\partial q_k} \frac{\partial q_k}{\partial p_n}} - \overset{(3.8.12)}{\frac{\partial p_i}{\partial p_k} \frac{\partial p_k}{\partial q_n}} \right) \rightarrow \left(-\frac{\partial p_i}{\partial p_n} \right) \rightarrow -\delta_{in}$$

$$+ \frac{\partial A}{\partial p_i} \frac{\partial B}{\partial p_n} \left(\overset{(3.8.9)}{\frac{\partial p_i}{\partial q_k} \frac{\partial q_k}{\partial p_n}} + \overset{(3.8.5)}{\frac{\partial p_i}{\partial p_k} \frac{\partial p_k}{\partial q_n}} \right) \rightarrow \frac{\partial p_i}{\partial q_n} \rightarrow 0$$

$$= \frac{\partial A}{\partial q_i} \frac{\partial B}{\partial p_i} - \frac{\partial A}{\partial p_i} \frac{\partial B}{\partial q_i} = \{A, B\}^{(q,p)}$$