Exercise

- (10) Prove either

$$(m_{llq}^{\max})^2 = \begin{cases} (m_{\tilde{q}}^2 - m_{\tilde{\chi}_2^0}^2)(m_{\tilde{\chi}_2^0}^2 - m_{\tilde{\chi}_1^0}^2)/m_{\tilde{\chi}_2^0}^2 & \text{iff} \quad {m_{\tilde{\chi}_2^0}}^2 < m_{\tilde{\chi}_1^0} m_{\tilde{q}}, \\ (m_{\tilde{q}}^2 - m_{\tilde{l}}^2)(m_{\tilde{l}}^2 - m_{\tilde{\chi}_1^0}^2)/m_{\tilde{l}}^2 & \text{iff} \quad m_{\tilde{\chi}_1^0} m_{\tilde{q}} < {m_{\tilde{l}}}^2, \\ (m_{\tilde{q}}^2 m_{\tilde{l}}^2 - m_{\tilde{\chi}_2^0}^2 m_{\tilde{\chi}_1^0}^2)(m_{\tilde{\chi}_2^0}^2 - m_{\tilde{l}}^2)/(m_{\tilde{\chi}_2^0}^2 m_{\tilde{l}}^2) & \text{iff} \quad {m_{\tilde{l}}}^2 m_{\tilde{q}} < m_{\tilde{\chi}_1^0} {m_{\tilde{\chi}_2^0}}^2, \\ (m_{\tilde{q}} - m_{\tilde{\chi}_1^0})^2 & \text{otherwise.} \end{cases}$$

or

$$(m_{llq}^{\max})^2 = \begin{cases} \max\left[\frac{(\tilde{q}-\tilde{\xi})(\tilde{\xi}-\tilde{\chi})}{\tilde{\xi}}, \frac{(\tilde{q}-\tilde{l})(\tilde{l}-\tilde{\chi})}{\tilde{l}}, \frac{(\tilde{q}\tilde{l}-\tilde{\xi}\tilde{\chi})(\tilde{\xi}-\tilde{l})}{\tilde{\xi}\tilde{l}}\right] \\ \text{except for the special case in which } \tilde{l}^2 < \tilde{q}\tilde{\chi} < \tilde{\xi}^2 \text{ and} \\ \tilde{\xi}^2\tilde{\chi} < \tilde{q}\tilde{l}^2 \text{ where one must use } (m_{\tilde{q}} - m_{\tilde{\chi}_1^0})^2. \end{cases}$$

and show that they are equivalent.

(See definitions of symbols approx three slides back).