1 Deviance

$$\begin{aligned} P(Y_i = y_i) &= \pi_i(1-\pi_i)^{y_i-1} \\ &= exp[y_i \times ln\left(\frac{\mu_i - 1}{\mu_i}\right) - ln(\mu_i - 1)] \end{aligned}$$

Hence

$$\begin{aligned} l(m;y) &= \sum_i^n [y_i \times ln\left(\frac{m_i - 1}{m_i}\right) - ln(m_i - 1)] \\ D &= 2\phi[l(y;y) - l(\mu;y)] \\ D &= 2\left(\sum_i^n \left[y_i \times ln\left(\frac{y_i - 1}{y_i}\right) - ln(y_i - 1)\right] - \sum_i^n [y_i \times ln\left(\frac{\mu_i - 1}{\mu_i}\right) - ln(\mu_i - 1)\right]\right) \\ D &= 2\left(\sum_i^n \left[y_i \times ln\left(\frac{y_i - 1}{y_i}\right) - ln(y_i - 1) - y_i \times ln\left(\frac{\mu_i - 1}{\mu_i}\right) + ln(\mu_i - 1)\right]\right) \\ D &= 2\left(\sum_i^n \left[y_i \times ln\left(\frac{y_i - 1}{y_i} \times \frac{\mu_i}{\mu_i - 1}\right) + ln\left(\frac{\mu_i - 1}{y_i - 1}\right)\right]\right) \end{aligned}$$