$$\sum_{m=1}^{M} g_t(\tilde{x_m})\tilde{y_m} = -\frac{1}{2}\left\{ \sum_{m=1}^{M} \left[g_t(\tilde{x_m}) - \tilde{y_m} \right]^2 - \sum_{m=1}^{M} \left[\tilde{y_m} \right]^2 - \sum_{m=1}^{M} \left[g_t(\tilde{x_m}) \right]^2 \right\} = -\frac{1}{2}(Me_t - Me_0 - Ms_t) = \frac{M}{2}(e_0 - e_t + s_t) = [a]$$