b) This is a generalized case of the previous question. All a_js are constant

$$\text{Var}(M_t^w) = \text{Var}\left(\sum_{t=T-N+1}^{t=T} (a_{T+1-t})\, y_t\right)$$

$$= \sum_{t=T-N+1}^{t=T} \text{Var}(a_{T+1-t} \cdot y_t)$$ (we can add variances since data is uncorrelated)

$$= \sum_{t=T-N+1}^{t=T} (a_{T+1-t})^2 \,\text{Var}(y_t)$$ as a_t are constant

$$= \sum_{t=T-N+1}^{t=T} (a_{T+1-t})^2 \cdot \sigma^2$$ all y_t have same variance

$$\cdot \sigma^2 \cdot \sum_{t=T-N+1}^{t=T} (a_{T+1-t})^2$$