

Ex 2.

$$\begin{aligned} s_i &= u_i^T y \\ \sum_{i=1}^N s_i^2 &= \sum_{i=1}^N s_i^T s_i \\ &= \sum_{i=1}^N y^T u_i u_i^T y \\ &= \cancel{y^T} y^T \underbrace{\sum_{i=1}^N u_i u_i^T}_{I_N} y \\ &= y^T y \\ &= \|y\|^2 \end{aligned}$$