Show that the Hoteling T^2 test only works when n>p.

Hint: One solution is to represent S using the $\mathbf{n \times p}$ data matrix $\boldsymbol{Y}$ and the $\mathbf{n \times p}$ sample mean matrix $\overline{\boldsymbol{Y}}$ (What should $\overline{\boldsymbol{Y}}$ be?) Also note that rank(A^TA)=rank(A).