Solution (#615) Let A be a square matrix. Suppose that A is invertible. Then by the product rule for transposes

$$\begin{aligned}(A^{-1})^T A^T &= (AA^{-1})^T = I^T = I;\\ A^T(A^{-1})^T &= (A^{-1}A)^T = I^T = I,\end{aligned}$$

and so A^T is invertible with inverse $(A^{-1})^T$.

Conversely say that A^T is invertible. By the above $(A^T)^T = A$ is invertible.