1×1: $A = \begin{bmatrix} 1 & 0 \end{bmatrix}_{1 \times 2}$, $B = A^T \implies AB = 1 \longrightarrow$ invertible ✓

2×2: $A = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \end{bmatrix}_{2 \times 3}$, $B = A^T \implies AB = I_2 \longrightarrow$ invertible ✓

3×3: $A = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \end{bmatrix}_{3 \times 4}$, $B = A^T \implies AB = I_3 \longrightarrow$ invertible ✓

$\vdots$

$n \times n$: $A = \begin{bmatrix} 1 & 0 & \cdots & 0 & 0 \\ 0 & 1 & & \vdots & \vdots \\ & & \ddots & & \\ 0 & 0 & \cdots & 1 & 0 \end{bmatrix}_{n \times (n+1)}$, $B = A^T \implies AB = I_n \longrightarrow$ invertible ✓