

① • Give an example of a linear transformation  $T_1: \mathbb{C}^4 \rightarrow M_{22}$  that is invertible.

• Then a  $T_2: \mathbb{C}^4 \rightarrow M_{22}$  that's not injective.

• Is there  $T_3: \mathbb{C}^4 \rightarrow M_{22}$  that is surjective but not injective? If "yes," give an example. If not, explain why.

② Suppose we have linear transformations as listed below. Fill in the blanks with "yes," "no," or "maybe."

	injective?	surjective?	invertible?
$T_4: P_5 \rightarrow M_{32}$			
$T_5: M_{44} \rightarrow M_{35}$			
$T_6: \mathbb{C}^9 \rightarrow \mathbb{C}^{10}$			

③ Is  $T_7: M_{22} \rightarrow M_{22}$  where  
 $T_7 A = 5A + 7A^t$  injective? surjective? Day  
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④ Is  $T_8: M_{22} \rightarrow \mathbb{C}^3$  where  
 $T \begin{bmatrix} a & b \\ c & d \end{bmatrix} = \begin{bmatrix} a+b+c \\ b+c+d \\ c+d+a \end{bmatrix}$  injective? surjective?

⑤ Is  $T_9: P_2 \rightarrow P_4$  where  
 $(Tp)(x) = x^2 p(x+1) - x p''(1)$   
injective? surjective?