

- 1.**    **a)** non                                  **b)** non                                  **c)** oui
- 2.**    **a)**  $A_\rho = \begin{bmatrix} -1 & 0 \\ 0 & -1 \end{bmatrix}$                                   **b)**  $A_\sigma = \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$   
             $\rho(x,y) = (-x, -y)$                                    $\sigma(x,y) = (y,x)$
- 3.**    **a)**  $A = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ , injective, surjective, bijective  
**b)**  $A = \begin{bmatrix} 1 & 0 \\ 0 & 0 \end{bmatrix}$ , non injective, non surjective, non bijective  
**c)**  $A = \begin{bmatrix} 1 & 1 & 0 \\ 1 & 0 & -1 \end{bmatrix}$ , non injective, surjective, non bijective  
**d)**  $A = \begin{bmatrix} 0 & 1 \\ 1 & 0 \\ 1 & -1 \end{bmatrix}$ , injective, non surjective, non bijective  
**e)**  $A = \begin{bmatrix} 1 & -1 \\ -1 & 1 \\ 2 & -2 \end{bmatrix}$ , non injective, non surjective, non bijective  
**f)**  $A = \begin{bmatrix} 1 & 1 & 1 \\ 1 & -1 & -1 \end{bmatrix}$ , non injective, surjective, non bijective
- 4.**    **a)**  $A = \begin{bmatrix} 1 & 3 & 5 & 7 \\ -1 & 3 & 0 & 0 \\ 1 & 2 & 3 & 7 \end{bmatrix}$   
**b)** non injective, surjective, non bijective  
**c)**  $\begin{bmatrix} x \\ y \\ z \\ u \end{bmatrix} = t \begin{bmatrix} -6 \\ -2 \\ 1 \\ 1 \end{bmatrix}$ , avec  $t \in \mathbb{R}$
- 5.**    injective mais pas surjective
- 6.**    ni surjective ni injective
- 7.**    **a)** F                                  **b)** V                                  **c)** V                                  **d)** F                                  **e)** V
- 8.**    **a)** non                                  **b)** non                                  **c)** oui                                  **d)** oui                                  **e)** non
- 9.**    **a)**  $A_\rho = \frac{\sqrt{2}}{2} \begin{bmatrix} 1 & -1 \\ 1 & 1 \end{bmatrix}$                                   **b)**  $A_\sigma = \begin{bmatrix} 0 & -1 \\ -1 & 0 \end{bmatrix}$   
             $\rho(x,y) = \frac{\sqrt{2}}{2}(x-y, x+y)$                                    $\sigma(x,y) = (-y, -x)$
- 10.**

**12. a)**  $A = \begin{bmatrix} 2 & -2 & 4 \\ 5 & -4 & 7 \\ 3 & -2 & 3 \\ 1 & -1 & 2 \end{bmatrix}$

**b)** non injective, non surjective, non bijective

**c)**  $\begin{bmatrix} x \\ y \\ z \end{bmatrix} = t \begin{bmatrix} 1 \\ 3 \\ 1 \end{bmatrix}$  avec  $t \in \mathbb{R}$

**13. a)**  $A = \begin{bmatrix} 2 & -2 & 4 \\ 5 & -4 & 7 \\ 3 & -2 & 4 \\ 1 & -1 & 2 \end{bmatrix}$

**b)** injective, non surjective, non bijective

**c)**  $\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$

**14. a)**  $n \geq m$

**b)**  $n \leq m$

**c)**  $n = m$