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$$1) \quad f(\mathbf{e}_1) = f\left(\begin{pmatrix} 1 \\ 0 \\ 0 \end{pmatrix}\right) = \begin{pmatrix} 1+0 \\ 2 \cdot 0 \end{pmatrix} = \begin{pmatrix} 1 \\ 0 \end{pmatrix}$$

$$f(\mathbf{e}_2) = f\left(\begin{pmatrix} 0 \\ 1 \\ 0 \end{pmatrix}\right) = \begin{pmatrix} 0+1 \\ 2 \cdot 0 \end{pmatrix} = \begin{pmatrix} 1 \\ 0 \end{pmatrix}$$

$$f(\mathbf{e}_3) = f\left(\begin{pmatrix} 0 \\ 0 \\ 1 \end{pmatrix}\right) = \begin{pmatrix} 0+0 \\ 2 \cdot 1 \end{pmatrix} = \begin{pmatrix} 0 \\ 2 \end{pmatrix}$$

$$A = \begin{pmatrix} 1 & 1 & 0 \\ 0 & 0 & 2 \end{pmatrix}$$

$$2) \quad f(\mathbf{e}_1) = f\left(\begin{pmatrix} 1 \\ 0 \end{pmatrix}\right) = \begin{pmatrix} 1 \\ 0 \end{pmatrix}$$

$$f(\mathbf{e}_2) = f\left(\begin{pmatrix} 0 \\ 1 \end{pmatrix}\right) = \begin{pmatrix} 0 \\ 0 \end{pmatrix}$$

$$A = \begin{pmatrix} 1 & 0 \\ 0 & 0 \end{pmatrix}$$

$$3) \quad f(\mathbf{e}_1) = f\left(\begin{pmatrix} 1 \\ 0 \end{pmatrix}\right) = \begin{pmatrix} 1 \\ 0 \\ 1+0 \end{pmatrix} = \begin{pmatrix} 1 \\ 0 \\ 1 \end{pmatrix}$$

$$f(\mathbf{e}_2) = f\left(\begin{pmatrix} 0 \\ 1 \end{pmatrix}\right) = \begin{pmatrix} 0 \\ 1 \\ 0+1 \end{pmatrix} = \begin{pmatrix} 0 \\ 1 \\ 0 \end{pmatrix}$$

$$A = \begin{pmatrix} 1 & 0 \\ 0 & 1 \\ 1 & 1 \end{pmatrix}$$

$$4) \quad f(\mathbf{e}_1) = f\left(\begin{pmatrix} 1 \\ 0 \\ 0 \end{pmatrix}\right) = \begin{pmatrix} 1+2 \cdot 0+3 \cdot 0 \\ 4 \cdot 1+5 \cdot 0+6 \cdot 0 \\ 7 \cdot 1+8 \cdot 0+9 \cdot 0 \end{pmatrix} = \begin{pmatrix} 1 \\ 4 \\ 7 \end{pmatrix}$$

$$f(\mathbf{e}_2) = f\left(\begin{pmatrix} 0 \\ 1 \\ 0 \end{pmatrix}\right) = \begin{pmatrix} 0+2 \cdot 1+3 \cdot 0 \\ 4 \cdot 0+5 \cdot 1+6 \cdot 0 \\ 7 \cdot 0+8 \cdot 1+9 \cdot 0 \end{pmatrix} = \begin{pmatrix} 2 \\ 5 \\ 8 \end{pmatrix}$$

$$f(\mathbf{e}_3) = f\left(\begin{pmatrix} 0 \\ 0 \\ 1 \end{pmatrix}\right) = \begin{pmatrix} 0+2 \cdot 0+3 \cdot 1 \\ 4 \cdot 0+5 \cdot 0+6 \cdot 1 \\ 7 \cdot 0+8 \cdot 0+9 \cdot 1 \end{pmatrix} = \begin{pmatrix} 3 \\ 6 \\ 9 \end{pmatrix}$$

$$A = \begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{pmatrix}$$