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i)  $e_1 = \begin{pmatrix} 1 \\ 0 \end{pmatrix}$ ,  $e_2 = \begin{pmatrix} 0 \\ 1 \end{pmatrix}$ ,  $A = \begin{pmatrix} a & b \\ c & d \end{pmatrix}$

$$\left. \begin{aligned} A e_1 &= \begin{pmatrix} a \\ c \end{pmatrix} = \begin{pmatrix} -1 \\ 0 \end{pmatrix} = -e_1 \\ A e_2 &= \begin{pmatrix} b \\ d \end{pmatrix} = \begin{pmatrix} 0 \\ 1 \end{pmatrix} = e_2 \end{aligned} \right\} A = \begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}$$

ii)

$$\left. \begin{aligned} A e_1 &= \begin{pmatrix} a \\ c \end{pmatrix} = \begin{pmatrix} 1 \\ 0 \end{pmatrix} = e_1 \\ A e_2 &= \begin{pmatrix} b \\ d \end{pmatrix} = \begin{pmatrix} 0 \\ -1 \end{pmatrix} = -e_2 \end{aligned} \right\} A = \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$$

iii)

$$\left. \begin{aligned} A e_1 &= \begin{pmatrix} 0 \\ 1 \end{pmatrix} = e_2 \\ A e_2 &= \begin{pmatrix} 1 \\ 0 \end{pmatrix} = e_1 \end{aligned} \right\} A = \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$$

iv)  $A e_1 = \begin{pmatrix} 0 \\ 1 \end{pmatrix} = e_2$  }  $A = \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}$   
 $A e_2 = \begin{pmatrix} -1 \\ 0 \end{pmatrix} = -e_1$

v)  $e_1 = \begin{pmatrix} 1 \\ 0 \\ 0 \end{pmatrix}$ ,  $e_2 = \begin{pmatrix} 0 \\ 1 \\ 0 \end{pmatrix}$ ,  $e_3 = \begin{pmatrix} 0 \\ 0 \\ 1 \end{pmatrix}$ ,  $A = \begin{pmatrix} a & b & c \\ d & e & f \\ g & h & i \end{pmatrix}$

$$\left. \begin{aligned} A e_1 &= \begin{pmatrix} 1/\sqrt{2} \\ 0 \\ 1/\sqrt{2} \end{pmatrix} \\ A e_2 &= \begin{pmatrix} 0 \\ 1 \\ 0 \end{pmatrix} = e_2 \quad (\text{?}) \\ A e_3 &= \begin{pmatrix} -1/\sqrt{2} \\ 0 \\ 1/\sqrt{2} \end{pmatrix} \end{aligned} \right\} A = \begin{pmatrix} 1/\sqrt{2} & 0 & -1/\sqrt{2} \\ 0 & 1 & 0 \\ 1/\sqrt{2} & 0 & 1/\sqrt{2} \end{pmatrix}$$