ENGINEERING ANALYSIS

TUTORIAL 1 MATRIX ALGEBRA

1. In each of the following cases find the inverse of the matrix **A**, if it exists. Hence or otherwise solve $\mathbf{A}\underline{\boldsymbol{x}} = \underline{\boldsymbol{b}}$ for $\underline{\boldsymbol{x}}$.

(a) $\mathbf{A} = \begin{bmatrix} 2 & -1 \\ 4 & 3 \end{bmatrix}$ $\underline{\boldsymbol{b}} = \begin{bmatrix} 3 \\ 1 \end{bmatrix}$ *Solution* $\underline{\boldsymbol{x}} = [1 \ \ -1]^T$

(b) $\mathbf{A} = \begin{bmatrix} 2 & -3 \\ 4 & -6 \end{bmatrix}$ $\underline{\boldsymbol{b}} = \begin{bmatrix} 1 \\ 2 \end{bmatrix}$ *Solution* $\underline{\boldsymbol{x}} = [(1 + 3k)/2 \quad k]^T$

(c) $\mathbf{A} = \begin{bmatrix} 3 & -2 \\ 6 & -4 \end{bmatrix}$ $\underline{\boldsymbol{b}} = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$ *Solution* $\underline{\boldsymbol{x}} = [t \quad 3t/2]^T$

(d) $\mathbf{A} = \begin{bmatrix} -3 & 4 & 1 \\ 1 & 2 & 0 \\ 1 & 1 & 3 \end{bmatrix}$ $\underline{\boldsymbol{b}} = \begin{bmatrix} 2 \\ 3 \\ 5 \end{bmatrix}$ *Solution* $\underline{\boldsymbol{x}} = [1 \quad 1 \quad 1]^T$

(e) $\mathbf{A} = \begin{bmatrix} 0 & 1 & 0 \\ 2 & -2 & 5 \\ 0 & 2 & 1 \end{bmatrix}$ $\underline{\boldsymbol{b}} = \begin{bmatrix} 0 \\ 5 \\ 1 \end{bmatrix}$ *Solution* $\underline{\boldsymbol{x}} = [0 \quad 0 \quad 1]^T$

(f) $\mathbf{A} = \begin{bmatrix} -2 & -1 & -3 \\ -1 & 2 & -3 \\ 1 & 1 & 4 \end{bmatrix}$ $\underline{\boldsymbol{b}} = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$ *Solution* $\underline{\boldsymbol{x}} = [0 \ \ 0 \ \ 0 \ ]^T$

Note that the method breaks down in the following question and it is not easy to 'see' what is happening.

(g) $\mathbf{A} = \begin{bmatrix} 1 & 2 & -1 \\ 3 & -3 & 2 \\ -1 & -11 & 6 \end{bmatrix}$ $\underline{\boldsymbol{b}} = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$ *Solution* $\underline{\boldsymbol{x}} = [\ ?\ \ ?\ \ ?]^T$