GIRTON SUMMER PROGRAMME

MATHEMATICS FOR ENGINEERING

MATRICES: HOMEWORK QUESTIONS

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The Homework Answers sheet can be downloaded from Moodle. Once completed (for all five homeworks) is must be uploaded as a ".pdf".

Question: Matrix-1

Find, if it exists, the matrix inverse for the following matrices:

(i) $\begin{bmatrix} 1 & 0 & 2 \\ 0 & 2 & 0 \\ 0 & 0 & 3 \end{bmatrix}$ (ii) $\begin{bmatrix} 2 & 0 & 0 \\ 4 & 2 & 6 \\ 6 & 1 & 3 \end{bmatrix}$

Enter your value for the distance on the **Homework Answers sheet.**

Question: Matrix-2

A two-dimensional image is processed so that the original point $\mathbf{x}_{old} = \begin{bmatrix} x_{old} & y_{old} \end{bmatrix}^t$ is mapped to the new position $\mathbf{x}_{new} = \begin{bmatrix} x_{new} & y_{new} \end{bmatrix}^t$ given by the non-square matrix:

$$\begin{bmatrix} x_{new} \\ y_{new} \end{bmatrix} = \begin{bmatrix} \frac{1}{2}(a+b) & \frac{1}{2}(a-b) & c \\ \frac{1}{2}(a-b) & \frac{1}{2}(a+b) & d \end{bmatrix} \begin{bmatrix} x_{old} \\ y_{old} \\ 1 \end{bmatrix}$$

where $\begin{bmatrix} x_{old} & y_{old} & 1 \end{bmatrix}^t$ is the "augmented vector". The mapping can be re-written as:

$$\mathbf{x}_{new} = \mathbf{x}_0 + \mathbf{A}\,\mathbf{x}_{old}$$

(i) Find expressions for the vector $\mathbf{x}_0$ and the 2x2 matrix $\mathbf{A}$.

(ii) Evaluate the determinant $|\mathbf{A}|$

(iii) By examining the vectors $\begin{bmatrix} 1 & 1 \end{bmatrix}^t$ and $\begin{bmatrix} 1 & -1 \end{bmatrix}^t$ describe the mapping.

Enter your description in the box on the **Homework Answers sheet.**