

Tutorial 1

MATH1850: Linear Algebra for Engineers

1.1 - Linear Systems

1.2 - Gaussian Elimination

1.3 - Matrix Operations

1.4 - Inverses

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Question 1 - Gaussian Elimination I

Solve the given system by Gaussian elimination:

$$2x \quad -y \quad -3z = 0$$

$$-x \quad +2y \quad -3z = 0$$

$$x \quad +y \quad +4z = 0$$

Question 2 - Gaussian Elimination II

Solve the given system by Gauss-Jordan elimination:

$$\begin{array}{ccccrc} v & +3w & -2x & = & 0 \\ 2u & +v & -2w & +3x & = & 0 \\ 2u & +3v & +2w & -x & = & 0 \\ -4u & -3v & +5w & -4x & = & 0 \end{array}$$

Verify your results using MATLAB.

Question 3 - Gaussian Elimination III

Solve the given system by Gaussian or Gauss-Jordan elimination (you choose):

$$x_1 + x_2 + x_3 + x_4 = 0$$

$$x_1 - x_2 + x_3 - x_4 = 0$$

Question 4 - Number of Solutions

Determine the value(s) of a for which the system has no solutions, exactly one solution, or infinitely-many solutions:

$$\begin{array}{rclcl} x & +2y & & +z & = 2 \\ 2x & -2y & & +3z & = 1 \\ x & +2y & -(a^2 - 3)z & & = a \end{array}$$

Question 5 - Matrix Multiplication I

Find the matrix product AB where,

$$A = \begin{bmatrix} 0 & -2 \\ 4 & -3 \end{bmatrix}, B = \begin{bmatrix} 1 & 4 & 1 \\ -3 & 0 & 2 \end{bmatrix}$$

Question 6 - Matrix Multiplication II

Find the matrix product CD where,

$$C = \begin{bmatrix} 2 & 7 & 3 \\ 1 & 5 & 8 \\ 0 & 4 & 1 \end{bmatrix}, D = \begin{bmatrix} -3 & 0 & -1 \\ 2 & -1 & 0 \\ 1 & 2 & 4 \end{bmatrix}$$

Verify your results in MATLAB.

Question 7 - Isolation

Assuming all matrices are $n \times n$ and invertible, solve the following expression for X :

$$C^T B^{-1} A^2 B A C^{-1} X A^{-2} B^{-T} C^{-2} = C^T$$

Question 8 - 2×2 Inverse

Find the inverse of the following matrix:

$$M = \begin{bmatrix} 3 & 1 \\ 2 & 1 \end{bmatrix}$$