

# ESC103 Unit 22

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## 1 An example and a segue into MAT185

Find the inverse of matrix A using G.E. (assuming the inverse exists).

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

[ A | I ]

$$\left[ \begin{array}{cccc|cccc} 1 & -1 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 1 & -2 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & -3 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \end{array} \right] \text{R3} + 3\text{R4}$$

$$\rightarrow \left[ \begin{array}{cccc|cccc} 1 & -1 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 1 & -2 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 1 & 3 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \end{array} \right] \text{R2} + 2\text{R3}$$

$$\rightarrow \left[ \begin{array}{cccc|cccc} 1 & -1 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & 2 & 6 \\ 0 & 0 & 1 & 0 & 0 & 0 & 1 & 3 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \end{array} \right] \text{R1} + \text{R2}$$

$$\rightarrow \left[ \begin{array}{cccc|cccc} 1 & 0 & 0 & 0 & 1 & 1 & 2 & 6 \\ 0 & 1 & 0 & 0 & 0 & 1 & 2 & 6 \\ 0 & 0 & 1 & 0 & 0 & 0 & 1 & 3 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \end{array} \right] = I$$

$$A^{-1} = \begin{bmatrix} 1 & 1 & 2 & 6 \\ 0 & 1 & 2 & 6 \\ 0 & 0 & 1 & 3 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

Remember, if you don't get the identity matrix on the left side of the super augment matrix, then matrix A is not invertible.