## 9.2.2 When Linear Systems Have No Solutions

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# 9.2.2 When Linear Systems Have No Solutions

## Video

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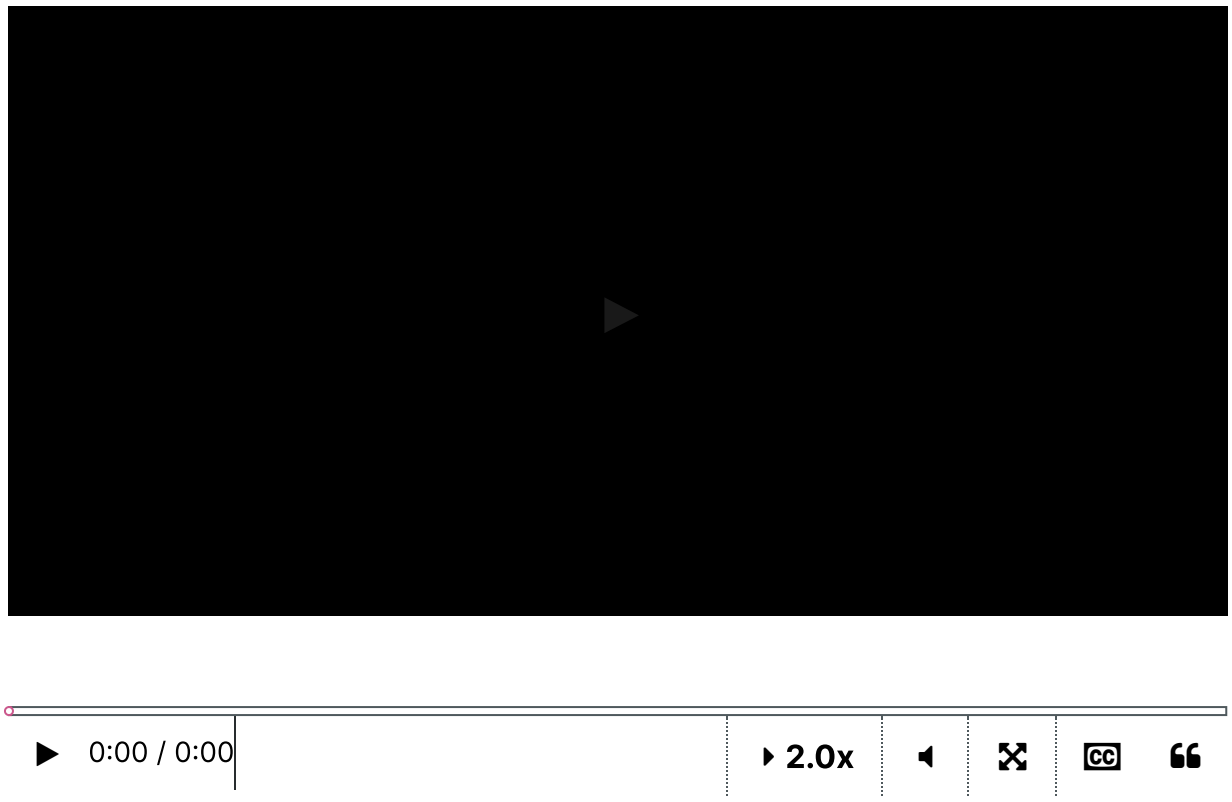

Dr. Robert van de Geijn: So let's have a look

at how we can show that a linear system does not have any solutions

and let's use the example from the last unit, the example

that we claimed to have no solution, to illustrate this.

In this particular case, we're starting

0:00 / 0:00 2.0x

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## Reading Assignment

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## Homework 9.2.2.1

Calculator

1/1 point (graded)

The system $\begin{pmatrix} 2 & -4 & -2 \\ -2 & 4 & 1 \\ 2 & -4 & 0 \end{pmatrix} \begin{pmatrix} \chi_0 \\ \chi_1 \\ \chi_2 \end{pmatrix} = \begin{pmatrix} 4 \\ -3 \\ 3 \end{pmatrix}$ has no solution.

TRUE ✔ Answer: TRUE

- Set this up as an appended system

$$\left(\begin{array}{ccc|c} 2 & -4 & -2 & 4 \\ -2 & 4 & 1 & -3 \\ 2 & -4 & 0 & 3 \end{array}\right).$$

  Now, start applying Gaussian elimination (with row exchanges if necessary).

- Use the first row to eliminate the coefficients in the first column below the diagonal:

$$\left(\begin{array}{ccc|c} 2 & -4 & -2 & 4 \\ 0 & 0 & -1 & 1 \\ 0 & 0 & 2 & -1 \end{array}\right).$$

- There is now a zero on the diagonal and no row below it with which to exchange to put a nonzero there. So, we move on and use the second row to eliminate the coefficients in the third column below the second row:

$$\left(\begin{array}{ccc|c} 2 & -4 & -2 & 4 \\ 0 & 0 & -1 & 1 \\ 0 & 0 & 0 & 1 \end{array}\right).$$

The last row translates to $0 \times \chi_0 + 0 \times \chi_1 + 0 \times \chi_2 = 1$ or $0 = 1$. This is a contradiction. It follows that this system does not have a solution since there are no choices for $\chi_0$, $\chi_1$, and $\chi_2$ such that $0 = 1$.

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Calculator

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