

# Linear Systems: Takeaways

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## Syntax

- Representing a matrix as an array:

```
import numpy as np
matrix_one = np.asarray([
    [0, 0, 0],
    [0, 0, 0]
], dtype=np.float32)
```

- Multiplying a row by a nonzero constant:

```
matrix[1] = 2*matrix[1]
```

- Adding one row to another row:

```
matrix[1] = matrix[1] + matrix[0]
```

- Combining and chaining row operations:

```
matrix[1] = 0.5*matrix[2] + matrix[1] + matrix[3]
```

## Concepts

- Linear algebra provides a way to represent and understand the solutions to systems of linear equations. We represent linear equations in the general form of  $Ax + By = c$ .
- A system of linear equations consists of multiple, related functions with a common set of variables. The point where the equations intersect is known as a solution to the system.
- The elimination method involves representing one of our variables in terms of a desired variable and substituting the equation that is in terms of the desired variable.
  - Suppose we have the equations  $y = 1000 + 30x$  and  $y = 100 + 50x$ . Since both are equal to  $y$ , we can substitute in the second function with the first function. The following are the steps to solve our example using the elimination method:
    - $1000 + 30x = 100 + 50x$
    - $900 = 20x$
    - $45 = x$
- A matrix uses rows and columns to represent only the coefficients in a linear system, and it's similar to the way data is represented in a spreadsheet or a DataFrame.
- Gaussian elimination is used to solve systems of equation that are modeled by many variables and equations.
- In an augmented matrix, the coefficients from the left side of the function are on the left side of the bar ( `|` ), while the constants from the right sides of the function are on the right side.
- To preserve the relationships in the linear system, we can use the following row operations:
  - Any two rows can be swapped.
  - Any row can be multiplied by a nonzero constant.
  - Any row can be added to another row.

- To solve an augmented matrix, you'll have to rearrange the matrix into echelon form. In this form, the values on the diagonal are all equal to 1 and the values below the diagonal are equal to 0.

## Resources

- [General form](#)
- [Elimination method](#)
- [Gaussian Elimination](#)
- [Linear algebra](#)