What are Systems of Linear Equations?

WPI

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- Linear algebra is to study system of linear equations via matrix and vector
- They have many applications
  - Machine learning
  - Economics and finance
  - Statistics
  - Image processing
  - and more ...

If you google "Matrix", you probably get ...

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Figure: From movie "The Matrix"

Definitions

- A matrix is a two-dimensional array of numbers,
  - A 2 by 3 matrix
  $$A = \begin{bmatrix} 2 & 1 & 15 \\ 1 & 1 & 5 \end{bmatrix}$$

- If a matrix has only one row or only one column it is called a vector,
  - A 2 dimensional column vector
  $$b_1 = \begin{bmatrix} 15 \\ 5 \end{bmatrix},$$

  - A 2 dimensional row vector
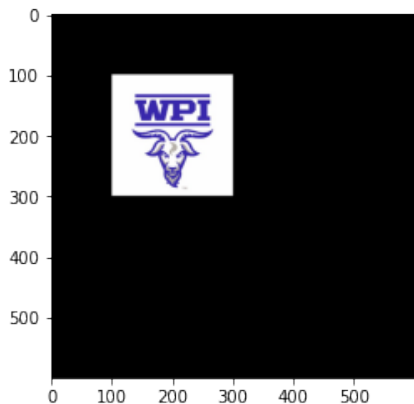 $$b_2 = \begin{bmatrix} 15 & 5 \end{bmatrix},$$

An example

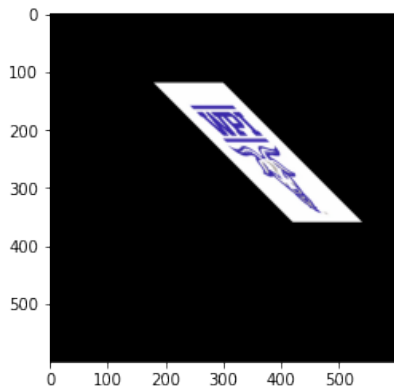Figure: Before Linear Transormation

Figure: After Linear Transormation