Gauss-Jordan
- first we want to make the first entry of the matrix equal to 1 by multiplying or dividing the first row by a constant
- we multiply the first row and add it to the other rows to make the other entries in the first column equal to zero
- then, we try to get the next non-zero number in the second row equal to 1 by multiplying or dividing the row by a constant
- and we continue with the process until we run out of rows

Solving Systems of Linear Equations Using Matrices
- Rewrite the system as a matrix by rearranging the order of the variables so that the variables in each column are the same.
- Take the coefficients of each variable as the input of the matrix.
- Use Gauss-Jordan to get the matrix into Reduce Row Echelon form
- If the rank is the same as the number of variables there are, then you have a unique solution (just set each variable equal to the column in the far right)
- If there is a row in which you have zeroes and a number in the last column of an auxiliary matrix, then there are no solutions
- if there is another number aside from the leading 1 and zeroes in a row, then you have an infinite number of solutions and need to use parameters (e.g. s and t).
  - EX: 1 0 0 1 | 4  \quad x^1 + x^4 = 4 \quad x^1 = 4 - x^4 \quad | -1 | \quad |4|
  - 0 1 0 2 | 3  \quad x^2 + x^4 = 3 \quad x^2 = 3 - x^4 \quad | -1 |(s) + |3|
  - 0 0 1 4 | 2  \quad x^3 + x^4 = 2 \quad x^3 = 2 - x^4 \quad | -1 | \quad |2|
  - 0 0 0 0 | 0  \quad |1 | \quad |0|

* Those are supposed to be vectors

Inverse Matrices
- a matrix must be a square matrix and must have a rank of n in order to be invertible
  - if the RRE form does not contain leading 1’s in every row, then you cannot find the inverse
- to find the inverse, write the matrix A next to the identity matrix I
- do Gauss-Jordan and treat A|I as a single matrix
- after reducing A into RRE form, then the matrix you have left is I|A^{-1}
- A*A^{-1} = I

Determinants
- formula: \( \det(M) \), where ‘i’ is the row, ‘j’ is the column, \( a_{ij} \) is the number at the ith row and jth column and M is the matrix left over when we take away the ith row and the jth column of the original matrix
- e.g. |1 2 3|
  \[ |4 5 6| \
  \[ |0 0 9| \]
  - pick the 3rd row to expand upon
\[ 0 \cdot (-1)^{1+3} \det \begin{bmatrix} 2 & 3 \\ 5 & 6 \end{bmatrix} + 0 \cdot (-1)^{2+3} \det \begin{bmatrix} 1 & 3 \\ 4 & 6 \end{bmatrix} + 9 \cdot (-1)^{3+3} \det \begin{bmatrix} 1 & 2 \\ 4 & 5 \end{bmatrix} \]

Subspaces
- subset of \( W \)
  - the 0 vector is an element of \( W \)
  - if \( \mathbf{v}^1 \) and \( \mathbf{v}^2 \) are elements of \( W \), then \( \mathbf{v}^1 + \mathbf{v}^2 \) are elements of \( W \) (adding the two will still give us something that is in \( W \))
  - if \( \mathbf{v}^1 \) is an element of \( W \) and \( c \) is an element of the real numbers, then \( c \mathbf{v}^1 \) is an element of \( W \)
- to prove that something is a subset of \( W \), you need to prove all 3 of these