Things that the linear algebra library needs to be able to compute

1. Transposition
2. Linear Combination
3. SumProduct of columns
4. Matrix Multiplication
5. Length of a vector (norm)
6. Gauss Elimination
   1. Finding Pivots
   2. With augmented matrices
   3. Row rank is the number of pivots in the REF for a matrix
   4. The number of pivots in the transposition of A is the column rank
7. One to one functions are also called “into” or “injective”
8. When every output directly maps to one input, the function is “onto” or “surjective”
9. F is bijective if it is both one-to-one and onto, meaning that it establishes a one-to-one correspondence
10. The identity function I(a) is I(a) = a
11. Row Echelon Form Calculation
12. Determine whether or not a system has a solution
13. Determine if there are one or more solutions
14. Find a single solution
15. Find all solutions
    1. Multiple solution finding algorithm
16. The null space of a matrix is all solutions to the equation Ax = 0
    1. Need to be able to compute null space
17. A system is consistent if it has at least one solution
18. A vector is in the column space of A if it is a linear combination of the columns of A
19. The span of a set of vectors is the set of all linear combinations of the vectors
    1. A system Ax = b is consistent
20. A set of vectors is linearly dependent if at least one of the vectors can be written as the linear combination of the remaining vectors.
    1. If a set is not linearly dependent, it is linear independent
    2. If a set of vectors is linearly dependent, we can throw away at least one vector without changing the span of the set
21. Need to be able to calculate whether or not a set is linearly dependent
22. A linearly independent set is called the basis of the column space of a set/matrix
23. Pivot columns in a one-to-on consistent system form the basis for the column space of a matrix
24. Need to be able to be able to calculate the basis for the column space of a matrix
25. The row space of a matrix A is the span of the set of row vectors
26. Non-zero rows after computing RREF are the basis for the row space of A
27. The rank of a matrix is the number of pivots in it
28. U (upside down t) or U-perp is the set of vectors for which any vector in the set U is orthogonal or perpendicular to vectors in the set U, this also means that all vectors in this set dotted againt U equal 0.
    1. This means that Row space – perp of a vector is the null space of a vector