# Tiny Project: Part A — Vector, Matrix, and Linear System Solver

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## Project Overview

This report is for Part A of the Tiny Project. The goal is to build a program in C++ that can solve linear equations using vectors and matrices.

## What We Implemented

### 1. Vector Class

*****Files:*** *Vector.h.cpp, Vector.cpp.cpp***

Can add, subtract, and multiply vectors

Supports 0-based and 1-based indexing

Includes memory management and printing

### 2. Matrix Class

*****Files:*** *Matrix.h.cpp, Matrix.cpp.cpp***

Can do matrix math and multiply with vectors

Includes transpose, inverse, and determinant

Uses 1-based indexing

### 3. LinearSystem Class

*****Files:*** *LinearSystem.h.cpp, LinearSystem.cpp.cpp***

Solves square systems using Gaussian elimination

Checks that matrix and vector sizes match

### 4. PosSymLinSystem Class

*****Files:*** *PosSymLinSystem.h.cpp, PosSymLinSystem.cpp.cpp***

Checks if the matrix is symmetric

Uses Conjugate Gradient method to solve

### 5. GeneralLinearSystem Class

*****Files:*** *GeneralLinearSystem.h.cpp, GeneralLinearSystem.cpp.cpp***

Solves over-determined or under-determined systems

Supports pseudo-inverse and Tikhonov regularization

## Final Status

| **Component** | **Done** | **Checked** |
| --- | --- | --- |
| Vector class | ✅ | ✅ |
| Matrix class | ✅ | ✅ |
| LinearSystem | ✅ | ✅ |
| PosSymLinSystem | ✅ | ✅ |
| General system solver | ✅ | ✅ |

## Conclusion

We have completed Part A of the Tiny Project. All the required C++ classes are working and tested.