**Progress Report: (To be filled in BEFORE you meet with the teacher)**

Date: May 13th, 2019, Number of Days before Due: 3

**1. List the project goals that were to be completed by this date. Check all the goals that have *actually* been completed.**

Completed goals:

* Learn Linear algebra(Gain intuition for vectors, matrices, matrix transformations, dot products, determinants, cross products, eigenvalues, and eigenvectors)
* 3D to 2D Projection(Math and Code)
* 3D Translation(Math and Code)
* 3D Rotation(Math and Code)
* 3D Sphere Scaling(Math)
* Bullet and sphere collision(Math)

**2. Have any goals been completed in advance? List them.**

Yes, most above goals in question 1 have been completed in advance(Before due date May 26th):

* 3D to 2D Projection(Math and Code)
* 3D Translation(Math and Code)
* 3D Rotation(Math and Code)
* 3D Sphere Scaling(Math)
* Bullet and sphere collision(Math)

**3. If you are behind schedule, what plans have you made to catch up?**

I am not behind schedule, however if I were to be, I can easily allocate more time at home to work on my summative, as I’ve previously done so for the “Learn Linear Algebra” goal

**4. What sorts of things did you have to research?**

* I had to research the underlying math behind 3D to 2D projection
* I had to research linear algebra, or more specifically:
  + Vectors, Span
  + Matrices
  + Matrix transformations
  + Matrix multiplication
  + Dot products
  + Cross products
  + Determinant
  + Inverse matrices

There was no research needed to solve 3D Rotation or 3D Translation, etc… As once I’ve learned the tools in linear algebra, I could come up with solutions purely from scratch instead of searching online. However I have researched for more efficient solutions and I found out my solutions are in fact the most efficient.

**5. What sorts of difficulties are you having so far? Are there any issues that you feel will come up in the future that will affect your progress?**

* Linear Algebra is not taught in school, it is taught as a university course therefore I must dedicate my free time to learn it. If in the future I suddenly realize my program requires another branch of math such as topology or multivariable calculus I may have to go through the same process of learning the university level subject from scratch, which will take a tremendous amount of time, and it will affect my progress.
* Linear Algebra is difficult to gain an intuition for. It’s easy to just memorise formulas but difficult to learn to use its tools to solve problems from scratch. However I solved this problem with the help of 3Blue1Brown’s linear algebra course.

**6. In general, how well do you think you are doing with this project?**

* I think I am doing extremely well with this project. I’ve figured out most of the underlying math of all my biggest programming challenges, and implementing it into code is the simple part.
* Learning linear algebra was also much easier than I thought as I have a deep interest in mathematics. Learning about it for me can be compared to watching netflix: It doesn’t feel like school, it feels like doing a hobby, therefore learning it is quite effortless.

Comments from Teacher: