

## Project 8A - Vector Products

Today we begin a unit on working with matrices. By the end of this unit you will be able to multiply matrices, invert matrices, and find eigenvalues of matrices. You will also see applications of these operations. In this unit, you will also learn/use some programming skills that were not required for the first half of the course. You will be able to separate your program into multiple files and use files that others in the course have written. You will write your own classes and use arrays to store sets of values.

In part A, you will work with separate files and write your own class definition. You will implement a constructor. You will do all this in the context of working with 3-D vectors. You do not need to use arrays yet.

1. In class work. Create a file called YOURFIRSTNAME.h that includes a method called print. This print method should just print your first name. Create, in a separate file, a program called test. Your test program should call the print function from your team member's program. Run it. You will need to copy your partner's files to your computer. There is nothing to submit for this part.
2. Create a class called VectorYOURFIRSTNAME that stores three doubles that represent the x,y, and z components of the vector. The class must have a constructor that takes three doubles and two integers as the input. Add a function/method to your class that prints the vector to the screen in a reasonable way.
3. Create another file called P8AYOURFIRSTNAME that creates an instance of a velocity vector  $\vec{v} = 2\hat{i} + 5\hat{j} + 9\hat{k}$  m/s and uses your print function from VectorYOURFIRSTNAME to print it to the screen.
4. Add two more functions to your VectorYOURFIRSTNAME. The first should compute the dot product of this vector with another (passed as three double inputs) and return one double value. The second should compute the cross product of this vector with another and return a VectorYOURFIRSTNAME.
5. Alter your P8AYOURFIRSTNAME to create an instance of a velocity vector for an electron  $\vec{v} = 2\hat{i} + 5\hat{j} + 9\hat{k}$  m/s and a magnetic field vector  $\vec{B} = 2\hat{i} + 7\hat{j} + 1\hat{k}$  Tesla and uses your VectorYOURFIRSTNAME cross product to compute the force on the electron moving through this field. Be sure to print units!
6. @ Review. Write a problem that computationally determines the centroid of a semi-circle. To get credit, show me your working program.

Place your code in the P8 dropbox, but note you can only get extra credit by showing me your program.