MATH-3030 – Math Models for CS

Project – Vector Calculus

General directions.

(1) You may use a computer algebra system (such as *Mathematica*, *Matlab*, etc)or a programming language (such as *C++*, *Java*, etc) or possibly some other appropriate software of your choice.

(2) The words *"A point (a vector) is given"* mean that its coordinates (components) are given.

The words *"A line is given"* mean that its equation is given. You can use as an input either equation of the line in some form or its initial point and direction vector.

The words *"A plane is given"* mean that its general equation is given. You can use as an input either this equation or the vector of coefficients.

The words *"Determine ..., find ..."* mean that you are asked to create a program(or some kind of software implementation) that takes as input the given data and returns the required equations.

(3) Submit a paper that includes: a nice cover sheet, an explanation of the mathematical principles used in your programs, and a printout of sample runs of the programs. *(5 points for the paper submission.)*

(4) Keep the programs on your computers. Later I will set up short meetings with you to check how your programs work on inputs selected by me. *(5 points for this.)*

The problem. A line l and a point P in $\mathbb{R}^3$ are given.

(1) Determine whether the point P lies on the line l.

(2) If P is not in the line l, find the plane that contains l and P.

(3) Find equation of the plane that passes through P perpendicular to l.

(4) Find the line that passes through P and perpendicular to l.

Due date. The paper portion of the project is due **Thursday, July 8** no later than 1:50 pm. Early submissions are welcome. After that date I'll set up short meetings with each group.