

## Math115 Test 5: Vector Geometry (optional take home)

Answer each question on a new sheet of paper, and do not erase anything. Show all working, reasoning and checks to achieve full marks. The number in square brackets indicates the number of marks available for each part of each question.

Any rough work done before attempting your solutions should be attached to your answers as I need to know how you came up with them. You are allowed to talk with me or other members of the class in general about the questions, but you must do them on your own. Plagiarism will earn a score of zero.

The numbers represented by  $a$ ,  $b$ ,  $c$  and  $d$  in the questions should be replaced by the last four digits of your registration number in that order. For instance, if my registration number was 20012705 then i would take  $a = 2$ ,  $b = 7$ ,  $c = 0$  and  $d = 5$ .

Each student is assigned a line and a point in 3 dimensions based upon these numbers:

The line is  $L := \begin{pmatrix} 2 \\ -1 \\ 0 \end{pmatrix} + k \begin{pmatrix} a \\ b \\ 0 \end{pmatrix}$  and the point is  $P := \begin{pmatrix} b \\ c \\ d \end{pmatrix}$ .

1. At which point does  $L$  intersect  $\begin{pmatrix} 4 \\ 3 \\ 0 \end{pmatrix} + j \begin{pmatrix} 11 \\ 7 \\ 0 \end{pmatrix}$ ?

2. What line passes through  $\begin{pmatrix} 2 \\ -1 \\ 0 \end{pmatrix}$  and is orthogonal to  $L$ ?

3. What is the distance between  $P$  and the plane  $\begin{pmatrix} x \\ y \\ z \end{pmatrix} \circ \begin{pmatrix} 6 \\ 1 \\ -5 \end{pmatrix} = 13$ ?

4. How close does  $L$  get to the line  $h \begin{pmatrix} 6 \\ 1 \\ -5 \end{pmatrix}$  which passes through the origin?