Lab 1—Lines, Planes, and Distances

Objective: To become accustomed to MATLAB and to use it to study some basic properties of lines, planes, and distances.

MATLAB Commands:

Some Arithmetic and Trig:

`x=7`	Assign to `x` the value 7.
`3*14/(4+2)`	Always use asterix (`*`) for multiplication, slash (`/`) for division.
`3^2`	Use hat (`^`) for exponents.
`sqrt(25)`	Square root function.
`cos(pi)`	Use `pi` for π. The other trig functions are similarly defined.
`acos(1)`	Inverse cosine (arccos). Make inverse trig functions by placing an `a` in front of the command for the trig function.

Some vector commands:

`a=[12 5 -3]`	This creates the vector (12,5,-3) and gives it the name `a`.
`b=(1/3)*[0 10 3]`	Creates vector (0,10/3,1). Notice how arithmetic is done in MATLAB: Slash (/) for division and asterix (*) for multiplication.
`c=a/3+(2^3)*b`	More arithmetic. The hat (^) denotes exponentiation (so `2^3=8`).
`dot(a,b)`	Takes the dot product of two vectors `a` and `b`.

Submit your answers on paper to your TA for marking. For those questions that involve the use of MATLAB, write down any relevant work involved in setting up the problem and copy the solution from the screen to your answer sheet.

1. Practise basic MATLAB commands by using MATLAB to compute the following quantities:

   a) $3^5/6^2-(2.05)(1.96)$

   b) $\sqrt{\dfrac{1}{2.54}}$

   c) $4(2,3,-4)-(2^5/9)(3.2,1.4,-1.5)$

   d) $(3,-2,4/3)\cdot(-2.5,-7/4,5)$

e) $\sin(\pi/6)$ (Note that by default MATLAB assumes angles are expressed in radians.)

f) $\arctan(0.8)$

g) $3.4\mathbf{u} - 1.8\mathbf{v}$ where $\mathbf{u} = (3.1, -4.2, 2.6)$ and $\mathbf{v} = (3.3, -4.1, -2.7)$.

2. Find the length of each vector and the angle between each pair:

a) $\mathbf{u} = (2, -3)$, $\mathbf{v} = (2, 1)$

b) $\mathbf{u} = (4, -2, -1)$, $\mathbf{v} = (3/2, 0, 2)$

c) $\mathbf{u} = (1.27, 2.33, -0.73)$, $\mathbf{v} = (1.78, -0.66, 1.22)$

3. Which of the following vectors lies parallel to the plane $2x_1 - 4x_2 + 3x_3 = 0$?

a) $(4, -2, 7)$

b) $(-3, 3/2, 4)$

c) $(2, 0, -3)$

4. Find the points of intersection, if any, of the following lines:

a) $\mathbf{x}(t) = (2, -3) + t(2, 4)$ and $\mathbf{x}(s) = (1, 1) + s(-1, -2)$ in R^2.

b) $\mathbf{x}(t) = (3, 4, 2) + t(-2, 1, 2)$ and $\mathbf{x}(u) = (1, 2, 4) + u(1, 4, -1)$ in R^3.

c) $\mathbf{x}(s) = (1, 3, 2) + s(-2, 1, 1)$ and $\mathbf{x}(u) = (3, 4, -2) + u(3, 0, 3)$ in R^3.

Which of the above pairs of lines are parallel?