Bilkent University

Quiz # 4
Math 102-011 Calculus
March 13, 2015 Friday

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Q-1) Let L be the line given by the parametrization

$$L(t) = (1+2t,\ 3+4t,\ 5+6t), \quad \text{where} \quad t \in \mathbb{R}.$$

a) Write an equation for the plane which contains the points

$$p_1 = (1,\ 2,\ 3) \quad \text{and} \quad p_2 = (3,\ 2,\ 1),$$

and is parallel to the line L.
b) Does the line L intersect the plane?

: Grading is 70+30 points.

Answer:

We find two vectors parallel to the plane. One is $p_2 - p_1$ and the other is the direction vector of the line L. Thus let

$$\vec{v}_1 = p_2 - p_1 = (2, 0, -2) \quad \text{and} \quad \vec{v}_2 = (2, 4, 6) :$$

A normal vector to the plane will be in the direction of $\vec{v}_1 \times \vec{v}_2$. We have

$$\vec{v}_1 \times \vec{v}_2 = \begin{vmatrix} i & j & k \\ 2 & 0 & -2 \\ 2 & 4 & 6 \end{vmatrix} = (8, -16, 8).$$

Take $\vec{n} = (1, -2, 1)$. Then an equation of the plane passing through p_1 and parallel to the line L is $\vec{n} \cdot (p - p_1) = 0$ where $p = (x, y, z)$. We can write this equation as

$$x - 2y + z = 0.$$

This answers part **a**. For the **b** part check that

$$(1+2t) - 2(3+4t) + (5+6t) = 0 \quad \text{for all} \quad t \in \mathbb{R},$$

hence the line L totally lies in the plane.