Bilkent University

Quiz # 05
Math 102 Section 08 Calculus II
11 March 2024 Monday
Instructor: Ali Sinan Sertöz
**Solution Key**

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**Q-1)** Let $L$ be the line passing through the points $P = (1, 2, 3)$ and $Q = (4, -5, 6)$. Write (a) a vector equation, (b) a parametric equation and (c) a symmetric equation for the line $L$.

**Q-2)** Let $\pi$ be the plane passing through the points $P = (1, -2, 3)$, $Q = (-1, -4, 2)$ and $R = (5, 1, 2)$. Write the equation of $\pi$ in the form $Ax + By + Cz = D$, where $A, B, C, D \in \mathbb{Z}$, $D > 0$ and $\gcd(A, B, C, D) = 1$.

*Show your work in detail. Correct answers with no justification will not get any credit.*

Grading: (2+2+2)+4 points

**Solution:** (Grader: melis.gezer@bilkent.edu.tr)

**(1)** Let $U = Q - P = (3, -7, 3)$. Then a vector equation is of the form $L(t) = P + tU$ with $t \in \mathbb{R}$. The required equations are then of the form

$$\begin{array}{ll} (a) & L(t) = (1 + 3t, 2 - 7t, 3 + 3t), \ \ t \in \mathbb{R}. \\ (b) & x = 1 + 3t, \ y = 2 - 7t, \ z = 3 + 3t, \ t \in \mathbb{R}. \\ (c) & \dfrac{x-1}{3} = \dfrac{y-2}{-7} = \dfrac{z-3}{3}. \end{array}$$

**(2)** Let $X = (x, y, z)$. Then an equation of $\pi$ is of the form

$$((Q - P) \times (R - P)) \cdot (X - P) = 0.$$

We see that $Q - P = (-2, -2, -1)$, $R - P = (4, 3, -1)$ and

$$(Q - P) \times (R - P) = \begin{vmatrix} \vec{i} & \vec{j} & \vec{k} \\ -2 & -2 & -1 \\ 4 & 3 & -1 \end{vmatrix} = (5, -6, 2).$$

Also note that $(5, -6, 2) \cdot P = 23$. Hence the required equation for $\pi$ is

$$5x - 6y + 2z = 23.$$