

Last Name: SOLUTIONS

First Name: _____

Student ID: _____

Quiz 9 (A)

Question 1. (5 marks) Find the equation of the plane that passes through the points $P_1(0, 2, -1)$, $P_2(3, 2, 5)$, and $P_3(4, -1, 2)$.

$$\overrightarrow{P_1P_2} = (3-0, 2-2, 5-(-1)) = (3, 0, 6)$$

$$\overrightarrow{P_1P_3} = (4-0, -1-2, 2-(-1)) = (4, -3, 3)$$

$$\vec{n} = \overrightarrow{P_1P_2} \times \overrightarrow{P_1P_3} = (3, 0, 6) \times (4, -3, 3) = \left(\begin{vmatrix} 0 & -3 \\ 6 & 3 \end{vmatrix}, -\begin{vmatrix} 3 & 4 \\ 6 & 3 \end{vmatrix}, \begin{vmatrix} 3 & 4 \\ 0 & -3 \end{vmatrix} \right)$$

$$= (18, 15, -9)$$

∴ EQUATION: $18x + 15y - 9z + d = 0$

$$18(0) + 15(2) - 9(-1) + d = 0$$

$$39 + d = 0$$

$$d = -39$$

$$\therefore 18x + 15y - 9z - 39 = 0$$

Question 2. (2 marks) Find the equations of the line that passes through the point $P(2, 0, -1)$ and is parallel to the vector $\vec{v} = (14, -\frac{35}{3}, 7)$.

$$(x, y, z) = \left(2 + 14t, -\frac{35}{3}t, -1 + 7t \right) \quad t \in \mathbb{R}$$

Question 3. (3 marks) Are the plane found in question 1 and the line found in question 2 perpendicular, parallel or neither?

$$\vec{n} \cdot \vec{v} = (18, 15, -9) \cdot \left(14, -\frac{35}{3}, 7 \right) = 252 - 175 - 63 = 14 \neq 0$$

NOT PARALLEL

$$(18, 15, -9) = \lambda \left(14, -\frac{35}{3}, 7 \right) \Rightarrow$$

$$18 = \lambda(14) \Rightarrow \lambda = \frac{9}{7}$$

$$15 = \lambda \left(-\frac{35}{3} \right) \Rightarrow \lambda = -\frac{9}{7}$$

$$-9 = \lambda(7) \Rightarrow \lambda = -\frac{9}{7}$$

NOT PERPENDICULAR.

THE PLANE AND THE LINE ARE
NOT PARALLEL OR PERPENDICULAR.