Dawson College: **Linear Algebra** (SCIENCE): 201-NYC-05-S1: Winter 2025: **Quiz 6** name: _____

Books, watches, notes or cell phones are **not** allowed. The **only** calculators allowed are the Sharp EL-531**. You **must** show all your work, the correct answer is worth 1 mark the remaining marks are given for the work.

Question 1. Consider the lines $\mathscr{L}: \begin{cases} x = kt + 7 \\ y = t - 3 \\ z = 3t + 4 \end{cases}$, $t \in \mathbb{R}$ and the plane $\mathscr{P}: 3x + 4z = 7$

a. *(3 marks)* Determine the values of k, if any, for which $\mathscr{L}$ is parallel to $\mathscr{P}$.

b. *(5 marks)* If $k = 1$ find the points on the line $\mathscr{L}$ that are 3 units away from the plane $\mathscr{P}$.

Question 2. *(3 marks)* Determine whether the following statement is true or false. If the statement is false provide a counterexample. If the statement is true provide a proof of the statement.

If the relationship $\text{proj}_{\mathbf{a}}(\mathbf{u}) = \text{proj}_{\mathbf{a}}(\mathbf{v})$ hold for some nonzero vector $\mathbf{a}$, then $\mathbf{u} = \mathbf{v}$.

Question 3. *(2 marks)* Find the parametric equation of the plane which is orthogonal to both $\mathscr{P}_1 : x+y+z=1$ and $\mathscr{P}_2 : x+2y+z=3$ and passes through the origin.

Question 4. *(3 marks)* Consider the system with equations: $x+y+z=b_1, x+2y+cz=b_2$ and $x+3y+dz=b_3$ where b_1, b_2, b_3, c, d are fixed real values, $P(1,1,1)$ satisfies all three equations and the solution set of the corresponding homogeneous linear system is $\mathbf{x} = t(2,-1,-1)$ where $t \in \mathbb{R}$.

Using a clearly labelled sketch give a geometrical interpretation of the linear system and its solution set, and the corresponding homogeneous linear system and its solution set.