Dawson College: **Linear Algebra** (SCIENCE): 201-NYC-05-S1: Winter 2023: **Quiz 11** 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. *(1 mark each)* Complete each of the following sentences with MUST, MIGHT, or CANNOT.

a. If $(1,1,0,0,0)$ and $(2,0,0,0,0)$ are both solutions of a system of 13 linear equations $A\mathbf{x} = \mathbf{b}$ then $(-1,1,0,0,0)$ _____ be a solution of the associated homogeneous system $A\mathbf{x} = \mathbf{0}$.

b. If the solution set of a system of 13 linear equations $A\mathbf{x} = \mathbf{b}$ is a line and $(1,1,0,0,0)$ and $(2,0,0,0,0)$ are both solutions of the system $\mathbf{x} = (-12,14,0,0,0) + t(-13,13,0,0,0), t \in \mathbb{R}$ _____ is the solution set of $A\mathbf{x} = \mathbf{b}$.

c. If $(1,1,0,0,0)$ and $(2,0,0,0,0)$ are both solutions of a system of 13 linear equations $A\mathbf{x} = \mathbf{b}$ then $(-1,1,0,0,0)$ _____ be orthogonal to the rows of the coefficient matrix A.

d. If $(1,1,0,0,0)$ and $(2,0,0,0,0)$ are both solutions of a system of 13 linear equations $A\mathbf{x} = \mathbf{b}$ then $(0,1,0,0,0)$ _____ be orthogonal to the rows of the coefficient matrix A.

Question 2.

a. *(2 marks)* Find the parametric equation of the plane $x + 2y + 3z = 5$. Find a point on the plane and two vectors parallel to the plane.

b. *(2 marks)* Find the intersection between the plane $x + 2y + 3z = 5$ and the xy-plane.

c. *(2 marks)* Find all unit vectors parallel to the plane $x + 2y + 3z = 5$ and the xy-plane.

Question 3. *(5 marks)* Given that $\mathscr{L}_1 : \mathbf{x} = (1,0,2) + t(-1,3,2)$, $\mathscr{L}_2 : \mathbf{x} = (1,1,-1) + t(-1,3,2)$ where $t \in \mathbb{R}$ and $P(0,5,-4)$ all lie on the same plane. Determine whether P lies between $\mathscr{L}_1$ and $\mathscr{L}_2$.

Bonus Question. *(3 marks)* Given a *Yann plane segment* defined as $\mathbf{x} = (1,0,2) + s(1,1,1) + t(2,1,3)$ where $(s,t) \in [-1,2] \times [-2,0]$. Find the area of the Yann plane segment.