Dawson College: **Linear Algebra** (SCIENCE): 201-NYC-05-S1: Winter 2023: **Quiz 14** 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. *(4 marks)* Determine whether $H = \{A \mid A \in \mathscr{M}_{n\times n} \text{ and } BAC = CAB\}$ where B and C are fixed $n \times n$ matrices, is a subspace of $\mathscr{M}_{n\times n}$

Question 2. *(4 marks)* Let $\{A_1, A_2, \ldots, A_k\}$ be linearly independent in $\mathscr{M}_{m\times n}$, and suppose that U and V are invertible matrices of size $m \times m$ and $n \times n$, respectively. Show that $\{UA_1V, UA_2V, \ldots, UA_kV\}$ is linearly independent.

Question 3. *(4 marks)* Determine whether the following statements is true or false. If the statement is false, provide a counterexample. If the statement is true, provide a proof of the statement.
If $\mathbf{u}, \mathbf{v}, \mathbf{p}, \mathbf{q}$ be nonzero vectors in $\mathbb{R}^3$ and $\operatorname{span}\{\mathbf{u}, \mathbf{v}\} = \operatorname{span}\{\mathbf{p}, \mathbf{q}\}$ then $(\mathbf{u} \times \mathbf{v}) \times (\mathbf{p} \times \mathbf{q}) = \mathbf{0}$.