Dawson College: **Linear Algebra** (SCIENCE): 201-NYC-05-S1: Winter 2023: **Quiz 13** 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] Let $V = \{(a,b) \mid a,b \in \mathbb{R}, b > 0\}$. And the addition in V is defined by $(a,b) \bigoplus (c,d) = (ad+bc, bd)$ and scalar multiplication in V is defined by $t \bigodot (a,b) = (tab^{t-1}, b^t)$

a. *(1 mark)* $(4,2) \bigoplus (-5,1)$

b. *(1 mark)* $-2 \bigodot (1,2)$

c. *(3 marks)* Demonstrate whether the 4th axiom of vector spaces holds. That is, does the zero vector exists in V.

d. *(3 marks)* Demonstrate whether the 5th axiom of vector spaces holds. That is, additive inverses in V exists for all vectors in V.

Question 2. *(5 marks)* Prove: If $a \neq 1$ and $\mathbf{v}$ is any vector in a vector space V such that $a\mathbf{v} = \mathbf{v}$ then $\mathbf{v} = \mathbf{0}$. *Show every step, justify every step, and cite the axiom(s) used!!!*

Bonus Question. *(3 mark)* Show that the commutativity axiom can be shown using the other axioms by first calculating $(1+1)(\mathbf{v}+\mathbf{w})$ in two different ways.

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[1]From http://www.math.uwaterloo.ca/ jmckinno/Math225/Week1/Lecture1e.pdf