Algebra A – Learning Log 2

The study goal is to understand how culture influences students' mathematical conceptions and learning skills.

In this study, you will be asked to answer questions. Some of them will be mathematical questions, regarding the material of the course. In other questions you will be asked to reflect on the previous answers that you gave and about your learning process in the course.

Taking part in this study is completely voluntary. There are no right or wrong answers. The records of this study will be kept private, and will not affect your course grade. Answering the mathematical questions incorrectly will not affect your course grade.

If you decide not to take part or to skip some of the questions, it will not affect your course grade. If you decide to take part, you are free to withdraw at any time.

If you decide to participate you will benefit a **bonus of 2 points** added to your final grade (see details on the course website).

If you have any questions, please don't hesitate to contact me, at:
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Thank you for your participation.

Definitions:

Let A be a matrix of order $n \times n$.

(1) The **trace** of A is denoted by $\mathrm{tr}(A)$, and is equal to the sum of the elements on its main diagonal:

$$\mathrm{tr}(A) = a_{11} + a_{22} + ... + a_{nn}$$

(2) A is called a **scalar matrix** if it is diagonal, and all the elements on its main diagonal are equal:

$$A = \lambda \cdot I = \begin{pmatrix} \lambda & 0 & ... & 0 \\ 0 & \lambda & ... & 0 \\ & & \ddots & \\ 0 & 0 & ... & \lambda \end{pmatrix}$$

Answer the following problem:

(a) Let A be a matrix of order 2×2 satisfying $\mathrm{tr}(A) = 0$. Prove that A^2 is a scalar matrix.

(b) Let A and B be matrices of order 2×2. Prove that $\mathrm{tr}(AB - BA) = 0$.

(c) Let A, B and C be matrices of order 2×2. Prove that $C(AB - BA)^2 = (AB - BA)^2 C$.

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Question: Can these results be extended to matrices of order $n \times n$? Add an explanation to support your answer.

Answer the following questions:

1. Rate the difficulty of the given problem, in scale of 1-9.
   (1 - very easy, 9 - very hard)

   1 2 3 4 5 6 7 8 9

2. How confident are you that you answered correctly, in scale of 1-9?
   (1 - not confident at all, 9 - very confident)

   1 2 3 4 5 6 7 8 9

3. If you think you were right, what helped you answer correctly?
   If you think you were wrong, what could have helped you answer correctly?

4. What skills are necessary in order to succeed in the course?