AGLA 1. TEST 1. **VARIANT 1.** 15 points, 60 minutes

Rules:

- no talking AT ALL is allowed during the Test
- no cheat-sheets are allowed
- any electronic devices are not allowed except for a simple non-programmable calculator

Full name:	Group:	Signature:

Task:	1	2	3	4	Total
Score:					

1. (2 points) Given two vectors $\mathbf{p} = (1, 2, 3)$ and $\mathbf{q} = (1, -2, 2)$.
   (a) Decompose the vector $\mathbf{p}$ into two components that are parallel and perpendicular to the vector $\mathbf{q}$.
   (b) Find the angle between $\mathbf{p}$ and $\mathbf{q}$.

2. (3 points) – *Ivan will edit this*
   (a) Find the matrix product AB if $A = \begin{bmatrix} 1 & 2 & 5 \\ 3 & 7 & x \end{bmatrix}$, $B = \begin{bmatrix} 5 & -1 \\ x & 2 \\ -3 & -1 \end{bmatrix}$
   (b) Find the largest and the smallest possible value of determinant $|AB|$.

3. (4 points) For which values x, vectors $\mathbf{a}$ and $\mathbf{b}$ are basis of some space? Explain your answer.
   $\mathbf{a} = \begin{bmatrix} 1-x \\ x \end{bmatrix}$, $\mathbf{b} = \begin{bmatrix} 1-x \\ -2 \end{bmatrix}$

4. (6 points) Given a parallelogram $ABCD$. Point N is the crossing of its diagonals. The old coordinate system has origin A and the basis AB, AD.
   (a) Define a new coordinate system formed by the point D and two new basis vectors: DB and DC.
   (b) Compute the transitions matrix A from the old basis to the new basis.
   (c) Calculate coordinates of point N in both bases, using the transition matrix A.

End of Test 1

AGLA 1. TEST 1. **VARIANT 2.** 15 points, 60 minutes

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Full name:	Group:	Signature:

Task:	1	2	3	4	Total
Score:					

1. (2 points) Given two vectors $\mathbf{p} = (2, 4, 6)$ and $\mathbf{q} = (1, 2, -2)$.
   (a) Decompose the vector $\mathbf{p}$ into two components that are parallel and perpendicular to the vector $\mathbf{q}$.
   (b) Find the angle between $\mathbf{p}$ and $\mathbf{q}$.

2. (3 points) *Ivan will edit this as well*
   (a) Find the matrix product AB if $A = \begin{bmatrix} 2 & x & 5 \\ 4 & 3 & -2 \end{bmatrix}$, $B = \begin{bmatrix} 1 & x \\ -3 & 2 \\ -1 & 2 \end{bmatrix}$
   (b) Find the largest and the smallest possible value of determinant $|AB|$.

3. (4 points) For which values x, vectors $\mathbf{a}$ and $\mathbf{b}$ are basis of some space? Explain your answer.
   $\mathbf{a} = \begin{bmatrix} x-6 \\ x-4 \end{bmatrix}$, $\mathbf{b} = \begin{bmatrix} -x \\ -1 \end{bmatrix}$

4. (6 points) Given a parallelogram $ABCD$. Point N is the crossing of its diagonals. The **old** coordinate system has origin A and the basis AN, AD.
   (a) Define a **new** coordinate system formed by the point C and two **new** basis vectors: CN and CD.
   (b) Compute the transitions matrix A from the old basis to the new basis.
   (c) Calculate coordinates of point N in both bases, using the transition matrix A.

End of Test 1