Linear Algebra. Midterm exam. Variant 1.

First name	Last name	Group	Points#1/2	Points#3
		BS1-		

I am, _____ (initials), confirming that I have read the following rules and agree to comply with them, that all solutions on this paper is my own work.

________________ (signature)

Rules:

- no talking AT ALL is allowed during the exam and after it (if you are still in the room)
- when time is up, you have to put down your pen (pencil) and do NOT write anything else
- you can NOT leave your seat till the end of the test
- any electronic devices are not allowed

1. (**1 point** for each correct answer) Indicate whether the statements are true or false:

- Rank is the number of the columns minus the total number of the rows. True / False
- The column space of a 2 by 2 matrix is the same as its row space. True / False
- A 4 by 4 matrix with a row of zeros is not invertible. True / False

2. (**4 points**) Let $S_1 = \{x, y, z : x + 5y - 8z = 11\}$ and $S_2 = \{x, y, z : x + z = 3\}$. $\vec{v} = \begin{bmatrix} \mathrm{x} \\ \mathrm{y} \\ \mathrm{z} \end{bmatrix}$ – is the intersection of S_1 and S_2. Find $\vec{v}$.

3. (**4 points**) Subspace S of $\mathbb{R}^3$is formed by linear combination of vectors v_1 and v_2. Find a vector v that is orthogonal to S, if: $v_1 = \begin{bmatrix} 2 \\ 2 \\ 1 \end{bmatrix}$, $v_2 = \begin{bmatrix} 4 \\ 4 \\ 2 \end{bmatrix}$.

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First name	Last name	Group	Points#4	Points#5
		BS1-		

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4. (**7 points**) For each real parameter λ construct a linear independent system that contains the maximum number of the following vectors:

$$\vec{a} = \begin{pmatrix} -\lambda \\ 1 \\ 2 \\ 3 \end{pmatrix} \vec{b} = \begin{pmatrix} 1 \\ -\lambda \\ 3 \\ 2 \end{pmatrix} \vec{c} = \begin{pmatrix} 2 \\ 3 \\ -\lambda \\ 1 \end{pmatrix} \vec{d} = \begin{pmatrix} 3 \\ 2 \\ 1 \\ -\lambda \end{pmatrix} \vec{e} = \begin{pmatrix} 1 \\ 1 \\ 1 \\ 1 \end{pmatrix}$$

5. (**6 points**) Find the dimensions of the four fundamental subspaces associated with A, depending on the parameters $\boldsymbol{\alpha}$ and $\boldsymbol{\beta}$.

$$\mathrm{A} = \begin{pmatrix} 7 & 8 & 5 & 3 \\ 4 & \boldsymbol{\alpha} & 3 & 2 \\ 6 & 8 & 4 & \boldsymbol{\beta} \\ 3 & 4 & 2 & 1 \end{pmatrix}$$

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First name	Last name	Group	Points#6	Points#7
		BS1-		

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6. (**5 points**) Let $A\ [n \times m]$ and $B[n \times k]$ matrixes with real components, $rank(A) = r_a$, $rank(B) = r_b$. Find $rank(C)$.

$$C = \begin{pmatrix} A & 9B \\ 2018A & B \end{pmatrix} \text{ – block matrix}$$

7. (**6 points**) Find a polynomial (with real coefficients) for which:
$P(0) = y_1, P(1) = y_2, P(-1) = y_3, P(2) = y_4$