

Linear Algebra. Final 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. (6 points) Find parameters α and β for which $f(x, \alpha, \beta) = \alpha x + \log \beta x$ best fits to the following points:
(1, 1), (2, 2), (4, 2).
2. (4 points) Find $\det(e^A)$ for $A = \begin{pmatrix} 7 & 6 \\ 6 & 2 \end{pmatrix}$.
3. (5 points) Find extrema of $f(x, y) = x^3 + y^3 - 6xy + 15$.

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First name	Last name	Group	Points#4/5	Points#6
		BS1-		

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4. (5 points) For which α and β quadratic form Q is positive definite? Negative definite?

$$Q(x, y, z) = ax^2 + y^2 + 8z^2 + bxy + 6xz$$

5. (2 points) Write down the system (and matrix) for the following differential equation:

$$y^{(IV)} + y''' - 2y'' + 6y = 0$$

(2 points) Is this system stable?

6. (5 points) Solve the following system of differential equations:

$$\begin{cases} \frac{dx}{dt} = -y \\ \frac{dy}{dt} = x + y - 2z \\ \frac{dz}{dt} = x - y \end{cases}$$

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First name	Last name	Group	Points#7/8	Points#9
		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.

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7. (4 points) Write down the matrix of the linear transformation, which performs the following:
 - first, rotates every vector to 45 degrees clockwise around OX
 - and then project onto plane, which is goes through points $(0,0,0)$, $(1,0,1)$, $(0,1,1)$
8. (4 points) Find the volume of the triangular pyramid with vertices $(0, 9, 7)$, $(1/2, -3, 1)$, $(-3, 1, 2)$, $(4, 2, 0)$
9. (1 point for each correct answer) Three theoretical questions for true/false
 - AB and BA have the same determinants
 - If eigenvalues of A 2, 2, 5 then the matrix is certainly invertible
 - If we know $T(v)$ for n different nonzero vectors in R^n (where $T(v)$ – linear transformation), then we know $T(v)$ for every vector in R^n .