Name:_____ İTÜ ID:_____ Signature:_____.

MAT281E – Extra Final Exam – Part 1, Spring 2020, Duration: 30 Minutes

Instructions:

- *Do NOT communicate with other people, including your friends, classmates, and family members!*
- *This is an open-book exam. Give your answers in English.*
- *Write the question number, your Name and İTÜ ID on the top of each page and **sign all pages**.*
- *Scan or take photo of your answers and upload them on Ninova within a **zip** file **before the deadline**!*
- *You will have 15 minutes to upload your answers on Ninova. **Accepted file formats** are *.pdf, *.jpeg, or *.png!*

Q1) (20 pts) True/False. For each of the following statement please circle T (True) or F (False).

i. T or F? The projection of a vector **v** to a subspace W is neither inside W nor $W^{\perp}$.
ii. T or F? $T(x) = \pi^3 x$ is a linear transformation from $\mathbb{R}$ to $\mathbb{R}$.
iii. T or F? If Q is an orthogonal matrix then $(Q^T x).(Q^T y) = x.y$
iv. T or F? Let A be $m \times n$ matrix, the $rank(A) = rank(A^T)$.
v. T or F? Every system with two equations in three unknowns has infinitely many solutions.

Q2) (**30 pts**) Let A= $\begin{bmatrix} -3 & 6 & -1 & 1 & -7 \\ 1 & -2 & 2 & 3 & -1 \\ 2 & -4 & 5 & 8 & -4 \end{bmatrix}$ matrix.

i. Find a basis for the null space of A.

ii. Find a basis for the column space of A.

iii. Determine the rank(A)?

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Use matrix $A = \begin{bmatrix} 1 & 3 \\ 1 & -1 \end{bmatrix}$ to solve following problems.

Q3) (25 pts) Find bases for the eigenspaces of *A* by explicitly showing eigenvalues and eigenvectors.

Q4) (25 pts)

a) (15 pts) What are geometric and algebraic multiplicities of *A*? Explain why?

b) (10 pts) Does matrix *A* diagonalizable? Prove your answer!