

Name:
Student ID number:

MATHEMATICS 2270-2. Second Midterm Test: Sample.

You have 90 minutes for this test. The exam is “closed book and closed notes” no calculators. You can use “cheat sheets”. Show all your work. Correct answers with incorrect justification may result in a zero score on the problem. If this or something else is unclear, ask me!

1	2	3	4	5	6

Exam Score:

1. [15 points] Use the “classical adjoint” to find inverse of the matrix

$$A = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 2 & 0 \\ 0 & 0 & 1 \end{bmatrix}.$$

2. [15 points] Is the following set a subspace in P_2 ? Find a basis if it is.

$$S = \{p(t) : p'(0) = p(1)\}.$$

3. [15 points] Using standard bases in P_1, P_2 find matrix representation, rank and nullity of the linear transformation $T : P_1 \rightarrow P_2$ which is given by the formula:

$$T(p(x)) = xp(x)$$

4. [20 points] Use characteristic polynomial to find eigenvalues of the matrix A and bases of the corresponding eigenvectors:

$$A = \begin{bmatrix} -1 & -1 & -1 \\ -1 & -1 & -1 \\ -1 & -1 & -1 \end{bmatrix}.$$

Diagonalize the matrix A if possible. If it is impossible, explain why.

5. [20 points] Find complex eigenvalues of the matrix

$$A = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -1 & 0 & 0 \end{bmatrix}.$$

Use these eigenvalues to compute A^{990} .

6. [15 points] Determine if the following formula defines an inner product on \mathbb{R}^2 :

$$\langle \vec{x}, \vec{y} \rangle = \vec{x}^T A \vec{y},$$

where

$$A = \begin{bmatrix} 2 & 1 \\ 1 & -1 \end{bmatrix}.$$