University of Balamand
Faculty of Arts and Sciences

Instructors: K. Hitti, M. Dib — **MATH** 211, 2nd examination
Date: Fall 2020 — **Duration**: 1 hour + [10 minutes for submission]

Question 1. (25pts)

Let $W = \left\{ \begin{bmatrix} a & -a \\ b & c \\ -2b & -c \end{bmatrix}; \text{a, b, and c are real numbers} \right\}$

- ***a.*** Show that W is a subspace of M_{3X2}.
- ***b.*** Find a basis for W (without justifying your claim). Call it S = {v_1, v_2, v_3}.
- ***c.*** Find a basis for M_{3X2} that includes v_1, v_2, and v_3.

Question 2. (25pts)

Let S = {v_1, v_2, v_3} and T = {$w_1 = 2t^2 + t$, $w_2 = t^2 + 3$, $w_3 = t$} be ordered bases for P_2.
If the transition matrix from the T-Basis to the S-Basis is

$P_{S \leftarrow T} = \begin{bmatrix} 1 & 1 & 0 \\ 0 & -1 & 1 \\ 0 & 1 & 1 \end{bmatrix}$, determine S.

Question 3. (25pts)

Let $A = \begin{bmatrix} 1 & 2 & -2 \\ -1 & 3 & -8 \end{bmatrix}$

- ***a.*** Find a basis for the column space of A.
- ***b.*** Compute rank A and deduce nullity A.
- ***c.*** Find a basis for the Null Space of A.

Question 4. (25pts)

Let $S = \{u_1 = [1\ \ 0\ \ 1], u_2 = [1\ \ 1\ 1], u_3 = [1\ \ 0\ \ 4]\}$

- ***a.*** Show that *S* is a basis for R_3.
- ***b.*** Find an orthonormal basis of R_3 using Gram-Schmidt Process.

Good Luck & Stay Safe