

**MATH 213 - Homework #5 (Due 2/24)**

1. Consider the following matrices:

$$A = \begin{pmatrix} -1 & 2 & 0 \\ 3 & 0 & -1 \\ 2 & 2 & 1 \end{pmatrix} \quad B = \begin{pmatrix} 1 & 0 & 0 & -1 \\ -5 & 8 & -1 & 3 \\ 3 & 2 & 1 & 0 \end{pmatrix} \quad \mathbf{v} = \begin{pmatrix} 2 \\ 1 \\ -3 \end{pmatrix} .$$

Compute  $A\mathbf{v}$ ,  $A^2$ ,  $AB$ ,  $BA$ . Check your answers with MATLAB.

2. Consider a discrete age-structured Leslie population model (discussed in class) governed by the evolution matrix

$$L = \begin{pmatrix} 0 & 1.4 & 0.9 \\ 0.8 & 0 & 0 \\ 0 & 0.6 & 0 \end{pmatrix}$$

and assume that the initial population vector is  $(4, 10, 3)$ . Using MATLAB compute the population vector after 10, 20 and 30 time-units and find the ratio of each age-group size with respect to the total population. What do you notice?

3. Problem #22 (c),(d), page 157.  
4. Solve the following linear system (with given initial conditions):

$$x_1' = x_2, x_2' = -2x_1 + 2x_2 ; x_1(0) = 2, x_2(0) = 1 .$$

5. Problem #29 (a) and (b), page 160 .