

# Midterm #2

*Please print your name:*

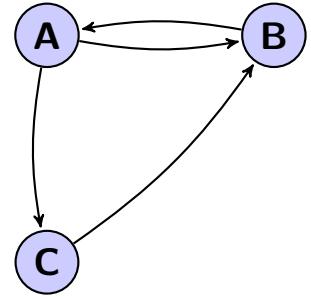
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No notes, calculators or tools of any kind are permitted. There are 31 points in total. You need to show work to receive full credit.

**Good luck!**

**Problem 1. (8 points)** Solve the initial value problem  $\mathbf{y}' = \begin{bmatrix} 1 & 3 \\ -1 & 5 \end{bmatrix} \mathbf{y}$ ,  $\mathbf{y}(0) = \begin{bmatrix} 2 \\ 0 \end{bmatrix}$ .

**Problem 2. (6 points)** Suppose the internet consists of only the three webpages  $A, B, C$  which link to each other as indicated in the diagram.



Rank these webpages by computing their PageRank vector:

- The PageRank vector is

- The ranking of the websites is

**Problem 3. (5 points)** Fill in the blanks.

(a) Let  $A$  be the  $4 \times 4$  matrix for orthogonally projecting onto a 2-dimensional subspace of  $\mathbb{R}^4$ .

Then  $\det(A) =$  $,$  and the eigenvalues (indicate if repeated) of  $A$  are .

(b) If  $A$  is a projection matrix, then  $A^{2020} =$ .

(c) If  $A$  is a reflection matrix, then  $A^{2020} =$ .

(d) If  $A$  has eigenvalue 2, then  $A^3$  has eigenvalue ,  $3A$  eigenvalue , and  $A^T$  eigenvalue .

(e) If  $A = \begin{bmatrix} -2 & 0 \\ 0 & 4 \end{bmatrix}$ , then  $A^n =$  $$  and  $e^{At} =$ .



(extra scratch paper)