

## Linear Algebra

### Quiz 12

Name: \_\_\_\_\_

You have 10 minutes to complete this quiz. If you have a question raise your hand and remain seated. In order to receive full credit your answer must be **complete**, **legible** and **correct**. Show your work, and give adequate explanations.

The real matrix  $A = \begin{bmatrix} 2 & 1 \\ -2 & 0 \end{bmatrix}$  has  $1 + i$  as one of its e-values.

1. Show that  $\begin{bmatrix} 1 \\ i - 1 \end{bmatrix}$  is an e-vector for  $A$  for e-value  $1 + i$ .

$$\begin{bmatrix} 2 & 1 \\ -2 & 0 \end{bmatrix} \begin{bmatrix} 1 \\ i - 1 \end{bmatrix} = \begin{bmatrix} 1 + i \\ -2 \end{bmatrix} = (1 + i) \begin{bmatrix} 1 \\ i - 1 \end{bmatrix}$$

2. What is the second e-value? What is an e-vector for this second e-value? (You should be able to answer this without calculation using information from above.)

These can be obtained by conjugating the first e-val and e-vec:  $1 - i$  and  $\begin{bmatrix} 1 \\ -i - 1 \end{bmatrix}$ .

3. Write down a real matrix  $S$  such that  $S^{-1}AS$  has block diagonal form where each block is a  $1 \times 1$  real block or a  $2 \times 2$  real block of the form  $\begin{bmatrix} a & b \\ -b & a \end{bmatrix}$ . (You should be able to answer this without calculation using information from above.)

This matrix is built from the real and imaginary parts of the first e-vec:  $S = [\text{Re}(\mathbf{v}) \text{ Im}(\mathbf{v})] = \begin{bmatrix} 1 & 0 \\ -1 & 1 \end{bmatrix}$ .