

sept 23rd

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

ID #: \_\_\_\_\_

As always you need to show your work. Fill in the appropriate blanks

1. A pair  $(\lambda, v)$  is an eigen pair if

$$Av = \lambda v$$

and

$$v \neq 0$$

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

2.1. Is  $v = \{1, 4, 2\}$  an evect of A?

yes

if it is compute the eval  $\lambda =$

2

$$\begin{pmatrix} 0 & 0 & 1 \\ 2 & 1 & 1 \\ 0 & 1 & 0 \end{pmatrix} \begin{pmatrix} 1 \\ 4 \\ 2 \end{pmatrix} = \begin{pmatrix} 2 \\ 8 \\ 4 \end{pmatrix} = 2 \begin{pmatrix} 1 \\ 4 \\ 2 \end{pmatrix}$$

2.2. Is  $v = \{1, 1, -1\}$  an evect of A?

No

if it is compute the eval  $\lambda =$

$$\begin{pmatrix} 0 & 0 & 1 \\ 2 & 1 & 1 \\ 0 & 1 & 0 \end{pmatrix} \begin{pmatrix} 1 \\ 1 \\ -1 \end{pmatrix} = \begin{pmatrix} -1 \\ 2 \\ 1 \end{pmatrix}$$

3. For  $A = \begin{pmatrix} 4 & 0 & 1 \\ 2 & 3 & 1 \\ 0 & 1 & 2 \end{pmatrix}$ .

3.1. Is  $\lambda = 2$  an eval of A?

yes

if it is compute the evect  $v =$

$$\begin{pmatrix} 1 \\ 0 \\ -2 \end{pmatrix}$$

$$A - 2I = \begin{pmatrix} 2 & 0 & 1 \\ 2 & 1 & 1 \\ 0 & 1 & 0 \end{pmatrix} \sim \begin{pmatrix} 2 & 0 & 1 \\ 0 & 1 & 0 \\ 0 & 1 & 0 \end{pmatrix} \sim \begin{pmatrix} 2 & 0 & 1 \\ 0 & 1 & 0 \\ 0 & 0 & 0 \end{pmatrix}$$

e.g.  $x_3 = 1$   
 $x_1 = -1/2$   
 $x_2 = 0$

e.g.  $x_3 = -2$   
 $x_2 = 0$   
 $x_1 = 1$

~~XXXX~~  $(A - \lambda I)x = 0$

$$2x_1 + 0x_2 + x_3 = 0$$

$x_2 = 0$   
~~XXXX~~  $x_3$  free

Sept 23rd

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1. The characteristic equation of a matrix A is

$$\det(A - \lambda I) = 0$$

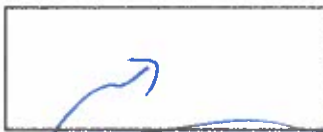
2. Eigenvalues are roots of

$$\det(A - \lambda I) = 0$$

$$\begin{aligned} ax^2 + bx + c &= 0 \\ x &= \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \end{aligned}$$

3. The char eqn of  $A = \begin{pmatrix} 2 & 1 \\ -7 & 3 \end{pmatrix}$  is

$$(2 - \lambda)(3 - \lambda) + 7 = 0 \quad \text{with evals}$$



$$\lambda = \frac{5 \pm \sqrt{25 - 4(13)}}{2(1)}$$

$$\begin{aligned} \det \begin{pmatrix} 2-\lambda & 1 \\ -7 & 3-\lambda \end{pmatrix} &= (2-\lambda)(3-\lambda) - (-7) \\ &= 6 - 5\lambda + \lambda^2 + 7 \\ 0 &= 13 - 5\lambda + \lambda^2 \end{aligned}$$

4. The char eqn of  $A = \begin{pmatrix} 6 & 0 & 1 \\ 1 & 6 & 2 \\ 0 & 0 & 3 \end{pmatrix}$  is

$$(3 - \lambda)(6 - \lambda)^2 = 0 \quad \text{with evals}$$

3, 6, 6

$$\det \begin{pmatrix} 6-\lambda & 0 & 1 \\ 1 & 6-\lambda & 2 \\ 0 & 0 & 3-\lambda \end{pmatrix} = (3-\lambda) \begin{vmatrix} 6-\lambda & 0 \\ 1 & 6-\lambda \end{vmatrix} = (3-\lambda)(6-\lambda)^2 = 0$$