Vishal Budhani
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Q.3
Eigen Value

$$A = \begin{bmatrix} 0 & -1 \\ 2 & 3 \end{bmatrix}.$$

Calculating eigen values.

$$|A - \lambda I| = 0$$

$$\begin{bmatrix} 0 & -1 \\ 2 & 3 \end{bmatrix} - \begin{bmatrix} \lambda & 0 \\ 0 & \lambda \end{bmatrix} = 0$$

$$\begin{vmatrix} -\lambda & -1 \\ 2 & 3-\lambda \end{vmatrix} = 0 \Rightarrow (-\lambda)(3-\lambda) + 2 = 0$$

$$\Rightarrow -3\lambda + \lambda^2 + 2 = 0$$

$$\lambda^2 - 3\lambda + 2 = 0$$

$$\lambda^2 - 2\lambda - \lambda + 2 = 0$$

$$\lambda(\lambda - 2) - 1(\lambda - 2) = 0$$

$$\boxed{\lambda = 1, \quad \lambda = 2}$$

Calculating eigen vector

$$AX = \lambda X.$$

$\lambda = 1$

$$\begin{bmatrix} 0 & -1 \\ 2 & 3 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$

Question 3

$\boxed{-x_2 = x_1}$ or $\boxed{x_2 = -x_1}$

Putting $x_2 = 1$ we get

$\lambda = 1$ Eigen Vector $\begin{bmatrix} -1 \\ +1 \end{bmatrix}$.

$\lambda = 2$ $AX = \lambda X$

$$\begin{bmatrix} 0 & -1 \\ 2 & 3 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} 2x_1 \\ 2x_2 \end{bmatrix}$$

$\boxed{-x_2 = 2x_1}$. or $\boxed{x_2 = -2x_1}$.

$x_2 = -2x_1 \Rightarrow \boxed{-2x_1 = x_2}$

Put $x_2 = 1$ $x_1 = -1/2$.

For $\lambda = 2$ $\begin{bmatrix} -1/2 \\ 1 \end{bmatrix}$.

For $\lambda = 1$ $\begin{bmatrix} -1 \\ 1 \end{bmatrix}$.

Vishal Budhani Ques # 2.
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Question 2. Let $\{v_1, v_2 --- v_n\}$ be an orthogonal basis for a subspace W of R^n.

Then for each

$$Z = c_1 v_1 + c_2 v_2 --- c_n v_n$$

We can generalize to

$$\cancel{Q_n = \frac{z \cdot v_n}{v_n \cdot v_n} \; (n = 1} \ldots$$

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$$\boxed{\lambda = 1, \quad \lambda = 2}$$

Calculating eigen vector

$$AX = \lambda X.$$

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$\lambda = 1$ Eigen Vector $\begin{bmatrix} -1 \\ +1 \end{bmatrix}$.

$\lambda = 2$ $AX = \lambda X$

$$\begin{bmatrix} 0 & -1 \\ 2 & 3 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} 2x_1 \\ 2x_2 \end{bmatrix}$$

$\boxed{-x_2 = 2x_1}$. or $\boxed{x_2 = -2x_1}$.

$x_2 = -2x_1 \Rightarrow \boxed{-2x_1 = x_2}$

Put $x_2 = 1$ $x_1 = -1/2$.

For $\lambda = 2$ $\begin{bmatrix} -1/2 \\ 1 \end{bmatrix}$.

For $\lambda = 1$ $\begin{bmatrix} -1 \\ 1 \end{bmatrix}$.

Vishal Budhani   Ques # 2.
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Question 2. Let $\{v_1, v_2 --- v_n\}$ be an orthogonal basis for a subspace W of R^n.

Then for each

$$Z = c_1 v_1 + c_2 V_2 --- c_n v_n$$

We can generalize to

$$c_j = \frac{Z \cdot v_j}{v_j \cdot v_j} \quad (j = 1, 2 --- n)$$

Proof:

Orthogonality of $\{v_1 --- v_n\}$ shows that

$$Z \cdot v_1 = (c_1 v_1 + c_2 v_2 --- c_n \cdot v_n) \cdot v_1$$

$$= c_1 (v_1 \cdot v_1)$$

Since $v_1 \cdot v_1$ is not zero equation above can be solved for c_1. To find c_j for $j = 2, 3, 4 -- n$ Compute $Z \cdot v_j$ and solve for c_j.