CS 512

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A 20 3008/8

A. Let
$$A = \begin{bmatrix} \frac{1}{2} \\ \frac{1}{2} \end{bmatrix}$$
, $B = \begin{bmatrix} \frac{4}{5} \\ \frac{1}{5} \end{bmatrix}$, $C = \begin{bmatrix} \frac{7}{3} \\ \frac{7}{3} \end{bmatrix}$, find

1. $2A - B = \begin{bmatrix} \frac{2}{4} \\ \frac{7}{3} \end{bmatrix} - \begin{bmatrix} \frac{4}{5} \\ \frac{1}{5} \end{bmatrix} = \begin{bmatrix} \frac{7}{2} \\ \frac{7}{1} \end{bmatrix}$

Let $A = \begin{bmatrix} \frac{7}{2} \\ \frac{7}{1} \end{bmatrix} + \frac{1}{2} = \begin{bmatrix} \frac{7}{14} \\ \frac{7}{14} \end{bmatrix} = \begin{bmatrix} \frac{7}{14} \\ \frac{7}{14}$

7 Q A. A' = 0 A' = (v,y,z) (a[3] B [3] c[3] X+2y+32>0 5- an be (1,2,-1) 8. AxB = (a263-a362, a361-a663, a.62-a261) = (2x6-3x5, 3x4-1x6, 1x5-2x4) =(-3,6,-3)B×A=(b.a3-b3a2, 6b3a, -b.as, b\$a2-b.a1) = (5 x 3 - 6 x 2, 6 x 1 - 4 x 3, 4 x 2 - 5 x 1) =(3,-6,3)9 x + 2y + 3 2 30 => 1 4x + 5y + 6 2 20 De ter minant = 2 4 7 1 3 1 3 1 = 15 + 12 - 12 + 15 - 24 - 6

.. A, B, c are not linearly independent

B.
$$\vec{A} = \begin{bmatrix} 1 & 2 & 3 \\ 4 & -2 & 5 \\ 0 & 5 & -1 \end{bmatrix}$$
 $\vec{R} = \begin{bmatrix} 2 & 1 & -4 \\ 2 & 1 & -4 \end{bmatrix}$ $\vec{C} = \begin{bmatrix} 1 & 23 \\ 4 & 16 \\ -1 & 13 \end{bmatrix}$

1. $2\vec{A} - \vec{B} = \begin{bmatrix} 2 & 4 & 6 \\ 8 & -4 & 6 \\ 0 & 10 & -3 \end{bmatrix} + \begin{bmatrix} -1 & -1 & -1 \\ -1 & -1 & 4 \end{bmatrix}$

$$= \begin{bmatrix} 1 & 2 & 5 \\ 6 & 5 & 10 \\ -3 & 12 & -1 \end{bmatrix}$$

2. $\vec{A}\vec{B} = \begin{bmatrix} 1 \times 1 + 2 \times 2 + 3 \times 3 & (1 \times 2 + 2 \times 1 + 3 \times (-2)) & |X| + 2 \times (-4) + 3 \times 1 \\ e \times 1 + 5 \times 2 + (-1) \times 3 & (1 \times 2 + 4 \times 1 + 3 \times (-2)) & |X| + 5 \times (-4) + (-4) \times (-4) \times (-4) + (-4) \times (-4) \times (-4) + (-4) \times (-4$

B's row vectors can form a orthogonal set.

Because each row multiply to another equals to 0

$$C. \overrightarrow{A} = \begin{bmatrix} 1 & 2 \\ 3 & 2 \end{bmatrix} \overrightarrow{B} = \begin{bmatrix} 2 & -2 \\ -2 & 5 \end{bmatrix}$$

$$det (\overrightarrow{A} - \lambda \overrightarrow{I}) = 0$$

$$= \left[\begin{bmatrix} 1 & 2 \\ 3 & 2 \end{bmatrix} - \begin{bmatrix} 1 & \lambda \\ 0 & \lambda \end{bmatrix}\right]$$

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

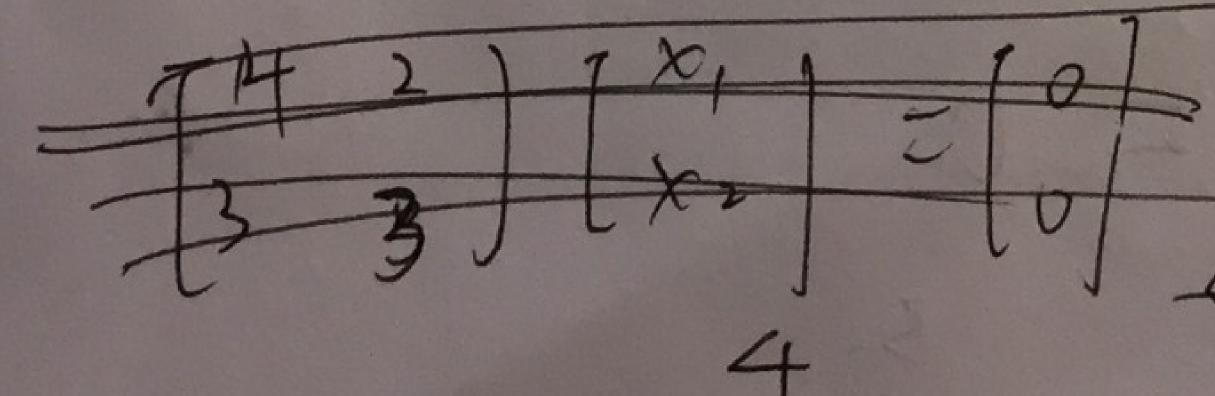
$$(1-\lambda)(3-\lambda) - 6 = 0$$

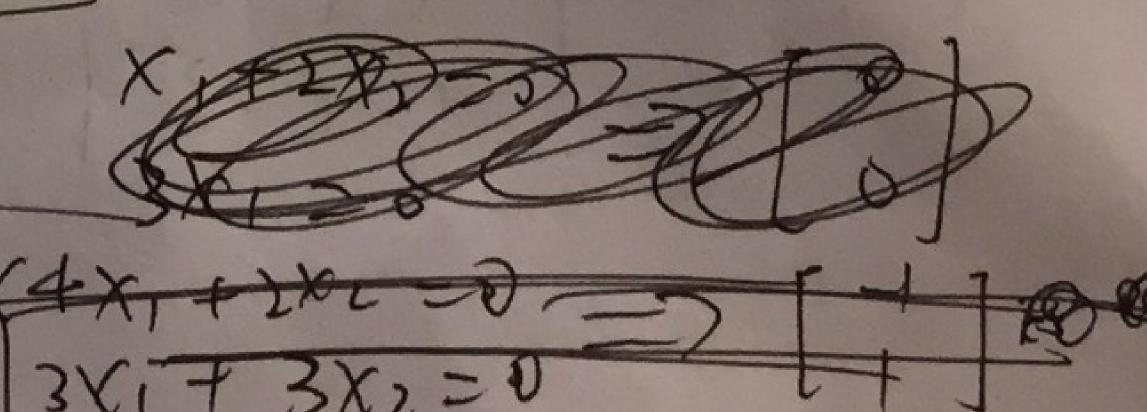
$$(\lambda + 1)(\lambda - 4) = 0$$

$$(\lambda + 1)(\lambda - 4) = 0$$

$$\lambda = -1$$
, 4 are eigenvalues.

when x=0, 13+1 2 16 = [0]





when
$$\lambda = 4 - 1$$

$$\begin{bmatrix} 3 & +1 \\ 3 & +1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_1 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$$

$$\begin{bmatrix} \frac{1}{3} & \frac{1}{3} \end{bmatrix} \begin{bmatrix} x_1 \\ x_1 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$$

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

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

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

$$V = \begin{bmatrix} \frac{1}{3} & \frac{1}{3} \\ \frac{1}{3} & \frac{1}{3} \end{bmatrix} \begin{bmatrix} \frac{1}{3} & \frac{1}{3} \end{bmatrix} \begin{bmatrix} \frac{1}{3} & \frac{1}{3} \end{bmatrix}$$

$$V = \begin{bmatrix} \frac{1}{3} & \frac{1}{3} & \frac{1}{3} \end{bmatrix} \begin{bmatrix} \frac{1}{3} & \frac{1}{3} & \frac{1}{3} \end{bmatrix} \begin{bmatrix} \frac{1}{3} & \frac{1}{3} & \frac{1}{3} \end{bmatrix}$$

$$V = \begin{bmatrix} \frac{1}{3} & \frac{1}{3}$$

The eigenvectors are an orthogonal set, because their dot product equals to 0

D.
$$f(x) = \chi^{2} + 3$$
, $g(x, y) = x^{2} + y^{2}$

1. $f'(x) = 2x$
 $f''(x) = 2$

2. $\frac{\partial g}{\partial x} = \frac{\partial}{\partial x}(x^{2} + y^{2}) = \frac{\partial}{\partial x}(x^{2}) + \frac{\partial}{\partial x}(y^{2}) = 2x + 0 = 2x$
 $\frac{\partial g}{\partial x} = \frac{\partial}{\partial x}(x^{2} + y^{2}) = \frac{\partial}{\partial x}(x^{2}) + \frac{\partial}{\partial y}(y^{2}) = 0 + y = y$

3. $\nabla g(x, y) = (\frac{\partial g}{\partial x}, \frac{\partial g}{\partial y}) = (2x, y)$

4. $f(x) = \frac{1}{2} = (-x^{2} + y^{2})^{2}$