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MATH 203

Q-1

i)

For what value of k vector $(1,-2,k)$ in R^3 be a linear combination of vectors $(3,0,-2)$ and $(2,-1,-5)$

So the matrix of the linear combination

$$\begin{bmatrix} x_1 & y_1 & z_1 \\ x_2 & y_2 & z_2 \\ x_3 & y_3 & z_3 \end{bmatrix} = 0$$

$$\begin{vmatrix} -1 & -2 & k \\ 3 & 0 & -2 \\ 2 & -1 & -5 \end{vmatrix} = 0$$

$$-1\begin{vmatrix} 0 & -2 \\ -1 & -5 \end{vmatrix} + 2\begin{vmatrix} 3 & -2 \\ 2 & -5 \end{vmatrix} + k\begin{vmatrix} 3 & 0 \\ 2 & -1 \end{vmatrix} = 0$$

$$-2 - 22 + k(-3) = 0$$

$$-24 - 3k = 0$$

$3k = -24$

$\boxed{k = -8}$ Ans.

Show that

$$(A^n)^{-1} = (A^{-1})^n$$

we know that

$$(A^n)(A^n)^{-1} = I$$

Multiply by $(A^{-1})^n$ b/s

$$(A^{-1})^n (A^n)(A^n)^{-1} = (A^{-1})^n I$$

$$\therefore (A^{-1})^n = (A^n)^{-1}$$

$$(A^n)^{-1}(A^n)(A^n)^{-1} = (A^{-1})^n$$

$$\therefore (A^n)^{-1} A^n = I$$

$$I(A^n)^{-1} = (A^{-1})^n$$

$(A^n)^{-1} = (A^{-1})^n$

Hence prove that

v)

If B and C are both inverse of A then
$B = C$

We know that

$B = A^{-1}$ $\quad$ $C = A^{-1}$

So

$AB = I$

multiply by C b/s

$C(AB) = CI$

$CAB = C$

$\because CA = I$

$IB = C$

$\because IB = B$

$B = C$

Hence prove that

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show that

$$(A^{-1})^T = (A^T)^{-1}$$

We know that

$A^T (A^{-1})^T = I$

Multiply by $(A^T)^{-1}$ b/s

$$(A^T)^{-1} A^T (A^{-1})^T = (A^T)^{-1} I$$

We know that

$$(A^T)^{-1} = (A^{-1})^T$$

$$(A^{-1})^T A^T (A^{-1})^T = (A^T)^{-1}$$

$$(A^{-1})^T A^T = I$$

$$I (A^{-1})^T = (A^T)^{-1}$$

$$(A^{-1})^T = (A^T)^{-1}$$

Hence prove that

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V ii)

P is orthogonal matrix

$$P \cdot P^T = I = P^T \cdot P$$

To prove P^T is an orthogonal matrix

sol.

Transpose of $P^T = (P^T)^T$

$$A^T \cdot (A^T)^T = A^T \cdot A$$

$$\because A^T \cdot A = I$$

$$A^T \cdot (A^T)^T = I \quad \text{--- i)}$$

$$(A^T)^T \cdot A^T = A \cdot A^T$$

$$(A^T)^T \cdot A^T = I \quad \text{--- ii)}$$

compare eq i) and ii)

$$(A^T)^T \cdot A^T = A^T \cdot (A^T)^T$$

Hence prove that

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X ii)

Normalize the vector

$v = (1, 2, 4, 5)$

so the norm of v

$$\|v\| = \sqrt{(1)^2 + (2)^2 + (4)^2 + (5)^2}$$

$$= \sqrt{1 + 4 + 16 + 25}$$

$$= \sqrt{46}$$

since v is not a unit vector, so we can normalize

$$\hat{v} = \frac{v}{\|v\|} = \left(\frac{1}{\sqrt{46}}, \frac{2}{\sqrt{46}}, \frac{4}{\sqrt{46}}, \frac{5}{\sqrt{46}}\right)$$

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Consider the vector

$u = (1, -5, 3)$

Find $\|u\|_\infty$, $\|u\|_1$, $\|u\|_2$

Now make matrix

$$\begin{bmatrix} 1 & -5 & 3 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$$

$\|u\|_1 = \text{Max}(1+0+0), -5+0+0, 3+0+0$

$\|u\|_1 = \text{Max} = \text{Max}(1, -5, 3)$

$\text{Max} = 3$

$\boxed{\|u\|_1 = 3}$

$\|u\|_2 = \sqrt{(1)^2 + (-5)^2 + (3)^2}$

$= \sqrt{1 + 25 + 9}$

$\|u\|_2 = \sqrt{35}$

$\|u\|_\infty = \overset{\text{Max}}{(}1 - 5 + 3, 0+0+0, 0+0+0)$

$= \text{Max}(-1, 0, 0)$

$\boxed{\|U\|_{ac} = 0}$

Show that the Matrix

$$A = \begin{bmatrix} 1 & 2 \\ 3 & -4 \end{bmatrix} \text{ is Zero}$$

of $g(x) = x^2 + 3x + 10$

so first we find A^2

$$A \cdot A = A^2 = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix} \begin{bmatrix} 1 & 2 \\ 3 & -4 \end{bmatrix}$$

$$= \begin{bmatrix} 1+6 & 2-8 \\ 3-12 & 6+16 \end{bmatrix}$$

$$= \begin{bmatrix} 7 & -6 \\ -9 & 22 \end{bmatrix}$$

Now put in equations

$$= \begin{bmatrix} 7 & -6 \\ -9 & 22 \end{bmatrix} + 3 \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix} + 10(I) = 0$$

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$$\begin{bmatrix} 7+3 \\ -9+9 \end{bmatrix}$$

$$\begin{bmatrix} 10 \\ 0 \end{bmatrix}$$

$$\begin{bmatrix} 10 \\ 0 \end{bmatrix}$$

The

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$$\begin{bmatrix} 7+3 & -6+6 \\ -9+9 & 22-12 \end{bmatrix} - \begin{bmatrix} 10 & 0 \\ 0 & 10 \end{bmatrix} = 0$$

$$\begin{bmatrix} 10 & 0 \\ 0 & 10 \end{bmatrix} - \begin{bmatrix} 10 & 0 \\ 0 & 10 \end{bmatrix} = 0$$

$$\begin{bmatrix} 10-10 & 0 \\ 0 & 10-10 \end{bmatrix} = 0 \rightarrow \text{null}$$

$$\begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix} = 0$$

Hence prove that
The matrix is equal to
Zero of the
$g(x) - x^2+3x-10$

$g(1)=0$

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Long

Find Eigenvalue and bases for Eigen spaces of $A = \begin{bmatrix} -2 & -1 \\ 5 & 2 \end{bmatrix}$

Now first we find the value

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

$$\begin{bmatrix} -2 & -1 \\ 5 & 2 \end{bmatrix} - \lambda \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} = 0$$

$$\begin{bmatrix} -2 & -1 \\ 5 & 2 \end{bmatrix} + \begin{bmatrix} -\lambda & 0 \\ 0 & -\lambda \end{bmatrix} = 0$$

$$\begin{bmatrix} -2-\lambda & -1 \\ 5 & 2-\lambda \end{bmatrix} = 0$$

$$(-2-\lambda)(2-\lambda) + 5 = 0$$

$$-4 + \cancel{2\lambda} - \cancel{2\lambda} + \lambda^2 + 5 = 0$$

$$-4 + \lambda^2 + 5 = 0$$

$$\lambda^2 = -1$$

Taking square of b/s

$$\sqrt{\lambda^2} = \sqrt{4}$$

$$\lambda = \pm 4$$

so the eigenvalues of the matrix is

$$\lambda = +3, -3$$

so when $\lambda = 3$

Now put the values

$$\begin{bmatrix} -2-3 & 1 \\ 5 & 2-3 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$$

$$\begin{bmatrix} -5 & 1 \\ 5 & -1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$$

$$-5x_1 + x_2 = 0$$

$$x_2 = t$$

$$-5x_1 + t = 0$$

$$x_1 = \frac{-t}{-5}$$

so the eigenvector of this matrix.

$$\begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} +t/5 \\ t \end{bmatrix}$$

$= t\begin{bmatrix} -1/5 \\ 1 \end{bmatrix}$

So the eigenvector is

$\begin{bmatrix} +1/5 \\ 1 \end{bmatrix}$

and the bases is

$= t$

when $\lambda = -3$

$$\begin{bmatrix} -2+3 & 1 \\ 5 & 2+1 \end{bmatrix}\begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$$

$$\begin{bmatrix} 1 & 1 \\ 5 & +5 \end{bmatrix}\begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$$

$x_1 + x_2 = 0$

let $x_2 = t$

$x_1 + t = 0$

$x_1 = -t$

So the eigenvector of this matrix is

$\begin{bmatrix} -t \\ t \end{bmatrix} = t\begin{bmatrix} -1 \\ 1 \end{bmatrix}$

bases is t

Determ
in R^4
or lin

(1,3,

Now
scala

a(1,3

(a,3a

a+
3a
-a
-4a

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(b)

Determine whether the vector in R^4 are linear dependent or linear independant

$(1,3,-1,-4),(3,8,-5,7),(2,9,4,23)$

Now we take the scalar $(a,b,c,d)=(0,0,0,0)$

$a(1,3,-1,-4)+b(3,8,-5,7)+c(2,9,4,23)=0$

$(a,3a,-a,-4)+(3b,8b,-5b,7b)+(2c,9c,4c,23c)$

$a+3b+2c=0$ — i)

$3a+8b+9c=0$ — ii)

$-a-5b+4c=0$ — iii)

$-4a+7b+23c=0$ — iv)

Now make matrix

$$\begin{bmatrix} 1 & 3 & 2 \\ 3 & 8 & 9 \\ -1 & -5 & 4 \\ -4 & 7 & 23 \end{bmatrix}$$

Now find

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the rank reduced into echelon form.

$$= \begin{bmatrix} 1 & 3 & 2 \\ 3 & 8 & 9 \\ -1 & -5 & 4 \\ -4 & 7 & 23 \end{bmatrix}$$

$R_2 \rightarrow R_2 - 3R_1$

$R_3 \rightarrow R_3 + R_1$

$$= \begin{bmatrix} 1 & 3 & 2 \\ 0 & -1 & 3 \\ 0 & -2 & 6 \\ -4 & 7 & 23 \end{bmatrix} \quad R_3 \rightarrow R_3 - 2R_2$$

$$= \begin{bmatrix} 1 & 3 & 2 \\ 0 & -1 & 3 \\ 0 & 0 & 0 \\ -4 & 7 & 23 \end{bmatrix}$$

Now change the $R_4 \leftrightarrow R_3$

$$= \begin{bmatrix} 1 & 3 & 2 \\ 0 & -1 & 3 \\ -4 & 7 & 23 \\ 0 & 0 & 0 \end{bmatrix}$$

$R_3 \rightarrow R_3 + 4R_1$

$R_2 \rightarrow R_3 + 19R_2$

So

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$$= \begin{bmatrix} 1 & 3 & 2 \\ 0 & -1 & 3 \\ 0 & 0 & 73 \\ 0 & 0 & 0 \end{bmatrix}$$

So the rank of this matrix is 3

Note:- There are 3 scalar if the rank is less than the variable so it is linear dependent but in this case rank = scalar so it is linear independent

Because

$\boxed{a=0}$ $\boxed{b=0}$ $\boxed{c=0}$

Q.3

a) Determine whether the vector $v=(3,3,-4)$ is a linear combination of $x(1,2,3)$ $y=(2,3,7)$ $z=(3,5,6)$

Now first we make the equation of the matrix.

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$(x, 2x, 3x) + (2y, 3y, 7y) + (3z, 5z, 6z) = (3, 3, -4)$

$x + 2y + 3z = 3$ —— i)

$2x + 3y + 5z = 3$ —— ii)

$3x + 7y + 6z = -4$ —— iii)

Now we reduce into echelon form to find the x, y, z

$$\left[\begin{array}{ccc|c} 1 & 2 & 3 & 3 \\ 2 & 3 & 5 & 3 \\ 3 & 7 & 6 & 4 \end{array}\right] \quad R_2 \to R_2 - 2R_1$$

$$\begin{bmatrix} 1 & 2 & 3 & 3 \\ 0 & -1 & -1 & -3 \\ 3 & 7 & 6 & 4 \end{bmatrix} \quad \begin{array}{l} R_3 \to R_3 - 3R_1 \\ R_3 \to R_3 + R_2 \end{array}$$

$$\begin{bmatrix} 1 & 2 & 3 & 3 \\ 0 & -1 & -1 & -3 \\ 0 & 0 & -4 & -8 \end{bmatrix}$$

$-4z = -8$

$\boxed{z = 2}$

$-y - z = -3$

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$-y-2=-3$

$-y=-1 \Rightarrow \boxed{y=1}$

$x+2y+3z=3$

$x+2+6=3$

$\boxed{x=-5}$

Now we check answer is correct

$(3,3,-4)=x(1,2,3)+y(2,3,7)+z(3,5,6)$

put the value

$(3,3,-4)=(-5,-10,-15)+(2,3,7)+(6,10,12)$

$(3,3,-4)=(-5+2+6,-10+3+10,-15+7+12)$

$(3,3,-4)=(3,3,-4)$

So the linear combination of this matrix is, $-5,1,2$

b)

Find Inverse

$$A = \begin{bmatrix} 1 & 1 & 1 \\ 0 & 1 & 2 \\ 1 & 2 & 4 \end{bmatrix}$$

So now find the inverse by using coffactor

$$A = \begin{bmatrix} 1 & 1 & 1 \\ 0 & 1 & 2 \\ 1 & 2 & 4 \end{bmatrix}$$

$$A_{11} = (-1)^{1+1} \begin{vmatrix} 1 & 2 \\ 2 & 4 \end{vmatrix} = 0$$

$$A_{12} = (-1)^{1+2} \begin{vmatrix} 0 & 2 \\ 1 & 4 \end{vmatrix} = 2$$

$$A_{13} = (-1)^{1+3} \begin{vmatrix} 0 & 1 \\ 1 & 2 \end{vmatrix} = -1$$

$$A_{21} = (-1)^{2+1} \begin{vmatrix} 1 & 1 \\ 2 & 4 \end{vmatrix} = -2$$

$$A_{22} = (-1)^{2+2} \begin{vmatrix} 1 & 1 \\ 1 & 4 \end{vmatrix} = 3$$

$$A_{23} = (-1)^{2+3} \begin{vmatrix} 1 & 1 \\ 1 & 2 \end{vmatrix} = -1$$

$$A_{31} = (-1)^{3+1} \begin{vmatrix} 1 & 1 \\ 1 & 2 \end{vmatrix} = 1$$

$$A_{32} = (-1)^{3+2} \begin{vmatrix} 1 & 1 \\ 0 & 2 \end{vmatrix} = -2$$

$$A_{33} = (-1)^{3+3} \begin{vmatrix} 1 & 1 \\ 0 & 1 \end{vmatrix} = 1$$

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

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

$$|A| = \begin{vmatrix} 1 & 1 & 1 \\ 0 & 1 & 2 \\ 1 & 2 & 4 \end{vmatrix}$$

$$= 1\begin{vmatrix} 1 & 2 \\ 2 & 4 \end{vmatrix} - 1\begin{vmatrix} 0 & 2 \\ 1 & 4 \end{vmatrix} + 1\begin{vmatrix} 0 & 1 \\ 1 & 2 \end{vmatrix}$$

$$= 0 + 2 - 1 = 1$$

$$A^{-1} = \frac{\begin{bmatrix} 0 & -2 & 1 \\ 2 & 3 & -2 \\ -1 & -1 & 1 \end{bmatrix}}{1} \quad \text{Ans.}$$

Q.4

Solve the system by Gauss elimination method

$$3x_1 + x_2 - x_3 = -4$$
$$x_1 + x_2 - 2x_3 = -4$$
$$-x_1 + 2x_2 - x_3 = 1$$

Now we make the matrix

$$= \begin{bmatrix} 3 & 1 & -1 & -4 \\ 1 & 1 & -2 & -4 \\ -1 & 2 & -1 & 1 \end{bmatrix}$$

Now we reduce this matrix into echelon form

$$= \begin{bmatrix} 3 & 1 & -1 & -4 \\ 0 & 3 & -3 & -3 \\ -1 & 2 & -1 & 1 \end{bmatrix}$$

$$= \begin{bmatrix} 3 & 1 & -1 & -4 \\ 0 & 3 & -3 & -3 \\ 0 & 7 & -4 & -1 \end{bmatrix}$$

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$$\begin{bmatrix} 3 & 1 & -1 & -4 \\ 0 & 1 & -1 & -1 \\ 0 & 0 & 3 & 6 \end{bmatrix}$$

$3x_1 + x_2 - x_3 = -4$ —— i)

$x_2 - x_3 = -1$ —— ii)

$3x_3 = 6$ —— iii)

$\boxed{x_3 = 2}$ put in eq ii) and i)

$x_2 - 2 = -1$

$\boxed{x_2 = 1}$ put in eq i)

$3x_1 + x_2 - x_3 = -4$

$3x_1 + 1 - 2 = -4$

$3x_1 - 1 = -4$

$3x_1 = -4 + 1$

$3x_1 = -3$

$\boxed{x_1 = -1}$

Now we check the answer is correct

$3x_1 + x_2 - x_3 = -4$

$3(-1) + 1 - 2 = -4$

$-3 + 1 - 2 = -4$

$-4 = -4$ Ans.

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Find the determinant of matrix

$$\begin{vmatrix}1&0&0&3\\2&7&0&6\\0&6&3&0\\7&3&1&-5\end{vmatrix}$$

$$= 1\begin{vmatrix}7&0&6\\6&3&0\\3&1&-5\end{vmatrix} + 0 + 0 - 3\begin{vmatrix}2&7&0\\0&6&3\\7&3&1\end{vmatrix}$$

$$= \begin{vmatrix}7&0&6\\6&3&0\\3&1&-5\end{vmatrix} - 3\begin{vmatrix}2&7&0\\0&6&3\\7&3&1\end{vmatrix}$$

$$= 7\begin{vmatrix}3&0\\1&-5\end{vmatrix} + 0 + 6\begin{vmatrix}6&3\\3&1\end{vmatrix}$$

$$-3\left(2\begin{vmatrix}6&3\\3&1\end{vmatrix} - 7\begin{vmatrix}0&3\\7&1\end{vmatrix} + 0\right)$$

$$= 7(-15) + 0 + 6(-3) - 3(2(-3) - 7(-21))$$

$$= -105 + 0 - 18 - 3(-6 + 147)$$

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$= -105 - 18 - 423$

$= -546$

Apply Gram Schmidt process

$u_1 = (1,1,1)$ $u_2 = (0,1,1)$

$u_3 = (0,0,1)$

find orthogonal basis and normalization of orthogonal.

Formula =

$V_1 = U_1$

$$V_2 = U_2 - \left(\frac{U_2 \cdot V_1}{V_1 \cdot V_1}\right)(\vec{V}_1)$$

$$V_3 = U_3 - \left(\frac{U_3 \cdot V_1}{V_1 \cdot V_1}\right)V_1 - \left(\frac{U_3 \cdot V_2}{V_2 \cdot V_2}\right)V_2$$

$V_1 = U_1$

$\boxed{V_1 = (1,1,1)}$ $V_1 = \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$

$$V_2 = (0,1,1) - \left(\frac{(0,1,1)\cdot(1,1,1)}{(1,1,1)(1,1,1)}\right)\begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix}$$

3x1x

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$$V_2 = (0,1,1)\left(-\frac{2}{3}\right)\begin{pmatrix}1\\1\\1\end{pmatrix}$$

$$V_2 = \begin{pmatrix}0\\1\\1\end{pmatrix} - \begin{pmatrix}2/3\\2/3\\2/3\end{pmatrix}$$

$$V_2 = \begin{pmatrix}0-2/3\\1-2/3\\1-2/3\end{pmatrix} = \begin{pmatrix}-2/3\\1/3\\1/3\end{pmatrix}$$

$$V_3 = U_3 - \left(\frac{U_3\cdot U_1}{U_1\cdot U_1}\right)\vec{U_1} - \left(\frac{U_3\cdot U_2}{U_2\cdot U_2}\right)U_2$$

$$= (0,0,1) - \left(\frac{(0,0,1)\cdot(1,1,1)}{3}\right)\begin{pmatrix}1\\1\\1\end{pmatrix}$$

$$- \left(\frac{(0,0,1)\cancel{(0,1,1)}\cdot(-2/3,1/3,1/3)}{(0,1,1)(0,1,1)}\right)$$

$$= (0,0,1) - \begin{pmatrix}1/3\\1/3\\1/3\end{pmatrix} - \left(\frac{1/3}{4/9}\right)^{3/4}\begin{pmatrix}-2/3\\1/3\\1/3\end{pmatrix} \qquad \begin{pmatrix}2/3\\1/3\\1/3\end{pmatrix}$$

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$= (0, 0, 1) - (1, 1, 1) - \begin{pmatrix} -1/3 \\ 1/18 \\ 1/18 \end{pmatrix}$

$= \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix} - \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix} - \begin{pmatrix} -1/2 \\ 1/4 \\ 1/4 \end{pmatrix}$

$\begin{pmatrix} 0 - 1 + 1/2 \\ 0 - 1 - 1/4 \\ 0 - 1 - 1/4 \end{pmatrix} = \begin{pmatrix} -1/2 \\ -4/18 \\ -4/18 \end{pmatrix}$

$= \begin{bmatrix} -2/3 \\ -19/18 \\ -19/18 \end{bmatrix} = \begin{bmatrix} -1/2 \\ -5/4 \\ -5/4 \end{bmatrix}$

so the othogonal basis

$V_1 = \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix} \quad V_2 = \begin{bmatrix} -2/3 \\ 1/3 \\ 1/3 \end{bmatrix} \quad V_3 = \begin{bmatrix} -1/2 \\ -5/4 \\ -5/4 \end{bmatrix}$

The normalize of the oothogonal

$$||v_1|| = \sqrt{1+1+1}$$

$$||v_1|| = \sqrt{3}$$

$$||v_2|| = \sqrt{4/9 + 1/9 + 1/9}$$

$$= \sqrt{\frac{4+1+1}{9}} = \sqrt{\frac{6}{9}} = \sqrt{2/3}$$

$$||v_2|| = \sqrt{2/3}$$

$$||v_3|| = \sqrt{(-1/2)^2 + (-5/4)^2 + (-5/4)^2}$$

$$= \sqrt{\frac{1}{4} + \frac{25}{20} + \frac{25}{20}}$$

$$= \sqrt{\frac{5+25+25}{20}}$$

$$= \sqrt{\frac{\cancel{55}^{11}}{\cancel{20}_{4}}} = \sqrt{\frac{11}{4}}$$

SO

$$||v_1|| = \sqrt{3}$$

$$||v_2|| = \sqrt{2/3}$$

$$||v_3|| = \sqrt{11/4}$$

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Show that the matrix

$$\begin{bmatrix} 0 & 0 & 1 \\ 0 & 1 & 2 \\ 0 & 0 & 1 \end{bmatrix}$$

can not diagonalization?

No first we find the eigen values of matrix

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

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

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

$$= -\lambda \begin{vmatrix} 1-\lambda & 2 \\ 0 & 1-\lambda \end{vmatrix} + 0 + 1 \begin{vmatrix} 0 & 1-\lambda \\ 0 & 0 \end{vmatrix} = 0$$

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

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

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

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

$$-\lambda=0$$

$$\lambda^2-2\lambda+1=0$$

$$\lambda^2-\lambda-\lambda+1=0$$

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

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

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

So we achieve the two eigen values of the matrix But the matrix is 3×3 or the charateristic equation is

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

so it is possibile find the matrix P.

$$P=\begin{bmatrix} P_1 \\ P_1 \\ P_1 \end{bmatrix}, \begin{bmatrix} P_2 \\ P_2 \\ P_2 \end{bmatrix} \begin{bmatrix} P_3 \\ P_3 \\ P_3 \end{bmatrix}$$

$$P=\begin{bmatrix} P_1 & P_2 & P_3 \\ P_1 & P_2 & P_3 \\ P_1 & P_2 & P_3 \end{bmatrix}$$

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So in which we can not find the

P_3 Because

$\lambda = 1, 1$ or

$\lambda = 0, 1$

So this is not a diagnolization.

LA 2016 3215

3rd semested

i)

Find $P(A)$ for $P(x) = x^2 - 2x - 3$

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