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Subject # leainer Algebra

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Qno(1)
(A part)

The non parrallel vector

$\overline{P_1P_2} = (-3, 2, 3)$

$P_1P_2 = (3, -1, 3)$

$(-1, 0, 3) - (2, -2, 1)$

$(-1, 0, 3) - 2, +2, -1$

$(-3, +2, 2)$

The Perpendicular vector is :-

$m = P_1P_2 \times P_1P_2$

$$n = \begin{vmatrix} i & j & k \\ -3 & 2 & 2 \\ 3 & -1 & 3 \end{vmatrix}$$

$\dfrac{\overline{P_1P_2}}{\overline{P_1P_2}} - \dfrac{\sqrt{(x_2-x_1)+(y-y_1)^2}}{\sqrt{(-1-2)^2}}$

$n = i(6+2) - j(-9-6) + k(3-6)$

$n = 8i + 15j - 3k$

$m = (2, 15, -3)$

Now $P_1(x_0, y_0, z_0) = (2, -3, 1)$

$m(a, b, c) = 8, 15, -3$

So equation of Plane is

$a(x-x_0) + b(y-y_0) + c(z-z_0) = 0$

$8(x-2) + 15(y+2) - 3(z-1) = 0$

$8x + 15y - 32 - 16 + 30 + 3 = 0$

$8x + 15y - 32 + 17 = 0$

Q No (1)
(Part b)

$$x = 2-3t$$
$$y = 3+t$$
$$z = 2-4t$$

Solution:-

$$z-2=-3t \Rightarrow t = \frac{x-2}{}$$
$$y=3=t \Rightarrow t = \frac{y-3}{1}$$
$$z-2 = -4t \Rightarrow t = \frac{z-2}{-4}$$

So $\quad \frac{x-2}{-3} = \frac{y-3}{1} = \frac{z-2}{-4}$

for 1st plane takes 1st and 2nd

$$\frac{x-2}{-3} \times \frac{y-3}{1}$$

$$x-2 = -3y+9$$

$$x+3y=11=0$$

for 2nd plane take 1st ad 3rd

$$\frac{x-2}{-3} = \frac{z-2}{-4}$$
$$-4x+8 = -3z+6$$
$$-4x+3z+2=0$$
or
$$4x-3z+2=0$$

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Q No (2)

$$L(x, y) = (x1, y, x+y)$$

Solution:

$$L(x, y) = (x+1, y, x+y)$$

Let $u = (x_1, y_1)$ $v = (x_2, y_2)$

$$u+v = (x_1, y_1) + (x_2, y_2)$$

$$u+v = (x_1+x_2, y_1+y_2)$$

$$L(u+v) = L(x_1+x_2, y_1+y_2)$$

$$L(u+v) = (x_1+x_2+1, y_1+y_2, x_1+x_2+y_1+y_2)$$

given that $u = (x+y_2)$

$$L(u) = L(x_1, y_1) = (x+1+y+, x1+y-1)$$

$$L(v) = L(x_2, y_2) = (x_2+1, y_2, x_2+y_2)$$

$$L(u) + L(v) = (x_1+x_2+2, y_1+y_2, x_1+x_2+y_2+y_2)$$

Since $1 \neq 2$

Q no (4) $(-1,3,2)$ $n=(0,1,-3)$

Solution:

Equ of plane

$a(x-x_0)+b(y-y_0)+c(z-z_0)=0$

Given that

$P=(x_0, y_0, z_0)=(-1,3,2)$

$n=(a,b,c)=(0,1,-3)$

So, $0(x-(-1))+1(y-3)-3(z-2)$

$0 \quad \underline{x+1}+1(y-3)-3(z-2$

$0+y-3-3z+6$

$\Rightarrow y-3z-3+6$

$\Rightarrow y-3z+3$ Ans

Q.No (3)

Sol:-

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

$$A^{-1} = \frac{1}{|A|} \cdot \text{adj } A$$

So

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

$$x_1 = \begin{bmatrix} 0 & +1 & -1 \\ 0 & -2 & -1 \\ -1 & 1 & 1 \end{bmatrix} \begin{bmatrix} 77 \\ 54 \\ 38 \end{bmatrix} = \begin{bmatrix} 0+54-38 \\ 154+108-53 \\ 77+55+38 \end{bmatrix}$$

$$x_1 = \begin{bmatrix} 16 \\ 8 \\ 15 \end{bmatrix}$$

$$x_2 = \begin{bmatrix} 0 & 1 & -1 \\ 2 & -2 & -1 \\ -1 & 1 & 1 \end{bmatrix} \begin{bmatrix} 71 \\ 49 \\ 29 \end{bmatrix} = \begin{bmatrix} 20 \\ 15 \\ 7 \end{bmatrix}$$

$$x_3 = \begin{bmatrix} 0 & 1 & -1 \\ 2 & -2 & -1 \\ -1 & 1 & 1 \end{bmatrix} \begin{bmatrix} 68 \\ 51 \\ 33 \end{bmatrix} = \begin{bmatrix} 18 \\ 1 \\ 16 \end{bmatrix}$$

$$x_4 = \begin{bmatrix} 0 & 1 & -1 \\ 2 & -2 & -1 \\ -1 & 1 & 1 \end{bmatrix} \begin{bmatrix} 76 \\ 48 \\ 40 \end{bmatrix} = \begin{bmatrix} 1 \\ 15 \\ 18 \end{bmatrix}$$

$$x_5 = \begin{bmatrix} 0 & 1 & -1 \\ 2 & -2 & -1 \\ -1 & 1 & 1 \end{bmatrix} \begin{bmatrix} 86 \\ 53 \\ 52 \end{bmatrix} = \begin{bmatrix} 1 \\ 14 \\ 18 \end{bmatrix}$$

$Q_{NO}^{(5)}$.

Given Value

Sol:

We Know that $Ax = \lambda x$

$$\begin{bmatrix} 1 & 1 \\ -2 & 4 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \lambda \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$

then $$\begin{bmatrix} x_1 + x_2 \\ -2x_1 + 4x_2 \end{bmatrix} = \begin{bmatrix} \lambda x_1 \\ \lambda x_2 \end{bmatrix}$$

$$x_1 + x_2 = \lambda x_1 \quad \text{—(i)}$$

$$-2x_1 + 4x_2 = \lambda x_2 \quad \text{—(ii)}$$

So

$$x_1 - \lambda x_1 + x_2 = 0$$

$$= (1-\lambda) x_1 + x_2 = 0$$

$$-2x_1 + 4x_2 - \lambda x_2 = 0$$

$$= -2x_1 + (4-\lambda) x_2 = 0$$

$$\begin{bmatrix} 1 - \lambda & 1 \\ -2 & 4-\lambda \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = 0$$

$\Rightarrow 2x_1 - x_2 = 0$

$\Rightarrow -2x_1 + 4x_2 = 3x_2 \quad \text{— (iii)}$

$\Rightarrow -2x_1 + x_2 = 0$

$\Rightarrow 2x_1 - x_2 = 0$

$$x_1 = \frac{1}{2} x^2$$

let $x_2 = x$

Where $r \neq 0$

So $x = \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} \frac{1}{2} r \\ r \end{bmatrix}$

eigen vector for $\lambda_2 = 2$ put in eq 1 2

$x_1 + x_2 = 2x_1$ — (i)

$-2x_1 + 4x_2 = 2x_2$ — (ii)

$= -x_1 + x_2 = 0$

$\Rightarrow x_1 - x_2 = 0$

$\Rightarrow x_1 = x_2$

$= -2x_1 + 4x_2 = 2x_2$ — (ii)

$= -2x_1 + 2x_2 = 0$

$x_1 - x_2 = 0$

$x_1 = x_2$

$x_1 = r$ than $x_2 = r$

So $x = \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} r \\ r \end{bmatrix}$