**NAME:**

Time:  7 Minutes

**NOTES:**
  a.  **credit is only given to the correct numerical values.**
  b.  **All numerical values must be calculated with three digits of accuracy after the decimal point.**
  c.  **Do not write on the back side of the papers.**

1.      Given the plane P as 4x-3y+5z+32=0 and two points A(8,2,5) and B(8,2,8). Find the equations of plane P after it has have been rotated =90 degrees around AB.

Show the matrices:
  • Translate point A to the origin. Line A'B' aligns with the z axis.
  • Rotate 90 degrees around z axis.
  • Translate point A back to its original coordinates.

| 1 | 0 | 0 | 8 |
|---|---|---|---|
| 0 | 1 | 0 | 2 |
| 0 | 0 | 1 | 5 |
| 0 | 0 | 0 | 1 |

| 0 | -1 | 0 | 0 |
|---|---|---|---|
| 1 | 0 | 0 | 0 |
| 0 | 0 | 1 | 0 |
| 0 | 0 | 0 | 1 |

| 1 | 0 | 0 | -8 |
|---|---|---|---|
| 0 | 1 | 0 | -2 |
| 0 | 0 | 1 | -5 |
| 0 | 0 | 0 | 1 |

Show the equation of the rotated plane P:

Select the normal vector to the plane $V = \begin{bmatrix} 4 \\ -3 \\ 5 \\ 1 \end{bmatrix}$

Find the normal vector after the transformations (Notice that vectors will not be affected by translations)

$$\vec{N'} = R_z \cdot \vec{N} = \begin{bmatrix} 0 & -1 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \cdot \begin{bmatrix} 4 \\ -3 \\ 5 \\ 1 \end{bmatrix} = \begin{bmatrix} 3 \\ 4 \\ 5 \\ 1 \end{bmatrix}$$

Select any point on the plane such as $P = \begin{bmatrix} -8 \\ 0 \\ 0 \\ 1 \end{bmatrix}$

Find the point P after the transformations $P = \begin{bmatrix} 10 \\ -14 \\ 0 \\ 1 \end{bmatrix}$

Equation of plane: 3x+4y+5z+D=0
3*10+4*(-14)*5*0+D=0
D=26
Equation of plane: 3x+4y+5z+26=0