CS20B1002
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(2) Given :-

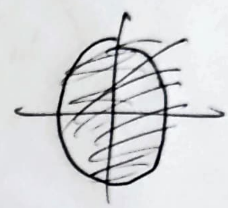
$z = x_1 y_1 + x_2 y_2 + x_3 y_3$

let,

unit normal Vector $\vec{Y} = (y_1, y_2, y_3)$

∵ Y is unit normal vector in 3D

Taking angles (α, β)



$\therefore y_1 = \sin\alpha \cos\beta$

$y_2 = \sin\alpha \sin\beta$

$y_3 = \cos\alpha$

$z = x_1 \sin\alpha \cos\beta + x_2 \sin\alpha \sin\beta + x_3 \cos\alpha$

$= (x_1 \cos\beta + x_2 \sin\beta) \sin\alpha + x_3 \cos\alpha$

$= \left[\text{Rotation}_x (x_1, x_2, \beta) \right] \sin\alpha + x_3 \cos\alpha$

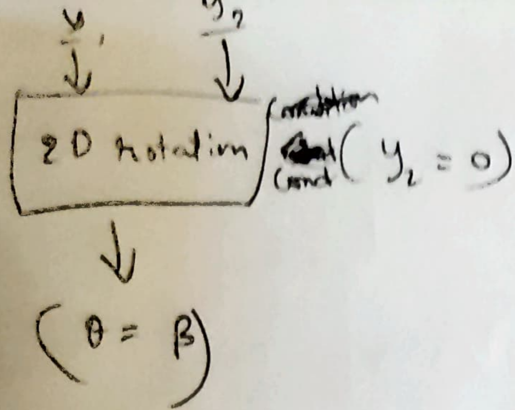
$= \text{Rotation}_x \left(x_3, \text{rot}_x (x_1, x_2, \beta), \alpha \right)$

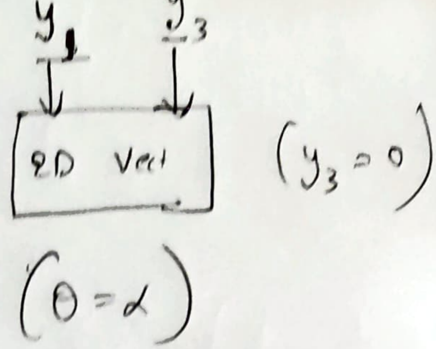
$= \text{Rot}_x \left(x_3, \text{Rot}_x (x_1, x_2, \beta), \alpha \right)$

Consider y evector

$\bar{Y} = (y_1, y_2, y_3)$

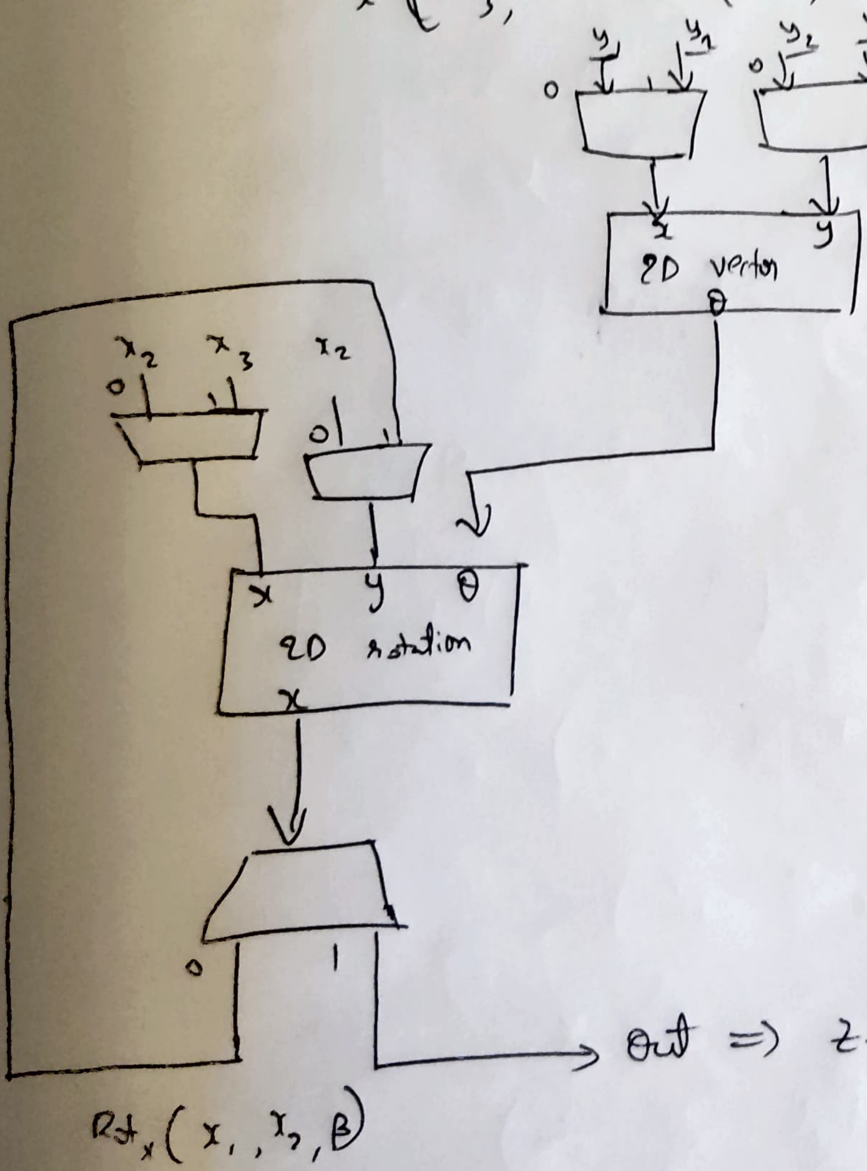
for angle β





Here angle β = azimuthal
angle α = depression

$$z = Rot_x\left(x_3,\ Rot_x(x_1, x_2, \beta)\, \alpha\right)$$



Cond 1 $\Rightarrow \underline{y_2} = 0$
$\cos\theta_2 \Rightarrow \underline{y_3} = 0$

Out $\Rightarrow z = Rot\ x\left(x_3,\ Rot_x(x_1, x_2, \beta), \alpha\right)$

$Rot_x(x_1, x_2, \beta)$

$$z = x_1 \underline{y_1} + x_2 \underline{y_2} + x_3 \underline{y_3}$$