Team-G

(1) $\because \; y = \dfrac{x_2 - x}{x_2 - x_1} y_1 + \dfrac{x_1 - x}{x_1 - x_2} y_2$

$x_1 = 0$
$x_2 = 3$
$x_3 = 2$

$y_1 = 2$
$y_2 = 5$
$y_3 = ?$

so for x_3 we have

$$y_3 = \frac{(x_2 - x_3)}{(x_2 - x_1)} y_1 + \left(\frac{x_1 - x_3}{x_1 - x_2}\right) y_2$$

$$x_3 = \frac{(y_2 - y_3)x_1 + (y_3 - y_1)x_2}{y_2 - y_1}$$

$$\cancel{x_3 = (2-5)(0) + 6}$$

$$y_3 = \left(\frac{3-2}{3-0}\right) 2 + \left(\frac{0-2}{0-3}\right) 5$$

$$= \frac{2}{3} + \frac{10}{3} = 4$$

(2) rotation around z-axis $(\gamma = 90°)$

$$\begin{bmatrix} \cos 90 & -\sin 90 & 0 \\ \sin 90 & \cos 90 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 7 \\ 3 \\ 2 \end{bmatrix}$$

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

$$= \begin{bmatrix} -3 \\ 7 \\ 2 \end{bmatrix}$$ rotation around y-axis

$$= \begin{bmatrix} \cos 90 & 0 & \sin 90 \\ 0 & 1 & 0 \\ -\sin 90 & 0 & \cos 90 \end{bmatrix} \begin{bmatrix} -3 \\ 7 \\ 2 \end{bmatrix} \quad (\beta = 90°)$$

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

$$= \begin{bmatrix} 2 \\ 7 \\ 3 \end{bmatrix}$$ after translation

$$= \begin{bmatrix} 2 + 4 \\ 7 - 3 \\ 3 + 7 \end{bmatrix} = \begin{bmatrix} 6 \\ 4 \\ 10 \end{bmatrix}$$

in Homogeneous = $\begin{bmatrix} 6 \\ 4 \\ 10 \\ 1 \end{bmatrix}$ = $\underset{\text{norm}}{\underset{\downarrow}{152}} \begin{bmatrix} 6 \\ 4 \\ 10 \\ 1 \end{bmatrix}$

$P = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 \end{bmatrix}$

(4)

$C = ((10 \times A) - B) + P$

$$= \begin{bmatrix} 100 & 900 & 160 & 160 \\ 0 & 110 & 110 & 110 \\ 180 & 300 & 330 & 330 \\ 180 & 180 & 180 & 180 \end{bmatrix}$$

$$- \begin{bmatrix} 10 & 90 & 16 & 16 \\ 0 & 13 & 17 & 11 \\ 18 & 34 & 31 & 33 \\ 18 & 17 & 19 & 18 \end{bmatrix}$$

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

$$= \begin{bmatrix} 100 & 900 & 160 & 160 \\ 0 & 110 & 110 & 110 \\ 180 & 900 & 330 & 330 \\ 180 & 180 & 180 & 180 \end{bmatrix} + \begin{bmatrix} 0 & 90 & 16 & 16 \\ 0 & 3 & 17 & 11 \\ 18 & 34 & 21 & 33 \\ 18 & 18 & 19 & 8 \end{bmatrix}$$

$$\begin{bmatrix} 100 & 990 & 176 & 176 \\ 0 & 113 & 127 & 121 \\ 198 & 334 & 351 & 363 \\ 198 & 197 & 199 & 188 \end{bmatrix}$$

(25) $f(x) = \dfrac{1}{\sigma\sqrt{2\pi}} e^{-(x-\mu)^2/(2\sigma^2)}$

$\sigma = 1$ code in Jupyter notebook.

(6) $\begin{bmatrix} 4 \\ 7 \end{bmatrix} = \begin{bmatrix} 4 \\ 7 \\ 1 \end{bmatrix} = \sqrt{4^2+7^2}\begin{bmatrix} 4 \\ 7 \\ 1 \end{bmatrix}$

$= \sqrt{16+49}\begin{bmatrix} 4 \\ 7 \\ 1 \end{bmatrix} = \sqrt{65}\begin{bmatrix} 4 \\ 7 \\ 1 \end{bmatrix}$

$= \begin{bmatrix} 4\sqrt{65} \\ 7\sqrt{65} \\ \sqrt{65} \end{bmatrix}$

7 New co-dinates.

$$\begin{bmatrix} 2+8 \\ 3+0 \\ 9+5 \end{bmatrix} \cdot \begin{bmatrix} 10 \\ 3 \\ 14 \end{bmatrix} = \underbrace{2}_{\text{scaling factor.}} \begin{bmatrix} 10 \\ 3 \\ 14 \end{bmatrix}$$

$$\begin{bmatrix} 20 \\ 6 \\ 28 \end{bmatrix}$$ in Homogeneous. $$n \begin{bmatrix} 20 \\ 6 \\ 28 \\ 1 \end{bmatrix}$$

$$\sqrt{20^2+6^2+28^2}$$

10 $p =$ intrinsic

$$\begin{bmatrix} f & 0 & px \\ 0 & f & py \\ 0 & 0 & 1 \end{bmatrix} = \begin{bmatrix} 1050 & 0 & 10 \\ 0 & 1050 & -5 \\ 0 & 0 & 1 \end{bmatrix}$$

$f = 1050$

~~frotass~~

⑧ $x+y-5=0$

$4x-5y+7=0$

To find intersection point first have cross product of

$(1, 1, -5)^T \quad (4, -5, 7)^T$

$$\begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 1 & 1 & -5 \\ 4 & -5 & 7 \end{vmatrix} = -18\hat{i} - 27\hat{j} - 9\hat{k}$$

$\downarrow$

point of intersection in homogeneous coordinate

$= (-18, -27, -9)^T$

$\Rightarrow (2, 3, 1)^T$ so in Euclidean it will be $(2, 3)^T$

(16)

(i) lines will be parallel in Euclidean plane.

(ii)
$$\begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 1 & 2 & 1 \\ 3 & 6 & -2 \end{vmatrix}$$

They intersect at the vanishing point.

$$(-4-6)\hat{i} - \hat{j}(-2-3) + \hat{k}(6-6)$$

$$-10\hat{i} + 5\hat{j} + 0\hat{k}$$

$$= (-10, 5, 0)^T$$