(9) $S_x = S_y = \sqrt{2}$

1) translacija

$$M_1 = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ -4 & 0 & 1 \end{bmatrix}$$

2) skaliranje

$S = \sqrt{2}$

$$M_2 = \begin{bmatrix} \sqrt{2} & 0 & 0 \\ 0 & \sqrt{2} & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

3) rotacija

$\varphi = -45^\circ$

$$M_3 = \begin{bmatrix} \cos(-45^\circ) & \sin(-45^\circ) & 0 \\ -\sin(-45^\circ) & \cos(-45^\circ) & 0 \\ 0 & 0 & 1 \end{bmatrix} = \begin{bmatrix} \frac{\sqrt{2}}{2} & -\frac{\sqrt{2}}{2} & 0 \\ \frac{\sqrt{2}}{2} & \frac{\sqrt{2}}{2} & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

4) translacija

$$M_4 = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 1 & 5 & 1 \end{bmatrix}$$

(7) ravnina $V_0\,(1\ 3\ -2)$ $\quad V_1(2\ 4\ 7)$ $\quad V_2(4\ -5\ 3)$

$$V = [u\ v\ 1]\underbrace{\begin{bmatrix} 1 & 1 & 9 & 0 \\ 3 & -8 & 5 & 0 \\ 1 & 3 & -2 & 1 \end{bmatrix}}_{R}$$

$V_1 - V_0$

$V_2 - V_0$

V_0

$x \quad x_1 = u + 3v + 1$

$y \quad x_2 = u - 8v + 3$

$z \quad x_3 = 9u + 5v - 2$

$x_4 = 1$

$$\begin{aligned} u &= x - 3v - 1 \\ -\ u &= y + 8v - 3 \\ \hline 0 &= x - y - 11v + 2 \end{aligned}$$

$$v = \frac{1}{11}x - \frac{1}{11}y + \frac{2}{11}$$

$$u = x - \frac{3}{11}x + \frac{3}{11}y - \frac{6}{11} - 1$$

$$u = \frac{8}{11}x + \frac{3}{11}y - \frac{17}{11}$$

$$z = \frac{72}{11}x + \frac{24}{11}y - \frac{153}{11} + \frac{5}{11}x - \frac{5}{11}y + \frac{10}{11} - 2$$

$$z = 7x + 2y - 15$$

$$\boxed{7x + 2y - z - 15 = 0}$$

(neg z)

$$R = \begin{bmatrix} 7 \\ 2 \\ -1 \\ -15 \end{bmatrix}$$

$$X \cdot R = [3\ 2\ 4\ 1]\begin{bmatrix} 7 \\ 2 \\ -1 \\ -15 \end{bmatrix} = 21 + \cancel{4} - \cancel{4} - 15 = 6 > 0$$

IZNAD

(8)

$$M = \begin{bmatrix} a & b & 0 \\ -1 & c & 0 \\ 0 & 0 & 2 \end{bmatrix} = \begin{bmatrix} \frac{a}{2} & \frac{b}{2} & 0 \\ -\frac{1}{2} & \frac{c}{2} & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$+\frac{1}{2} = +\sin\varphi$$

$$\varphi_1 = 30^\circ \qquad \varphi_2 = 150^\circ$$

$$\frac{c}{2} = \frac{a}{2} = \cos\varphi$$

$$a = c = 2\cos\varphi$$

$$a_1 = c_1 = 2\cos 30^\circ = \sqrt{3}$$

a, c

$$a_2 = c_2 = 2\cos 150^\circ = -\sqrt{3}$$

$$\frac{b}{2} = \sin\varphi = \frac{1}{2}$$

$b = 1$

3) 2D POMAK

$$\psi_P = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ \Delta x & \Delta y & 1 \end{bmatrix}$$

2D ROTACIJA

$$\psi_R = \begin{bmatrix} \cos\varphi & \sin\varphi & 0 \\ -\sin\varphi & \cos\varphi & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

2D SMIK

$$\psi_S = \begin{bmatrix} 1 & tg\,\alpha & 0 \\ tg\,\beta & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

linija - $V_1(10,10)$ $V_2(35,20)$

1) trans za $\boxed{\Delta x = 5}$ $\Rightarrow$ $V_1'(15,10)$ $V_2'(40,20)$

2) rot za $\boxed{\varphi = 30^\circ}$ $V_1'' = [15 \;\; 10 \;\; 1] \begin{bmatrix} \cos 30 & \sin 30 & 0 \\ -\sin 30 & \cos 30 & 0 \\ 0 & 0 & 1 \end{bmatrix} = \left[\frac{15\sqrt{3}-10}{2} \;\; \frac{15+10\sqrt{3}}{2} \;\; 1\right]$

$V_2'' = [40 \;\; 20 \;\; 1] \begin{bmatrix} & -\|- & \end{bmatrix} = [20\sqrt{3}-10 \;\; 20+10\sqrt{3} \;\; 1]$

$\Rightarrow$ dobijemo liniju određenu točkama

$$\boxed{V_1''\left(\frac{15\sqrt{3}-10}{2}, \frac{15+10\sqrt{3}}{2}\right) \quad V_2''\left(20\sqrt{3}-10, 20+10\sqrt{3}\right)}$$

$\left(\frac{2}{3}, \frac{1}{3}, 0, 1\right)$ $\left(\frac{1}{4}, 0, \frac{1}{2}, 1\right)$

4) pravac $V_0 = (2, 1, 0, 3)$ $V_1 = (1, 0, 2, 4)$

ravnina $R = (1, 1, 1, 1)^T$ proboda?

$$L = \begin{bmatrix} V_1 - V_0 \\ V_0 \end{bmatrix} = \begin{bmatrix} -\frac{5}{12} & -\frac{1}{3} & \frac{1}{2} & 0 \\ \frac{1}{4} & 0 & \frac{1}{2} & 1 \end{bmatrix}$$

$$V = [t \; 1] \begin{bmatrix} -5 & -4 & 6 & 0 \\ 3 & 0 & 6 & 12 \end{bmatrix}$$

$$x + y + z + 1 = 0$$

$$-\frac{5}{12}t + \frac{1}{4} - \frac{1}{3}t + \frac{1}{2}t + \frac{1}{2} + 1 = 0$$

$$-\frac{1}{4}t = -\frac{7}{4} \qquad t = 7$$

radni

$$V_P = [7 \; 1] \begin{bmatrix} -5 & -4 & 6 & 0 \\ 3 & 0 & 6 & 12 \end{bmatrix} = (-32 \;\; -28 \;\; 48 \;\; 12) = \left(-\frac{8}{3}, -\frac{7}{3}, 4\right)$$