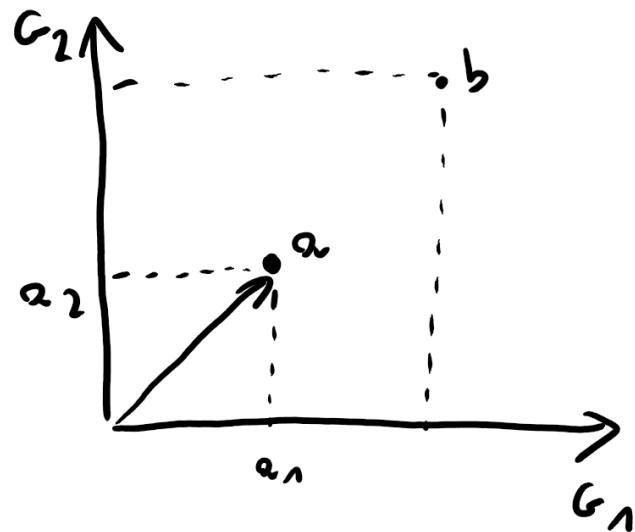
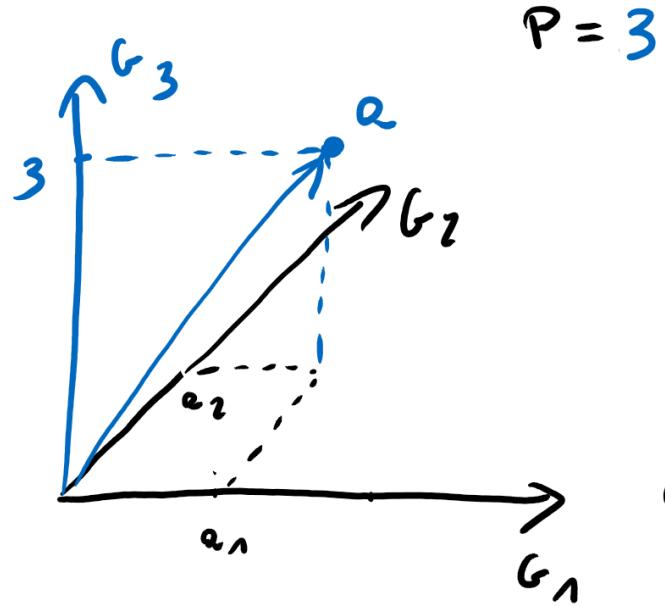


$P = 2$



$$a = \begin{bmatrix} a_1 \\ a_2 \end{bmatrix} \quad b = \begin{bmatrix} b_1 \\ b_2 \end{bmatrix}$$

$$d(a, b) = \sqrt{(a_1 - b_1)^2 + (a_2 - b_2)^2}$$



$$a = \begin{bmatrix} a_1 \\ a_2 \\ a_3 \end{bmatrix} \quad b = \begin{bmatrix} b_1 \\ b_2 \\ b_3 \end{bmatrix}$$

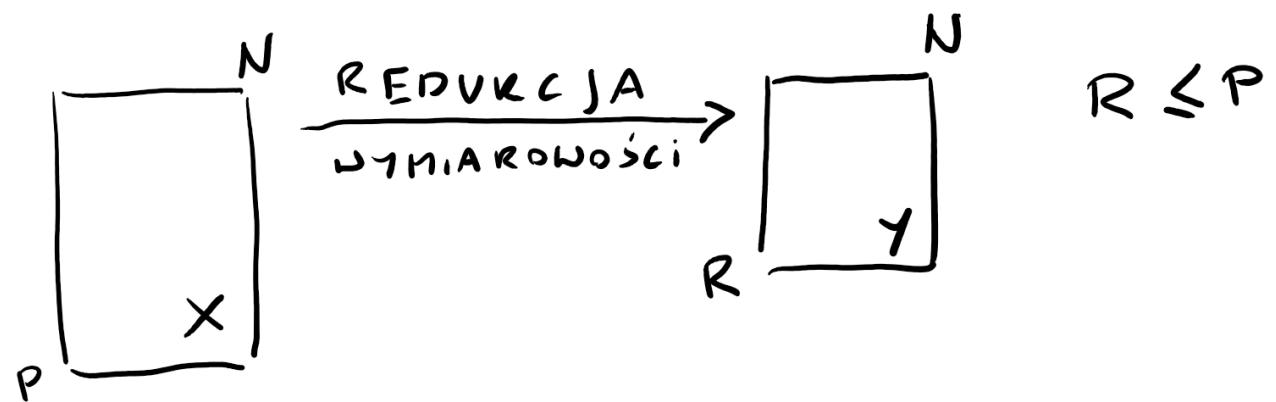
$$d(a, b) = \sqrt{(a_1 - b_1)^2 + (a_2 - b_2)^2 + (a_3 - b_3)^2}$$

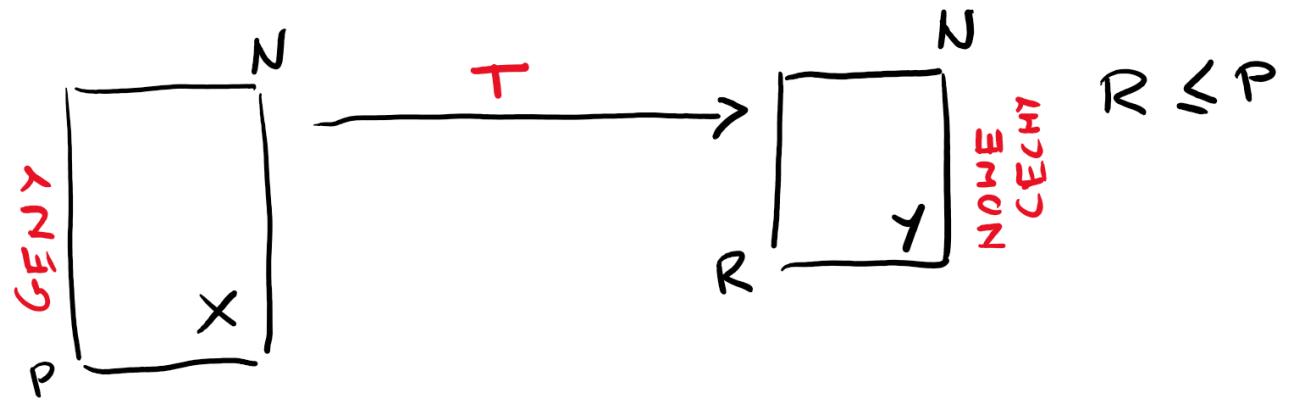
P = 1000

?

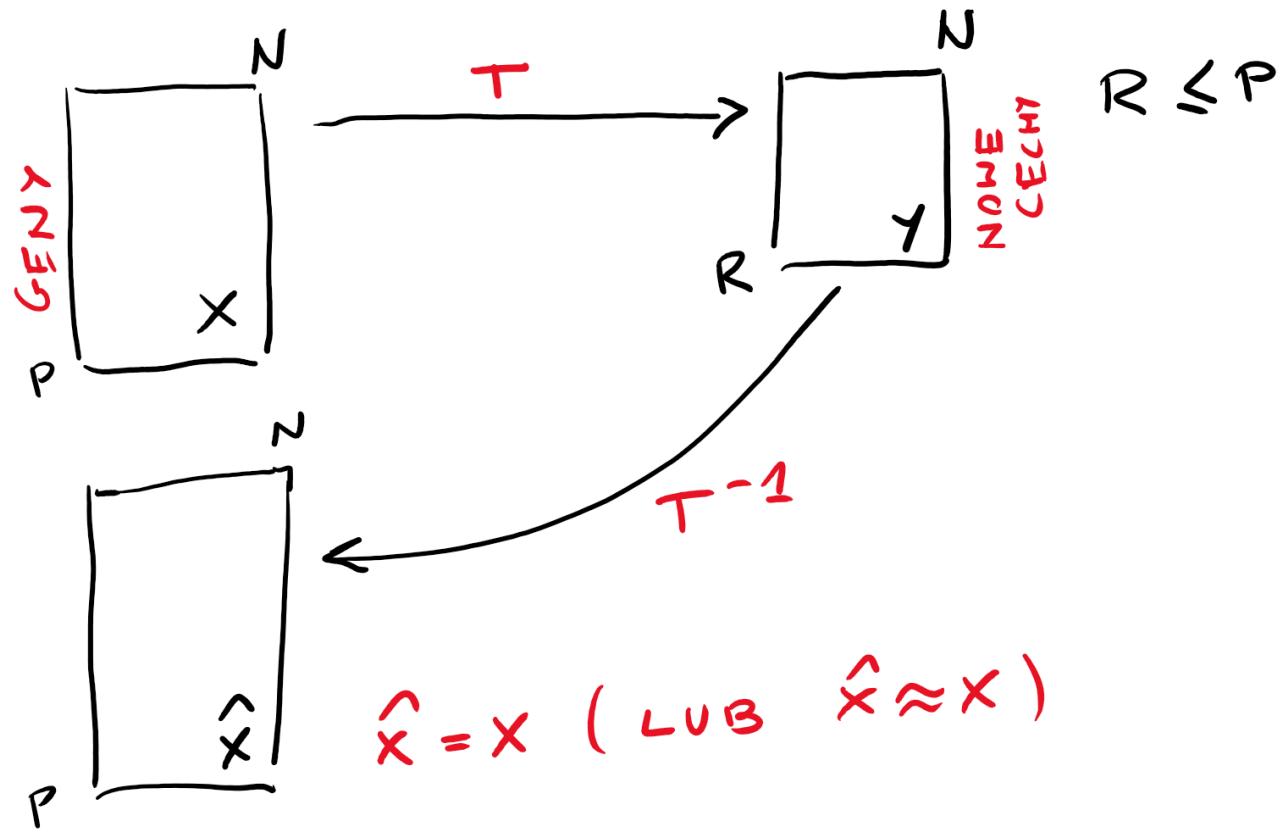
$$a = \begin{bmatrix} a_1 \\ a_2 \\ a_3 \\ \vdots \\ a_{1000} \end{bmatrix} \quad b = \begin{bmatrix} b_1 \\ b_2 \\ b_3 \\ \vdots \\ b_{1000} \end{bmatrix}$$

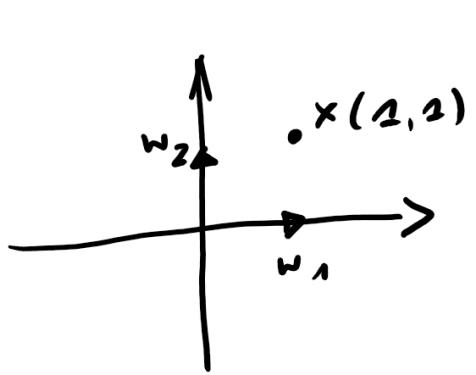
$$d(a, b) = \sqrt{(a_1 - b_1)^2 + (a_2 - b_2)^2 + (a_3 - b_3)^2 + \dots + (a_{1000} - b_{1000})^2}$$



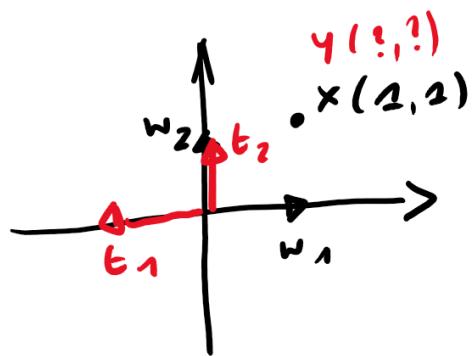


$$R \leq P$$

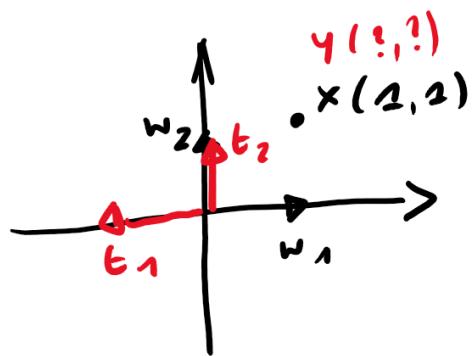




$$W = \begin{bmatrix} w_1 & w_2 \\ 1 & 0 \\ 0 & 1 \end{bmatrix} \quad x = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$$



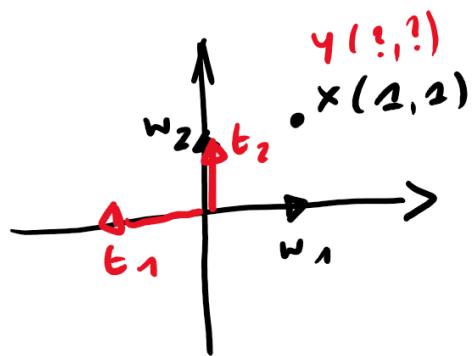
$$W = \begin{bmatrix} w_1 & w_2 \\ 1 & 0 \\ 0 & 1 \end{bmatrix} \quad x = \begin{bmatrix} 1 \\ 2 \end{bmatrix}$$



$$W = \begin{bmatrix} w_1 & w_2 \\ 1 & 0 \\ 0 & 1 \end{bmatrix} \quad x = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$$

$$T = \begin{bmatrix} t_1 & t_2 \\ -1 & 0 \\ 0 & 1 \end{bmatrix}$$

$$y = T^T \cdot x = t_2 \begin{bmatrix} -1 & 0 \\ 0 & 1 \end{bmatrix} \begin{bmatrix} 1 \\ 1 \end{bmatrix} = \begin{bmatrix} -1 \\ 1 \end{bmatrix}$$

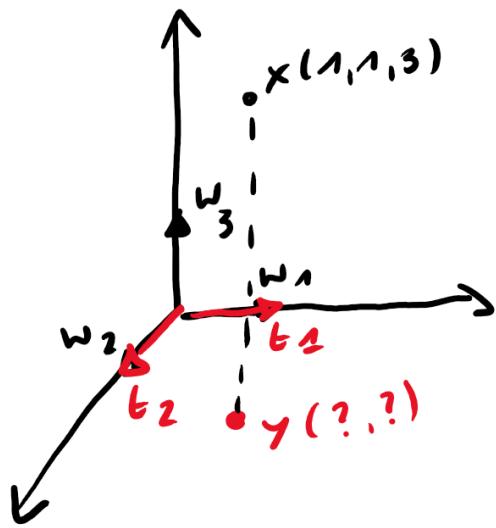


$$W = \begin{bmatrix} w_1 & w_2 \\ 1 & 0 \\ 0 & 1 \end{bmatrix} \quad x = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$$

$$T = \begin{bmatrix} t_1 & t_2 \\ -1 & 0 \\ 0 & 1 \end{bmatrix}$$

$$y = T^T \cdot x = t_2 \begin{bmatrix} -1 & 0 \\ 0 & 1 \end{bmatrix} \begin{bmatrix} 1 \\ 1 \end{bmatrix} = \begin{bmatrix} -1 \\ 1 \end{bmatrix}$$

$$Y = T^T \cdot X = \begin{bmatrix} -1 & 0 \\ 0 & 1 \end{bmatrix} \cdot \begin{bmatrix} x_{11} & x_{21} & \dots \\ x_{12} & x_{22} & \dots \end{bmatrix}$$



$$W = \begin{bmatrix} w_1 & w_2 & w_3 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$x = \begin{bmatrix} 1 \\ 1 \\ 3 \end{bmatrix}$$

$$T = \begin{bmatrix} t_1 & t_2 & t_3 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 0 \end{bmatrix} = \begin{bmatrix} t_1 & t_2 \\ 1 & 0 \\ 0 & 1 \\ 0 & 0 \end{bmatrix}$$

$$y = T^T \cdot x = t_1 \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \end{bmatrix} \cdot \begin{bmatrix} 1 \\ 1 \\ 3 \end{bmatrix} = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$$

$$\begin{matrix} b_1 \\ \vdots \\ b_R \end{matrix} \begin{matrix} P \\ \cdot \\ T^T \end{matrix} \begin{matrix} x_1 \dots x_n \\ N \\ P \end{matrix} = \begin{matrix} v_1 \dots v_n \\ N \\ R \end{matrix} \begin{matrix} Y \end{matrix}$$

A hand-drawn diagram illustrating matrix multiplication. On the left, a vertical vector b with components b_1, \dots, b_R is multiplied by a transpose operator T^T . This results in a horizontal vector x with components x_1, \dots, x_n . This intermediate vector x is then multiplied by a matrix N , resulting in a final vector y with components v_1, \dots, v_n .