How to find x_1, x_2, x_3 by using Cramer's Rule?

$$\begin{cases} a_1 x_1 + b_1 x_2 + c_1 x_3 = d_1 \\ a_2 x_1 + b_2 x_2 + c_2 x_3 = d_2 \\ a_3 x_1 + b_3 x_2 + c_3 x_3 = d_3 \end{cases}$$

$$A = \begin{bmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{bmatrix}$$

$$x_1 = \frac{\det\left(\begin{bmatrix} d_1 & b_1 & c_1 \\ d_2 & b_2 & c_2 \\ d_3 & b_3 & c_3 \end{bmatrix}\right)}{\det(A)} \qquad x_2 = \frac{\det\left(\begin{bmatrix} a_1 & d_1 & c_1 \\ a_2 & d_2 & c_2 \\ a_3 & d_3 & c_3 \end{bmatrix}\right)}{\det(A)} \qquad x_3 = \frac{\det\left(\begin{bmatrix} a_1 & b_1 & d_1 \\ a_2 & b_2 & d_2 \\ a_3 & b_3 & d_3 \end{bmatrix}\right)}{\det(A)}$$

Principle:

for x_1:

$$\underbrace{\begin{bmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{bmatrix}}_{A} \underbrace{\begin{bmatrix} x_1 & 0 & 0 \\ x_2 & 1 & 0 \\ x_3 & 0 & 1 \end{bmatrix}}_{X_1} = \underbrace{\begin{bmatrix} d_1 & b_1 & c_1 \\ d_2 & b_2 & c_2 \\ d_3 & b_3 & c_3 \end{bmatrix}}_{D_1}$$

$$A X_1 = D_1$$

$$\det(A X_1) = \det(D_1)$$

$$\det(A)\det(X_1) = \det(P_1)$$

$$\det(X_1) = x_1$$

$$x_1 = \frac{\det(D_1)}{\det(A)} = \frac{\det\left(\begin{bmatrix} d_1 & b_1 & c_1 \\ d_2 & b_2 & c_2 \\ d_3 & b_3 & c_3 \end{bmatrix}\right)}{\det(A)}$$