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$$\begin{bmatrix} a & b \\ c & d \end{bmatrix}\begin{bmatrix} x_1 & * \\ * & x_2 \end{bmatrix} = \begin{bmatrix} 1 & * \\ * & 1 \end{bmatrix}$$

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

$$\begin{bmatrix} a & b \\ 0 & -\frac{c}{a}b - d \end{bmatrix}\begin{bmatrix} x_{11} & x_{12} \\ x_{21} & x_{22} \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ -\frac{c}{a} & 1 \end{bmatrix} \longleftarrow AA^{-1} = I$$

$$a x_{11} + b x_{12} = 1$$

$$\left(-\frac{c}{a}b + d\right)x_{12} = -\frac{c}{a}$$

$$x_{12} = -\frac{c}{a} \cdot \frac{1}{-\frac{c}{a}b + d}$$

$$a x_{11} + b\left(-\frac{c}{a} \cdot \frac{1}{-\frac{c}{a}b + d}\right) = 1$$

$$x_{11} = \frac{1 - b\left(-\frac{c}{a}b + d\right)^{-1}}{a}$$

$$a x_{21} + b x_{22} = 0$$

$$\left(-\frac{c}{a}b + d\right)x_{22} = 1$$

$$x_{22} = \frac{1}{-\frac{c}{a}b + d}$$

$$a x_{21} + b\left(-\frac{c}{a}b + d\right)^{-1} = 1$$

$$x_{21} = \frac{1 - b\left(-\frac{c}{a}b + d\right)^{-1}}{a}$$

NEXT I WOULD SIMPLIFY & VERIFY

$$\begin{bmatrix} x_{11} & x_{12} \\ x_{21} & x_{22} \end{bmatrix} = A^{-1}$$