

Evaluate the determinant:

$$\begin{vmatrix} 2 & 2 & 0 & 0 \\ 1 & 0 & 2 & 5 \\ 0 & 0 & 0 & 1 \\ 1 & 3 & -2 & 1 \end{vmatrix} \xrightarrow[\text{Row 2 \& 3}]{\text{interchange}} \begin{vmatrix} 2 & 2 & 0 & 0 \\ 0 & 0 & 0 & 1 \\ 1 & 0 & 2 & 5 \\ 1 & 3 & -2 & 1 \end{vmatrix}$$

using cofactor expansion along 2nd row

$$= -0 \begin{vmatrix} 2 & 0 & 0 \\ 0 & 2 & 5 \\ 3 & -2 & 1 \end{vmatrix} + 0 \begin{vmatrix} 2 & 0 & 0 \\ 1 & 2 & 5 \\ 1 & -2 & 1 \end{vmatrix} - 0 \begin{vmatrix} 2 & 2 & 0 \\ 1 & 0 & 5 \\ 1 & 3 & 1 \end{vmatrix} + 1 \begin{vmatrix} 2 & 2 & 0 \\ 1 & 0 & 2 \\ 1 & 3 & -2 \end{vmatrix}$$

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

cofactor expansion along first row:

$$= 2 \begin{vmatrix} 0 & 2 \\ 3 & -2 \end{vmatrix} - 2 \begin{vmatrix} 1 & 2 \\ 1 & -2 \end{vmatrix} + 0 \begin{vmatrix} 1 & 0 \\ 1 & 3 \end{vmatrix}$$

$$= 2(-6) - 2(-2-2) + 0$$

$$= -12 + 8$$

$$= -4$$

∵ interchanged once

∴ ~~the~~ sign is changed

$$\text{Answer: } -4 \Rightarrow \boxed{4}$$