① Compute Cofactor C_{41}:

The cofactor C_{41} is given by:

$$C_{41} = (-1)^{4+1}\det(M_{41}) = -\det(M_{41})$$

Where M_{41} is the 3×3 minor obtained by deleting row 4 and Column 1 from A.

Thus

$$M_{41} = \begin{bmatrix} 1 & -2 & 3 \\ 3 & 1 & 0 \\ 0 & 1 & 2 \end{bmatrix}$$

Compute its determinant by expanding along the first row:

$$\det(M_{41}) = 1\cdot\det\begin{pmatrix} 1 & 0 \\ 1 & 2 \end{pmatrix} - (-2)\cdot\det\begin{pmatrix} 3 & 0 \\ 0 & 2 \end{pmatrix} + 3\cdot\det\begin{pmatrix} 3 & 1 \\ 0 & 1 \end{pmatrix}$$

$$= 1(1\cdot 2 - 0\cdot 1) + 2(3\cdot 2 - 0\cdot 0) + 3(3\cdot 1 - 1\cdot 0)$$

$$= 2 + 2(6) + 3(3)$$

$$= 2 + 12 + 9 = 23$$

Hence:

dont forget (-) sign

$$\boxed{C_{41} = -23}$$

② Compute det(A) by expansion down column 2:

The determinant can be expanded along column 2:

$$\det(A) = \sum_{i=1}^{4} A_{i2}C_{i2} = A_{12}C_{12} + A_{22}C_{22} + A_{32}C_{32} + A_{42}C_{42}$$

From the matrix, $\begin{bmatrix} a & 1 & -2 & 3 \\ b & 3 & 1 & 0 \\ c & 0 & 1 & 2 \\ d & 6 & -2 & 1 \end{bmatrix}$

$A_{12} = 1 \qquad A_{22} = 3 \qquad A_{32} = 0 \qquad A_{42} = 6$

We're given:

$C_{12} = 2 \qquad C_{22} = -1 \qquad C_{32} = -4 \qquad C_{42} = 1$

Therefore:

$$\det(A) = (1\cdot 2) + (3\cdot -1) + (0\cdot -4) + (6\cdot 1)$$

$$= 2 - 3 + 0 + 6$$

$$\boxed{\det(A) = 5}$$