

Solution We have

$$\begin{vmatrix} x & x+1 \\ x-1 & x \end{vmatrix} = x(x) - (x+1)(x-1) = x^2 - (x^2 - 1) = x^2 - x^2 + 1 = 1$$

Solution Note that in the third column, two entries are zero. So expanding along third column (C_3), we get

$$\begin{aligned} \Delta &= 4 \begin{vmatrix} -1 & 3 \\ 4 & 1 \end{vmatrix} - 0 \begin{vmatrix} 1 & 2 \\ 4 & 1 \end{vmatrix} + 0 \begin{vmatrix} 1 & 2 \\ -1 & 3 \end{vmatrix} \\ &= 4(-1 - 12) - 0 + 0 = -52 \end{aligned}$$

Solution Expanding along R_1 , we get

$$\begin{aligned} \Delta &= 0 \begin{vmatrix} 0 & \sin \beta \\ -\sin \beta & 0 \end{vmatrix} - \sin \alpha \begin{vmatrix} -\sin \alpha & \sin \beta \\ \cos \alpha & 0 \end{vmatrix} - \cos \alpha \begin{vmatrix} -\sin \alpha & 0 \\ \cos \alpha & -\sin \beta \end{vmatrix} \\ &= 0 - \sin \alpha (0 - \sin \beta \cos \alpha) - \cos \alpha (\sin \alpha \sin \beta - 0) \\ &= \sin \alpha \sin \beta \cos \alpha - \cos \alpha \sin \alpha \sin \beta = 0 \end{aligned}$$

Solution By definition of minors and cofactors, we have

$$\text{Minor of } a_{11} = M_{11} = \begin{vmatrix} a_{22} & a_{23} \\ a_{32} & a_{33} \end{vmatrix} = a_{22} a_{33} - a_{23} a_{32}$$

$$\text{Cofactor of } a_{11} = A_{11} = (-1)^{1+1} M_{11} = a_{22} a_{33} - a_{23} a_{32}$$

$$\text{Minor of } a_{21} = M_{21} = \begin{vmatrix} a_{12} & a_{13} \\ a_{32} & a_{33} \end{vmatrix} = a_{12} a_{33} - a_{13} a_{32}$$

$$\text{Cofactor of } a_{21} = A_{21} = (-1)^{2+1} M_{21} = (-1)(a_{12} a_{33} - a_{13} a_{32}) = -a_{12} a_{33} + a_{13} a_{32}$$

Solution: Option (D) is correct.