



Question 5:

If area of triangle is 35 square units with vertices  $(2, -6)$ ,  $(5, 4)$ , and  $(k, 4)$ . Then  $k$  is

A. 12 B. -2 C. -12, -2 D. 12, -2

Answer

**Answer: D**

The area of the triangle with vertices  $(2, -6)$ ,  $(5, 4)$ , and  $(k, 4)$  is given by the relation,

$$\begin{aligned}\Delta &= \frac{1}{2} \begin{vmatrix} 2 & -6 & 1 \\ 5 & 4 & 1 \\ k & 4 & 1 \end{vmatrix} \\ &= \frac{1}{2} [2(4-4) + 6(5-k) + 1(20-4k)] \\ &= \frac{1}{2} [30 - 6k + 20 - 4k] \\ &= \frac{1}{2} [50 - 10k] \\ &= 25 - 5k\end{aligned}$$

It is given that the area of the triangle is  $\pm 35$ .

Therefore, we have:

$$\Rightarrow 25 - 5k = \pm 35$$

$$\Rightarrow 5(5 - k) = \pm 35$$

$$\Rightarrow 5 - k = \pm 7$$

$$\text{When } 5 - k = -7, k = 5 + 7 = 12.$$

$$\text{When } 5 - k = 7, k = 5 - 7 = -2.$$

Hence,  $k = 12, -2$ .

The correct answer is D.

#### Exercise 4.4

Question 1:

Write Minors and Cofactors of the elements of following determinants:

$$(i) \begin{vmatrix} 2 & -4 \\ 0 & 3 \end{vmatrix} \quad (ii) \begin{vmatrix} a & c \\ b & d \end{vmatrix}$$

Answer

$$(i) \text{ The given determinant is } \begin{vmatrix} 2 & -4 \\ 0 & 3 \end{vmatrix}.$$

Minor of element  $a_{ij}$  is  $M_{ij}$ .

$$\therefore M_{11} = \text{minor of element } a_{11} = 3$$

$$M_{12} = \text{minor of element } a_{12} = 0$$

$$M_{21} = \text{minor of element } a_{21} = -4$$

$$M_{22} = \text{minor of element } a_{22} = 2$$

$$\text{Cofactor of } a_{ij} \text{ is } A_{ij} = (-1)^{i+j} M_{ij}.$$

$$\therefore A_{11} = (-1)^{1+1} M_{11} = (-1)^2 (3) = 3$$

$$A_{12} = (-1)^{1+2} M_{12} = (-1)^3 (0) = 0$$

$$A_{21} = (-1)^{2+1} M_{21} = (-1)^3 (-4) = 4$$

$$A_{22} = (-1)^{2+2} M_{22} = (-1)^4 (2) = 2$$

$$(ii) \text{ The given determinant is } \begin{vmatrix} a & c \\ b & d \end{vmatrix}.$$

Minor of element  $a_{ij}$  is  $M_{ij}$ .

$$\therefore M_{11} = \text{minor of element } a_{11} = d$$

$$M_{12} = \text{minor of element } a_{12} = b$$

$$M_{21} = \text{minor of element } a_{21} = c$$

$$M_{22} = \text{minor of element } a_{22} = a$$

$$\text{Cofactor of } a_{ij} \text{ is } A_{ij} = (-1)^{i+j} M_{ij}.$$

$$\therefore A_{11} = (-1)^{1+1} M_{11} = (-1)^2 (d) = d$$

$$A_{12} = (-1)^{1+2} M_{12} = (-1)^3 (b) = -b$$

$$A_{21} = (-1)^{2+1} M_{21} = (-1)^3 (c) = -c$$

$$A_{22} = (-1)^{2+2} M_{22} = (-1)^4 (a) = a$$

Question 2:

$$(i) \begin{vmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{vmatrix} \quad (ii) \begin{vmatrix} 1 & 0 & 4 \\ 3 & 5 & -1 \\ 0 & 1 & 2 \end{vmatrix}$$

Answer

$$(i) \text{ The given determinant is } \begin{vmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{vmatrix}.$$

By the definition of minors and cofactors, we have:

$$M_{11} = \text{minor of } a_{11} = \begin{vmatrix} 0 & 0 \\ 0 & 1 \end{vmatrix} = 0$$

$$M_{12} = \text{minor of } a_{12} = \begin{vmatrix} 0 & 0 \\ 0 & 1 \end{vmatrix} = 0$$

$$M_{13} = \text{minor of } a_{13} = \begin{vmatrix} 0 & 1 \\ 0 & 0 \end{vmatrix} = 0$$

$$M_{21} = \text{minor of } a_{21} = \begin{vmatrix} 0 & 0 \\ 0 & 1 \end{vmatrix} = 0$$

$$M_{22} = \text{minor of } a_{22} = \begin{vmatrix} 1 & 0 \\ 0 & 1 \end{vmatrix} = 1$$

$$M_{23} = \text{minor of } a_{23} = \begin{vmatrix} 1 & 0 \\ 0 & 0 \end{vmatrix} = 0$$

$$M_{31} = \text{minor of } a_{31} = \begin{vmatrix} 0 & 0 \\ 1 & 0 \end{vmatrix} = 0$$

$$M_{32} = \text{minor of } a_{32} = \begin{vmatrix} 1 & 0 \\ 0 & 0 \end{vmatrix} = 0$$

$$M_{33} = \text{minor of } a_{33} = \begin{vmatrix} 1 & 0 \\ 0 & 1 \end{vmatrix} = 1$$

$$A_{11} = \text{cofactor of } a_{11} = (-1)^{1+1} M_{11} = 1$$

$$A_{12} = \text{cofactor of } a_{12} = (-1)^{1+2} M_{12} = 0$$

$$A_{13} = \text{cofactor of } a_{13} = (-1)^{1+3} M_{13} = 0$$

$$A_{21} = \text{cofactor of } a_{21} = (-1)^{2+1} M_{21} = 0$$

$$A_{22} = \text{cofactor of } a_{22} = (-1)^{2+2} M_{22} = 1$$

$$A_{23} = \text{cofactor of } a_{23} = (-1)^{2+3} M_{23} = 0$$

$$A_{31} = \text{cofactor of } a_{31} = (-1)^{3+1} M_{31} = 0$$

$$A_{32} = \text{cofactor of } a_{32} = (-1)^{3+2} M_{32} = 0$$

$$A_{33} = \text{cofactor of } a_{33} = (-1)^{3+3} M_{33} = 1$$

$$(ii) \text{ The given determinant is } \begin{vmatrix} 1 & 0 & 4 \\ 3 & 5 & -1 \\ 0 & 1 & 2 \end{vmatrix}.$$

By definition of minors and cofactors, we have:

$$M_{11} = \text{minor of } a_{11} = \begin{vmatrix} 5 & -1 \\ 1 & 2 \end{vmatrix} = 10 - (-1) = 11$$

$$M_{12} = \text{minor of } a_{12} = \begin{vmatrix} 3 & -1 \\ 0 & 2 \end{vmatrix} = 6 - 0 = 6$$

$$M_{13} = \text{minor of } a_{13} = \begin{vmatrix} 3 & 5 \\ 0 & 1 \end{vmatrix} = 3 - 0 = 3$$

$$M_{21} = \text{minor of } a_{21} = \begin{vmatrix} 0 & 4 \\ 1 & 2 \end{vmatrix} = 0 - 4 = -4$$

$$M_{22} = \text{minor of } a_{22} = \begin{vmatrix} 1 & 4 \\ 0 & 2 \end{vmatrix} = 2 - 0 = 2$$

$$M_{23} = \text{minor of } a_{23} = \begin{vmatrix} 1 & 0 \\ 0 & 1 \end{vmatrix} = 1 - 0 = 1$$

$$M_{31} = \text{minor of } a_{31} = \begin{vmatrix} 0 & 4 \\ 5 & -1 \end{vmatrix} = 0 - 20 = -20$$

$$M_{32} = \text{minor of } a_{32} = \begin{vmatrix} 1 & 4 \\ 3 & -1 \end{vmatrix} = -1 - 12 = -13$$

$$M_{33} = \text{minor of } a_{33} = \begin{vmatrix} 1 & 0 \\ 3 & 5 \end{vmatrix} = 5 - 0 = 5$$

$$A_{11} = \text{cofactor of } a_{11} = (-1)^{1+1} M_{11} = 11$$

$$\begin{aligned}
 A_{12} &= \text{cofactor of } a_{12} = (-1)^{1+2} M_{12} = -6 \\
 A_{13} &= \text{cofactor of } a_{13} = (-1)^{1+3} M_{13} = 3 \\
 A_{21} &= \text{cofactor of } a_{21} = (-1)^{2+1} M_{21} = 4 \\
 A_{22} &= \text{cofactor of } a_{22} = (-1)^{2+2} M_{22} = 2 \\
 A_{23} &= \text{cofactor of } a_{23} = (-1)^{2+3} M_{23} = -1 \\
 A_{31} &= \text{cofactor of } a_{31} = (-1)^{3+1} M_{31} = -20 \\
 A_{32} &= \text{cofactor of } a_{32} = (-1)^{3+2} M_{32} = 13 \\
 A_{33} &= \text{cofactor of } a_{33} = (-1)^{3+3} M_{33} = 5
 \end{aligned}$$

Question 3:

$$\Delta = \begin{vmatrix} 5 & 3 & 8 \\ 2 & 0 & 1 \\ 1 & 2 & 3 \end{vmatrix}$$

Using Cofactors of elements of second row, evaluate

Answer

$$\begin{vmatrix} 5 & 3 & 8 \\ 2 & 0 & 1 \\ 1 & 2 & 3 \end{vmatrix}$$

The given determinant is

We have:

$$M_{21} = \begin{vmatrix} 3 & 8 \\ 2 & 3 \end{vmatrix} = 9 - 16 = -7$$

$$\therefore A_{21} = \text{cofactor of } a_{21} = (-1)^{2+1} M_{21} = 7$$

\*\*\*\*\* END \*\*\*\*\*