

# NCERT Solutions for Class 12 Maths Chapter 4 Exercise 4.1 (Ex 4.1)

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## NCERT Solutions class 12 Maths Determinants

Evaluate the following determinants in Exercise 1 and 2.

$$1. \begin{vmatrix} 2 & 4 \\ -5 & -1 \end{vmatrix}$$

$$\text{Ans. } \begin{vmatrix} 2 & 4 \\ -5 & -1 \end{vmatrix} = 2(-1) - 4(-5) = -2 + 20 = 18$$

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$$2. (i) \begin{vmatrix} \cos \theta & -\sin \theta \\ \sin \theta & \cos \theta \end{vmatrix}$$

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

$$\text{Ans. (i)} \begin{vmatrix} \cos \theta & -\sin \theta \\ \sin \theta & \cos \theta \end{vmatrix} = \cos \theta \cdot \cos \theta - (-\sin \theta) \cdot \sin \theta = \cos^2 \theta + \sin^2 \theta = 1$$

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

$$= (x^3 + 1) - (x^2 - 1) = x^3 - x^2 + 2$$

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## NCERT Solutions class 12 Maths Exercise 4.1

3. If  $A = \begin{bmatrix} 1 & 2 \\ 4 & 2 \end{bmatrix}$ , then show that  $|2A| = 4|A|$ .

Ans. Given:  $A = \begin{bmatrix} 1 & 2 \\ 4 & 2 \end{bmatrix}$ , then  $2A = 2 \begin{bmatrix} 1 & 2 \\ 4 & 2 \end{bmatrix}$

$$= \begin{bmatrix} 2 \times 1 & 2 \times 2 \\ 2 \times 4 & 2 \times 2 \end{bmatrix} = \begin{bmatrix} 2 & 4 \\ 8 & 4 \end{bmatrix}$$

$$\text{L.H.S.} = |2A| = \begin{vmatrix} 2 & 4 \\ 8 & 4 \end{vmatrix} = 2 \times 4 - 4 \times 8 = 8 - 32 = -24$$

$$\text{R.H.S.} = 4|A| = 4 \begin{vmatrix} 1 & 2 \\ 4 & 2 \end{vmatrix}$$

$$= 4(1 \times 2 - 4 \times 8) = 4(-6) = -24$$

Since L.H.S. = R.H.S.

Hence, proved.

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## NCERT Solutions class 12 Maths Exercise 4.1

4. If  $A = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 2 \\ 0 & 0 & 4 \end{bmatrix}$ , then show that  $|3A| = 27|A|$ .

$$\text{Ans. Given: } A = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 2 \\ 0 & 0 & 4 \end{bmatrix}, \text{ then } 3A = 3 \begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 2 \\ 0 & 0 & 4 \end{bmatrix} = \begin{bmatrix} 3 & 0 & 3 \\ 0 & 3 & 6 \\ 0 & 0 & 12 \end{bmatrix}$$

$$\text{L.H.S.} = |3A| = \begin{vmatrix} 3 & 0 & 3 \\ 0 & 3 & 6 \\ 0 & 0 & 12 \end{vmatrix}$$

$$= 3(36 - 0) = 3 \times 36 = 108$$

$$\text{R.H.S.} = 27|A| = 27 \begin{vmatrix} 1 & 0 & 1 \\ 0 & 1 & 2 \\ 0 & 0 & 4 \end{vmatrix}$$

$$= 27 [1(4 - 0)] = 27 \times 4 = 108$$

Since L.H.S. = R.H.S.

Hence, proved.

5. Evaluate the determinants:

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

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

$$(iii) \begin{vmatrix} 0 & 1 & 2 \\ -1 & 0 & -3 \\ -2 & 3 & 0 \end{vmatrix}$$

$$(iv) \begin{vmatrix} 2 & -1 & -2 \\ 0 & 0 & -1 \\ 3 & -5 & 0 \end{vmatrix}$$

Ans. Evaluate the determinants:

(i) Given: 
$$\begin{vmatrix} 3 & -1 & -2 \\ 0 & 0 & -1 \\ 3 & -5 & 0 \end{vmatrix}$$

Expanding along first row, 
$$3 \begin{vmatrix} 0 & -1 \\ -5 & 0 \end{vmatrix} - (-1) \begin{vmatrix} 0 & -1 \\ 3 & 0 \end{vmatrix} + (-2) \begin{vmatrix} 0 & 0 \\ 3 & -5 \end{vmatrix}$$

$$= 3(0 - 5) + 1\{0 - (-3)\} - 2(0 - 0)$$

$$= -15 + 3 - 0 = -12$$

(ii) Given: 
$$\begin{vmatrix} 3 & -4 & 5 \\ 1 & 1 & -2 \\ 2 & 3 & 1 \end{vmatrix}$$

Expanding along first row, 
$$3 \begin{vmatrix} 1 & -2 \\ 1 & 1 \end{vmatrix} - (-4) \begin{vmatrix} 1 & -2 \\ 2 & 1 \end{vmatrix} + 5 \begin{vmatrix} 1 & 1 \\ 2 & 3 \end{vmatrix}$$

$$= 3(1 + 2) + 4\{1 - (-4)\} + 5(3 - 2)$$

$$= 3 \times 3 + 4 \times 5 + 5 \times 1$$

$$= 9 + 20 + 5 = 34$$

(iii) Given: 
$$\begin{vmatrix} 0 & 1 & 2 \\ -1 & 0 & -3 \\ -2 & 3 & 0 \end{vmatrix}$$

Expanding along first row, 
$$0 \begin{vmatrix} 0 & -3 \\ 3 & 0 \end{vmatrix} - 1 \begin{vmatrix} -1 & -3 \\ -2 & 0 \end{vmatrix} + 2 \begin{vmatrix} -1 & 0 \\ -2 & 3 \end{vmatrix}$$

$$= 0(0 - 9) - (0 - 6) + 2(-3 - 0)$$

$$= 0 + 6 - 6 = 0$$

$$(iv) \text{ Given: } \begin{vmatrix} 2 & -1 & -2 \\ 0 & 0 & -1 \\ 3 & -5 & 0 \end{vmatrix}$$

$$\text{Expanding along first row, } 2 \begin{vmatrix} 2 & -1 \\ -5 & 0 \end{vmatrix} - (-1) \begin{vmatrix} 0 & -1 \\ 3 & 0 \end{vmatrix} + (-2) \begin{vmatrix} 0 & 0 \\ 3 & -5 \end{vmatrix}$$

$$= 2(0 - 5) + (0 + 3) - 2(0 - 6)$$

$$= -10 + 3 + 12 = 5$$

$$6. \text{ If } A = \begin{bmatrix} 1 & 1 & -2 \\ 2 & 1 & -3 \\ 5 & 4 & -9 \end{bmatrix}, \text{ find } |A|.$$

$$\text{Ans. Given: } A = \begin{bmatrix} 1 & 1 & -2 \\ 2 & 1 & -3 \\ 5 & 4 & -9 \end{bmatrix}$$

$$\Rightarrow |A| = \begin{vmatrix} 1 & 1 & -2 \\ 2 & 1 & -3 \\ 5 & 4 & -9 \end{vmatrix}$$

$$\text{Expanding along first row, } 1 \begin{vmatrix} 1 & -3 \\ 4 & -9 \end{vmatrix} - 1 \begin{vmatrix} 2 & -3 \\ 5 & -9 \end{vmatrix} + (-2) \begin{vmatrix} 2 & 1 \\ 5 & 4 \end{vmatrix}$$

$$= \{-9 - (-12)\} - \{-18 - (-15)\} - 2(8 - 5)$$

$$= -9 + 12 - (-18 + 15) - 2(3)$$

$$= 3 - (-3) - 6$$

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

7. Find the value of  $x$ , if:

$$(i) \begin{vmatrix} 2 & 4 \\ 5 & 1 \end{vmatrix} = \begin{vmatrix} 2x & 4 \\ 6 & x \end{vmatrix}$$

$$(ii) \begin{vmatrix} 2 & 3 \\ 4 & 5 \end{vmatrix} = \begin{vmatrix} x & 3 \\ 2x & 5 \end{vmatrix}$$

Ans. (i) Given:  $\begin{vmatrix} 2 & 4 \\ 5 & 1 \end{vmatrix} = \begin{vmatrix} 2x & 4 \\ 6 & x \end{vmatrix}$

$$\Rightarrow 2 - 20 = 2x^2 - 24$$

$$\Rightarrow -18 = 2x^2 - 24$$

$$\Rightarrow 2x^2 = -18 + 24$$

$$\Rightarrow 2x^2 = 6$$

$$\Rightarrow x^2 = 3$$

$$\Rightarrow x = \pm\sqrt{3}$$

$$(ii) \begin{vmatrix} 2 & 3 \\ 4 & 5 \end{vmatrix} = \begin{vmatrix} x & 3 \\ 2x & 5 \end{vmatrix}$$

$$\Rightarrow 10 - 12 = 5x - 6x$$

$$\Rightarrow -2 = -x$$

$$\Rightarrow x = 2$$

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8. If  $\begin{vmatrix} x & 2 \\ 18 & x \end{vmatrix} = \begin{vmatrix} 6 & 2 \\ 18 & 6 \end{vmatrix}$ , then  $x$  is equal to:

(A) 6

(B)  $\pm 6$

(C)  $-6$

(D) 0

Ans. Given:  $\begin{vmatrix} x & 2 \\ 18 & x \end{vmatrix} = \begin{vmatrix} 6 & 2 \\ 18 & 6 \end{vmatrix}$

$$\Rightarrow x^2 - 36 = 36 - 36$$

$$\Rightarrow x^2 - 36 = 0$$

$$\Rightarrow x^2 = 36$$

$$\Rightarrow x = \pm 6$$

Therefore, option (B) is correct.

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