EXPRESSWALA ACADEMY

Maths 1A: Determinants

MCQ Test, Set 09

Time: 30 minutes | Maximum marks: 25

Name: _____ Class: _____ Date: _____

1. There are 25 questions. Each has exactly one correct answer: choose A, B, C or D.
2. Each correct answer carries 1 mark. There is no negative marking.
3. The key sheet and worked solutions are at the end of this test.

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

A. 15 **B.** -33 **C.** -35 **D.** 35

2. If $\begin{vmatrix} x & -4 \\ -6 & x \end{vmatrix} = 25$, then

A. $x = 7$ only **B.** $x = \pm 8$ **C.** $x = \pm 1$ **D.** $x = \pm 7$

3. The cofactor of the element -1 in $\begin{bmatrix} 2 & -1 & 6 \\ 1 & 0 & -3 \\ 1 & -3 & 7 \end{bmatrix}$ is

A. 4 **B.** -4 **C.** 10 **D.** -10

4. In $\begin{bmatrix} 0 & 5 & 9 \\ -4 & 9 & 6 \\ -2 & 9 & -3 \end{bmatrix}$, the minor M_{23} is

A. 10 **B.** 13 **C.** -10 **D.** 36

5. $\begin{vmatrix} 1 & 2 & 0 \\ -4 & -4 & 1 \\ -3 & 2 & 3 \end{vmatrix} =$

A. -12 **B.** 4 **C.** -32 **D.** -4

6. The value of $\begin{vmatrix} 1 & -1 & 6 \\ 0 & 4 & 3 \\ 0 & 2 & 5 \end{vmatrix}$ is

A. 14 **B.** 20 **C.** 10 **D.** -14

7. If $\begin{vmatrix} a & b & c \\ p & q & r \\ x & y & z \end{vmatrix} = 4$, then $\begin{vmatrix} a & 4b & c \\ p & 4q & r \\ x & 4y & z \end{vmatrix} =$

A. 12 **B.** 16 **C.** 4 **D.** -16

8. If $\begin{vmatrix} a & b & c \\ p & q & r \\ x & y & z \end{vmatrix} = 7$, then $\begin{vmatrix} p & q & r \\ x & y & z \\ a & b & c \end{vmatrix} =$

A. -7 **B.** 21 **C.** 7 **D.** 14

9. $\begin{vmatrix} b+c & a & 1 \\ a+c & b & 1 \\ a+b & c & 1 \end{vmatrix} =$

A. 0 **B.** abc **C.** 1 **D.** $a+b+c$

10. Using $C_1 \to C_1 - 5C_3$, the value of $\begin{vmatrix} 12 & -1 & 3 \\ 36 & 5 & 6 \\ 25 & -4 & 5 \end{vmatrix}$ is

A. 189 **B.** -179 **C.** -378 **D.** -189

11. For $A = \begin{bmatrix} 2 & 4 & 4 \\ -5 & 8 & 0 \\ 3 & -5 & 6 \end{bmatrix}$ with cofactors A_{ij}, $a_{11}A_{11} + a_{12}A_{12} + a_{13}A_{13} =$

A. 440 **B.** -220 **C.** 220 **D.** 0

12. The roots of $\begin{vmatrix} x & -1 & 7 \\ -1 & x & 7 \\ -1 & 7 & x \end{vmatrix} = 0$ are

A. $-1,\ 7,\ -6$ **B.** $-1,\ 7,\ 6$ **C.** $-1,\ 7$ **D.** $1,\ -7,\ 6$

13. If A is a square matrix of order 2 and $|A| = -4$, then $|3A| =$

A. -12 **B.** 36 **C.** -108 **D.** -36

14. If $|A| = 5$ for a matrix A of order 2, the determinant of the matrix of cofactors of A is

A. -5 **B.** 25 **C.** 125 **D.** 5

15. The determinant of a nilpotent matrix is

A. -1 **B.** 0 **C.** 1 or -1 **D.** 1

16. The determinant of $\begin{bmatrix} 6 & -6 & -6 \\ 0 & 3 & -6 \\ 0 & 0 & 3 \end{bmatrix}$ is

A. 12 **B.** -54 **C.** 54 **D.** 48

17. $\begin{vmatrix} 121 & 144 & 169 \\ 144 & 169 & 196 \\ 169 & 196 & 225 \end{vmatrix} =$

A. -8 **B.** 0 **C.** 8 **D.** 216

18. $\begin{vmatrix} 1 & 3 & 27 \\ 1 & 6 & 216 \\ 1 & 8 & 512 \end{vmatrix} =$

A. 510 **B.** 30 **C.** -510 **D.** 2700

19. $\begin{vmatrix} p+1 & 1 & 1 \\ 1 & q+1 & 1 \\ 1 & 1 & r+1 \end{vmatrix} =$

A. $1+p+q+r$ **B.** pqr **C.** $pqr+pq+qr+rp$ **D.** $pqr+p+q+r$

20. Multiplying $\begin{vmatrix} 3 & -3 \\ 5 & -1 \end{vmatrix}$ and $\begin{vmatrix} 2 & 4 \\ -3 & 2 \end{vmatrix}$ row by row, the element in row 2, column 1 of the product is

A. -6 **B.** 6 **C.** -15 **D.** 13

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21. If $\Delta(x) = \begin{vmatrix} 2x+1 & \cos x \\ 3 & -2 \end{vmatrix}$, then $\Delta'(x) =$

A. $4 - 3\sin x$ **B.** $6\sin x - 8$ **C.** $3\sin x - 4$ **D.** 0

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22. If $\Delta(x) = \begin{vmatrix} x^2 & \sin x \\ \cos x & 3x-2 \end{vmatrix}$, then $\Delta'(x) =$

A. $6x + \sin x \cos x$

B. $9x^2 - 4x + \sin^2 x - \cos^2 x$

C. $-9x^2 + 4x - \sin^2 x + \cos^2 x$

D. $6x^2 - 4x - \cos^2 x$

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23. $\displaystyle\int_0^1 \begin{vmatrix} 2x+1 & 2 \\ x^2+x & 1 \end{vmatrix}\, dx =$

A. $\frac{4}{3}$ **B.** $\frac{1}{3}$ **C.** $-\frac{1}{3}$ **D.** $\frac{2}{3}$

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24. If A is a singular matrix, then A^T is

A. the unit matrix

B. non-singular

C. orthogonal

D. singular

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25. $\begin{bmatrix} 3 & 6 \\ -6 & p \end{bmatrix}$ is singular when $p =$

A. -11 **B.** 12 **C.** -12 **D.** -24

Key sheet

1. C	**2.** D	**3.** D	**4.** A	**5.** B
6. A	**7.** B	**8.** C	**9.** A	**10.** D
11. C	**12.** A	**13.** D	**14.** D	**15.** B
16. C	**17.** A	**18.** A	**19.** C	**20.** B
21. C	**22.** B	**23.** B	**24.** D	**25.** C

Solutions

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

$2 \cdot (-5) - (-5) \cdot (-5) = -35$

Ans: (C) -35

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2. If $\begin{vmatrix} x & -4 \\ -6 & x \end{vmatrix} = 25$, then

$x^2 - 24 = 25$

$x^2 = 49 \Rightarrow x = \pm 7$

Ans: (D) $x = \pm 7$

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3. The cofactor of the element -1 in $\begin{bmatrix} 2 & -1 & 6 \\ 1 & 0 & -3 \\ 1 & -3 & 7 \end{bmatrix}$ is

$M_{12} = \begin{vmatrix} 1 & -3 \\ 1 & 7 \end{vmatrix} = 10$

$A_{12} = (-1)^3(10) = -10$

Ans: (D) -10

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4. In $\begin{bmatrix} 0 & 5 & 9 \\ -4 & 9 & 6 \\ -2 & 9 & -3 \end{bmatrix}$, the minor M_{23} is

$M_{23} = \begin{vmatrix} 0 & 5 \\ -2 & 9 \end{vmatrix} = 0 - (-10) = 10$

Ans: (A) 10

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5. $\begin{vmatrix} 1 & 2 & 0 \\ -4 & -4 & 1 \\ -3 & 2 & 3 \end{vmatrix} =$

$\Delta = \begin{vmatrix} -4 & 1 \\ 2 & 3 \end{vmatrix} - 2\begin{vmatrix} -4 & 1 \\ -3 & 3 \end{vmatrix}$

$= (-12 - 2) - 2(-12 - (-3))$

$= (-14) - 2(-9) = 4$

Ans: (B) 4

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6. The value of $\begin{vmatrix} 1 & -1 & 6 \\ 0 & 4 & 3 \\ 0 & 2 & 5 \end{vmatrix}$ is

$\Delta = \begin{vmatrix} 4 & 3 \\ 2 & 5 \end{vmatrix}$

$= (20 - 6)$

$= (14) = 14$

Ans: (A) 14

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7. If $\begin{vmatrix} a & b & c \\ p & q & r \\ x & y & z \end{vmatrix} = 4$, then $\begin{vmatrix} a & 4b & c \\ p & 4q & r \\ x & 4y & z \end{vmatrix} =$

One column is multiplied by 4, so the value is multiplied by 4.

$\therefore \text{value} = 4 \times 4 = 16$

Ans: (B) 16

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8. If $\begin{vmatrix} a & b & c \\ p & q & r \\ x & y & z \end{vmatrix} = 7$, then $\begin{vmatrix} p & q & r \\ x & y & z \\ a & b & c \end{vmatrix} =$

The rows are moved round once: two interchanges, so the sign changes twice.

$\therefore \text{value} = 1 \times 7 = 7$

Ans: (C) 7

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9. $\begin{vmatrix} b+c & a & 1 \\ a+c & b & 1 \\ a+b & c & 1 \end{vmatrix} =$

$C_1 \to C_1 + C_2$ gives $a+b+c$ in every row: $(a+b+c)$ times C_3.

$\therefore \Delta = 0$

Ans: (A) 0

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10. Using $C_1 \to C_1 - 5C_3$, the value of $\begin{vmatrix} 12 & -1 & 3 \\ 36 & 5 & 6 \\ 25 & -4 & 5 \end{vmatrix}$ is

$C_1 \to C_1 - 5C_3$ leaves the value unchanged and gives $\begin{vmatrix} -3 & -1 & 3 \\ 6 & 5 & 6 \\ 0 & -4 & 5 \end{vmatrix}$.

$\Delta = -189$

Ans: (D) -189

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11. For $A = \begin{bmatrix} 2 & 4 & 4 \\ -5 & 8 & 0 \\ 3 & -5 & 6 \end{bmatrix}$ with cofactors A_{ij}, $a_{11}A_{11} + a_{12}A_{12} + a_{13}A_{13} =$

Elements of a line times their own cofactors give the determinant.

$a_{11}A_{11} + a_{12}A_{12} + a_{13}A_{13} = |A| = 220$

Ans: (C) 220

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12. The roots of $\begin{vmatrix} x & -1 & 7 \\ -1 & x & 7 \\ -1 & 7 & x \end{vmatrix} = 0$ are

$C_1 \to C_1 + C_2 + C_3$ gives the factor $x+6$; then $R_2 - R_1$, $R_3 - R_1$ leave $(x+1)(x-7)$.

$x = -1,\ 7,\ -6$

Ans: (A) $-1,\ 7,\ -6$

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13. If A is a square matrix of order 2 and $|A| = -4$, then $|3A| =$

$|3A| = 3^2|A| = -36$

Ans: (D) -36

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14. If $|A| = 5$ for a matrix A of order 2, the determinant of the matrix of cofactors of A is

$|\text{cofactor matrix}| = |A|^{n-1} = 5^1 = 5$

Ans: (D) 5

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15. The determinant of a nilpotent matrix is

$A^k = O \Rightarrow |A|^k = 0$, so $|A| = 0$.

Ans: (B) 0

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16. The determinant of $\begin{bmatrix} 6 & -6 & -6 \\ 0 & 3 & -6 \\ 0 & 0 & 3 \end{bmatrix}$ is

Triangular: product of the diagonal elements.

$6 \times 3 \times 3 = 54$

Ans: (C) 54

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17. $\begin{vmatrix} 121 & 144 & 169 \\ 144 & 169 & 196 \\ 169 & 196 & 225 \end{vmatrix} =$

The entries are squares of consecutive numbers, each row starting one later; this is result 11 with $n = 11$.

$\Delta = -8$

Ans: (A) -8

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18. $\begin{vmatrix} 1 & 3 & 27 \\ 1 & 6 & 216 \\ 1 & 8 & 512 \end{vmatrix} =$

Use result 4, $(a+b+c)(a-b)(b-c)(c-a)$ with $a, b, c = 3, 6, 8$.

$(17)(3-6)(6-8)(8-3) = 510$

Ans: (A) 510

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19. $\begin{vmatrix} p+1 & 1 & 1 \\ 1 & q+1 & 1 \\ 1 & 1 & r+1 \end{vmatrix} =$

Result 9: $abc\left(1 + \frac{1}{a} + \frac{1}{b} + \frac{1}{c}\right) = abc + bc + ca + ab$.

Ans: (C) $pqr + pq + qr + rp$

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20. Multiplying $\begin{vmatrix} 3 & -3 \\ 5 & -1 \end{vmatrix}$ and $\begin{vmatrix} 2 & 4 \\ -3 & 2 \end{vmatrix}$ row by row, the element in row 2, column 1 of the product is

Row 2 of the first times row 1 of the second:

$5 \cdot 2 + (-1) \cdot 4 = 6$

Ans: (B) 6

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21. If $\Delta(x) = \begin{vmatrix} 2x+1 & \cos x \\ 3 & -2 \end{vmatrix}$, then $\Delta'(x) =$

$\Delta'(x) = \begin{vmatrix} 2 & -\sin x \\ 3 & -2 \end{vmatrix} + \begin{vmatrix} 2x+1 & \cos x \\ 0 & 0 \end{vmatrix}$

$= 3\sin x - 4$

Ans: (C) $3\sin x - 4$

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22. If $\Delta(x) = \begin{vmatrix} x^2 & \sin x \\ \cos x & 3x-2 \end{vmatrix}$, then $\Delta'(x) =$

$\Delta'(x) = \begin{vmatrix} 2x & \cos x \\ \cos x & 3x-2 \end{vmatrix} + \begin{vmatrix} x^2 & \sin x \\ -\sin x & 3 \end{vmatrix}$

$= 9x^2 - 4x + \sin^2 x - \cos^2 x$

Ans: (B) $9x^2 - 4x + \sin^2 x - \cos^2 x$

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23. $\int_0^1 \begin{vmatrix} 2x+1 & 2 \\ x^2+x & 1 \end{vmatrix} dx =$

Only one column contains x, so integrate that column:

$\begin{vmatrix} \int_0^1 (2x+1)\,dx & 2 \\ \int_0^1 (x^2+x)\,dx & 1 \end{vmatrix} = \begin{vmatrix} 2 & 2 \\ \frac{5}{6} & 1 \end{vmatrix}$

$= \frac{1}{3}$

Ans: (B) $\frac{1}{3}$

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24. If A is a singular matrix, then A^T is

$|A^T| = |A| = 0.$

Ans: (D) singular

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25. $\begin{bmatrix} 3 & 6 \\ -6 & p \end{bmatrix}$ is singular when $p =$

$3p + 36 = 0$

$p = -12$

Ans: (C) -12
