EXPRESSWALA ACADEMY

Maths 1A: Determinants

MCQ Test, Set 03

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. $\begin{vmatrix} 3 & 10 \\ -6 & 2 \end{vmatrix} =$

A. -38 **B.** 66 **C.** -54 **D.** -66

2. If $\begin{vmatrix} x & -5 \\ 3 & x \end{vmatrix} = 40$, then

A. $x = \pm 6$ **B.** $x = \pm\sqrt{55}$ **C.** $x = 5$ only **D.** $x = \pm 5$

3. The cofactor of the element -1 in $\begin{bmatrix} -4 & 1 & 0 \\ 6 & -5 & -1 \\ -4 & -6 & -5 \end{bmatrix}$ is

A. -20 **B.** 20 **C.** 28 **D.** -28

4. In $\begin{bmatrix} 0 & 9 & 1 \\ -3 & 8 & -2 \\ -6 & 2 & 6 \end{bmatrix}$, the minor M_{21} is

A. 52 **B.** -30 **C.** 56 **D.** -52

5. $\begin{vmatrix} -1 & 3 & 1 \\ 0 & -1 & 1 \\ 6 & -3 & -1 \end{vmatrix} =$

A. -20 **B.** 20 **C.** -1 **D.** -16

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

A. -30 **B.** 228 **C.** -228 **D.** -132

7. If $\begin{vmatrix} a & b & c \\ p & q & r \\ x & y & z \end{vmatrix} = 5$, then $\begin{vmatrix} a & p & x \\ b & q & y \\ c & r & z \end{vmatrix} =$

A. 10 **B.** 15 **C.** -5 **D.** 5

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

A. -8 **B.** 12 **C.** -4 **D.** 4

9. Using $C_3 \to C_3 - 8C_2$, the value of $\begin{vmatrix} -1 & 3 & 24 \\ 2 & 4 & 30 \\ 4 & -3 & -21 \end{vmatrix}$ is

A. -96 **B.** 48 **C.** -38 **D.** -48

10. Using $C_1 \to C_1 - 12C_3$, the value of $\begin{vmatrix} -40 & 6 & -3 \\ -21 & 6 & -2 \\ -33 & 0 & -3 \end{vmatrix}$ is

A. -144 **B.** 144 **C.** 288 **D.** 154

11. For $A = \begin{bmatrix} 0 & -2 & -3 \\ -4 & 5 & 1 \\ 8 & -5 & 2 \end{bmatrix}$ with cofactors A_{ij}, $a_{31}A_{31} + a_{32}A_{32} + a_{33}A_{33} =$

A. 28 **B.** -28 **C.** 56 **D.** 0

12. The roots of $\begin{vmatrix} x & 1 & 6 \\ 1 & x & 6 \\ 1 & 6 & x \end{vmatrix} = 0$ are

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

13. If A is a square matrix of order 3 and $|A| = 8$, then $|-3A| =$

A. 216 **B.** -216 **C.** -24 **D.** 72

14. If $|A| = 6$ for a matrix A of order 2, the determinant of the matrix of cofactors of A is

A. -6 **B.** 36 **C.** 216 **D.** 6

15. $\begin{vmatrix} 0 & 9 & -3 \\ -9 & 0 & -2 \\ 3 & 2 & 0 \end{vmatrix} =$

A. 94 **B.** 0 **C.** -18 **D.** 108

16. The determinant of $\begin{bmatrix} -5 & 12 & -1 \\ 0 & 6 & -8 \\ 0 & 0 & 5 \end{bmatrix}$ is

A. -150 **B.** 6 **C.** -138 **D.** 150

17. $\begin{vmatrix} 2 & 3 & -1 \\ 3 & 10 & -3 \\ -1 & -3 & 2 \end{vmatrix} =$

A. 4 **B.** 11 **C.** 12 **D.** 40

18. $\begin{vmatrix} 1 & -3 & -27 \\ 1 & 4 & 64 \\ 1 & 5 & 125 \end{vmatrix} =$

A. -392 **B.** 56 **C.** 336 **D.** -336

19. $\begin{vmatrix} a & n & m \\ n & b & x \\ m & x & c \end{vmatrix} =$

A. $abc + mnx - ax^2 - bm^2 - cn^2$ **B.** $abc + 2mnx + ax^2 + bm^2 + cn^2$

C. $abc - 2mnx - ax^2 - bm^2 - cn^2$ **D.** $abc + 2mnx - ax^2 - bm^2 - cn^2$

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20. Multiplying $\begin{vmatrix} -2 & -1 \\ 1 & 6 \end{vmatrix}$ and $\begin{vmatrix} 5 & 1 \\ -2 & 5 \end{vmatrix}$ row by row, the element in row 2, column 1 of the product is

A. -11 **B.** 11 **C.** -1 **D.** -7

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

A. $-5x^4 + 4xe^{2x} + 4e^{2x}$ **B.** $-2x^4 + 2e^{2x}$

C. $5x^4 - 4xe^{2x} - 4e^{2x}$ **D.** $-6x^3 + 4e^{2x}$

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

A. $2xe^{2x} + e^{2x} + e^x \sin x - e^x \cos x$ **B.** $2e^{2x} + e^x \sin x$

C. $2xe^{2x} - e^x \cos x$ **D.** $-2xe^{2x} - e^{2x} - e^x \sin x + e^x \cos x$

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23. $\int_0^{\frac{\pi}{2}} \begin{vmatrix} \sin x & -5 \\ \cos x & 6 \end{vmatrix} dx =$

A. -11 **B.** 12 **C.** 11 **D.** $\frac{11\pi}{2}$

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24. $\begin{bmatrix} p & -6 \\ 2 & -2 \end{bmatrix}$ is singular when $p =$

A. 6 **B.** 7 **C.** -6 **D.** 12

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25. $\begin{bmatrix} 2 & -6 \\ 7 & p \end{bmatrix}$ is singular when $p =$

A. 21 **B.** -20 **C.** -21 **D.** -42

Key sheet

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

Solutions

1. $\begin{vmatrix} 3 & 10 \\ -6 & 2 \end{vmatrix} =$

$3 \cdot 2 - 10 \cdot (-6) = 66$

Ans: (B) 66

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2. If $\begin{vmatrix} x & -5 \\ 3 & x \end{vmatrix} = 40$, then

$x^2 - (-15) = 40$

$x^2 = 25 \Rightarrow x = \pm 5$

Ans: (D) $x = \pm 5$

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3. The cofactor of the element -1 in $\begin{bmatrix} -4 & 1 & 0 \\ 6 & -5 & -1 \\ -4 & -6 & -5 \end{bmatrix}$ is

$M_{23} = \begin{vmatrix} -4 & 1 \\ -4 & -6 \end{vmatrix} = 28$

$A_{23} = (-1)^5(28) = -28$

Ans: (D) -28

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4. In $\begin{bmatrix} 0 & 9 & 1 \\ -3 & 8 & -2 \\ -6 & 2 & 6 \end{bmatrix}$, the minor M_{21} is

$M_{21} = \begin{vmatrix} 9 & 1 \\ 2 & 6 \end{vmatrix} = 54 - 2 = 52$

Ans: (A) 52

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5. $\begin{vmatrix} -1 & 3 & 1 \\ 0 & -1 & 1 \\ 6 & -3 & -1 \end{vmatrix} =$

$\Delta = -\begin{vmatrix} -1 & 1 \\ 6 & -1 \end{vmatrix} - \begin{vmatrix} -1 & 3 \\ 6 & -3 \end{vmatrix}$

$= -(1 - 6) - (3 - 18)$

$= -(-5) - (-15) = 20$

Ans: (B) 20

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

$\Delta = 5\begin{vmatrix} 3 & 6 \\ 5 & -2 \end{vmatrix} - 4\begin{vmatrix} 0 & 6 \\ -2 & -2 \end{vmatrix}$

$= 5(-6 - 30) - 4(0 - (-12))$

$= 5(-36) - 4(12) = -228$

Ans: (C) -228

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7. If $\begin{vmatrix} a & b & c \\ p & q & r \\ x & y & z \end{vmatrix} = 5$, then $\begin{vmatrix} a & p & x \\ b & q & y \\ c & r & z \end{vmatrix} =$

Rows and columns are interchanged: $|A^T| = |A|$.

$\therefore \text{value} = 1 \times 5 = 5$

Ans: (D) 5

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

Interchanging two rows changes the sign.

$\therefore \text{value} = (-1) \times 4 = -4$

Ans: (C) -4

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9. Using $C_3 \to C_3 - 8C_2$, the value of $\begin{vmatrix} -1 & 3 & 24 \\ 2 & 4 & 30 \\ 4 & -3 & -21 \end{vmatrix}$ is

$C_3 \to C_3 - 8C_2$ leaves the value unchanged and gives $\begin{vmatrix} -1 & 3 & 0 \\ 2 & 4 & -2 \\ 4 & -3 & 3 \end{vmatrix}$.

$\Delta = -48$

Ans: (D) -48

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10. Using $C_1 \to C_1 - 12C_3$, the value of $\begin{vmatrix} -40 & 6 & -3 \\ -21 & 6 & -2 \\ -33 & 0 & -3 \end{vmatrix}$ is

$C_1 \to C_1 - 12C_3$ leaves the value unchanged and gives $\begin{vmatrix} -4 & 6 & -3 \\ 3 & 6 & -2 \\ 3 & 0 & -3 \end{vmatrix}$.

$\Delta = 144$

Ans: (B) 144

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11. For $A = \begin{bmatrix} 0 & -2 & -3 \\ -4 & 5 & 1 \\ 8 & -5 & 2 \end{bmatrix}$ with cofactors A_{ij}, $a_{31}A_{31} + a_{32}A_{32} + a_{33}A_{33} =$

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

$a_{31}A_{31} + a_{32}A_{32} + a_{33}A_{33} = |A| = 28$

Ans: (A) 28

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12. The roots of $\begin{vmatrix} x & 1 & 6 \\ 1 & x & 6 \\ 1 & 6 & x \end{vmatrix} = 0$ are

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

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

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

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13. If A is a square matrix of order 3 and $|A| = 8$, then $|-3A| =$

$|-3A| = (-3)^3|A| = -216$

Ans: (B) -216

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14. If $|A| = 6$ for a matrix A of order 2, the determinant of the matrix of cofactors of A is

$|\text{cofactor matrix}| = |A|^{n-1} = 6^1 = 6$

Ans: (D) 6

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15. $\begin{vmatrix} 0 & 9 & -3 \\ -9 & 0 & -2 \\ 3 & 2 & 0 \end{vmatrix} =$

Skew-symmetric of odd order, so the determinant is 0.

Ans: (B) 0

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16. The determinant of $\begin{bmatrix} -5 & 12 & -1 \\ 0 & 6 & -8 \\ 0 & 0 & 5 \end{bmatrix}$ is

Triangular: product of the diagonal elements.

$(-5) \times 6 \times 5 = -150$

Ans: (A) -150

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17. $\begin{vmatrix} 2 & 3 & -1 \\ 3 & 10 & -3 \\ -1 & -3 & 2 \end{vmatrix} =$

Result 10 with $a, b, c = 1, 3, -1$:

$1 + a^2 + b^2 + c^2 = 1 + 1 + 9 + 1 = 12$

Ans: (C) 12

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18. $\begin{vmatrix} 1 & -3 & -27 \\ 1 & 4 & 64 \\ 1 & 5 & 125 \end{vmatrix} =$

Use result 4, $(a+b+c)(a-b)(b-c)(c-a)$ with $a, b, c = -3, 4, 5$.

$(6)(-3-4)(4-5)(5-(-3)) = 336$

Ans: (C) 336

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19. $\begin{vmatrix} a & n & m \\ n & b & x \\ m & x & c \end{vmatrix} =$

Result 2 with $h = n$, $g = m$, $f = x$: $abc + 2fgh - af^2 - bg^2 - ch^2$.

Ans: (D) $abc + 2mnx - ax^2 - bm^2 - cn^2$

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20. Multiplying $\begin{vmatrix} -2 & -1 \\ 1 & 6 \end{vmatrix}$ and $\begin{vmatrix} 5 & 1 \\ -2 & 5 \end{vmatrix}$ 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:

$1 \cdot 5 + 6 \cdot 1 = 11$

Ans: (B) 11

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

$\Delta'(x) = \begin{vmatrix} 2 & 2x \\ x^3 & e^{2x} \end{vmatrix} + \begin{vmatrix} 2x+1 & x^2 \\ 3x^2 & 2e^{2x} \end{vmatrix}$

$= -5x^4 + 4xe^{2x} + 4e^{2x}$

Ans: (A) $-5x^4 + 4xe^{2x} + 4e^{2x}$

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

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

$= 2xe^{2x} + e^{2x} + e^x \sin x - e^x \cos x$

Ans: (A) $2xe^{2x} + e^{2x} + e^x \sin x - e^x \cos x$

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23. $\int_0^{\frac{\pi}{2}} \begin{vmatrix} \sin x & -5 \\ \cos x & 6 \end{vmatrix} dx =$

Only one column contains x, so integrate that column:

$\begin{vmatrix} \int_0^{\frac{\pi}{2}} \sin x\, dx & -5 \\ \int_0^{\frac{\pi}{2}} \cos x\, dx & 6 \end{vmatrix} = \begin{vmatrix} 1 & -5 \\ 1 & 6 \end{vmatrix}$

$= 11$

Ans: (C) 11

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24. $\begin{bmatrix} p & -6 \\ 2 & -2 \end{bmatrix}$ is singular when $p =$

$12 - 2p = 0$

$p = 6$

Ans: (A) 6

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25. $\begin{bmatrix} 2 & -6 \\ 7 & p \end{bmatrix}$ is singular when $p =$

$2p + 42 = 0$

$p = -21$

Ans: (C) -21
