EXPRESSWALA ACADEMY

Maths 1A: Determinants

MCQ Test, Set 05

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. $\begin{vmatrix} -1 & 7 \\ 8 & -4 \end{vmatrix} =$

A. -52 **B.** 60 **C.** 20 **D.** 52

2. If $\begin{vmatrix} x & -2 \\ 1 & x \end{vmatrix} = 11$, then

A. $x = \pm 4$ **B.** $x = 3$ only **C.** $x = \pm\sqrt{13}$ **D.** $x = \pm 3$

3. The cofactor of the element -3 in $\begin{bmatrix} 0 & 5 & 2 \\ -3 & -5 & -5 \\ -2 & 2 & 6 \end{bmatrix}$ is

A. 26 **B.** 34 **C.** -34 **D.** -26

4. In $\begin{bmatrix} 8 & 1 & -5 \\ 0 & 5 & -6 \\ 8 & 4 & -5 \end{bmatrix}$, the minor M_{23} is

A. -48 **B.** 24 **C.** 40 **D.** -24

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

A. -81 **B.** 81 **C.** 0 **D.** 9

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

A. 27 **B.** 33 **C.** 18 **D.** -27

7. If $\begin{vmatrix} a & b & c \\ p & q & r \\ x & y & z \end{vmatrix} = -3$, then $\begin{vmatrix} a & -2b & c \\ p & -2q & r \\ x & -2y & z \end{vmatrix} =$

A. -6 **B.** 6 **C.** -3 **D.** -9

8. If $\begin{vmatrix} a & b & c \\ p & q & r \\ x & y & z \end{vmatrix} = 12$, then $\begin{vmatrix} p & q & r \\ x & y & z \\ a & b & c \end{vmatrix} =$

A. 12 **B.** 24 **C.** 36 **D.** -12

9. Using $C_1 \to C_1 - 6C_2$, the value of $\begin{vmatrix} -14 & -2 & 2 \\ 12 & 1 & 0 \\ 40 & 7 & -1 \end{vmatrix}$ is

A. 88 **B.** -78 **C.** 78 **D.** 156

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10. $\begin{vmatrix} a & b & a+b \\ b & c & b+c \\ x & y & x+y \end{vmatrix} =$

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

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11. For $A = \begin{bmatrix} -3 & 0 & 4 \\ -1 & 7 & 2 \\ -1 & -4 & 4 \end{bmatrix}$ with cofactors A_{ij}, $a_{11}A_{21} + a_{12}A_{22} + a_{13}A_{23} =$

A. 0 **B.** -64 **C.** 64 **D.** -128

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12. The roots of $\begin{vmatrix} x & 4 & 6 \\ 4 & x & 6 \\ 4 & 6 & x \end{vmatrix} = 0$ are

A. $4,\ 6,\ 10$ **B.** $4,\ 6$ **C.** $4,\ 6,\ -10$ **D.** $-4,\ -6,\ 10$

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

A. -6 **B.** 24 **C.** -24 **D.** 12

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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

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

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15. The determinant of $\begin{bmatrix} 2 & -6 & -8 \\ 0 & 6 & -3 \\ 0 & 0 & -5 \end{bmatrix}$ is

A. 60 **B.** -60 **C.** -66 **D.** 3

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16. The determinant of an orthogonal matrix is

A. 1 or -1 **B.** any real number

C. always 1 **D.** 0

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17. $\begin{vmatrix} 1 & 1 & 1 \\ 1 & 4 & 8 \\ 1 & 25 & 125 \end{vmatrix} =$

A. 12 **B.** 204 **C.** -204 **D.** 96

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18. $\begin{vmatrix} 1 & 7 & 49 \\ 1 & 4 & 16 \\ 1 & -2 & 4 \end{vmatrix} =$

A. 90 **B.** -1458 **C.** -162 **D.** 162

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19. $\begin{vmatrix} 1 & x & x^3 \\ 1 & y & y^3 \\ 1 & z & z^3 \end{vmatrix} =$

A. $(x-y)(y-z)(z-x)$ **B.** $(xy+yz+zx)(x-y)(y-z)(z-x)$

C. $(x+y+z)(x-y)(y-z)(z-x)$ **D.** $xyz(x-y)(y-z)(z-x)$

20. Multiplying $\begin{vmatrix} 2 & 5 \\ 6 & 4 \end{vmatrix}$ and $\begin{vmatrix} -3 & 3 \\ 6 & -3 \end{vmatrix}$ row by row, the element in row 1, column 1 of the product is

A. 9 **B.** -9 **C.** 24 **D.** 10

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

A. $3x^2\cos x + 2x\sin x$ **B.** $x^3\cos x + 4x^2\sin x - 2x\cos x + \sin x$

C. $3x^2\sin x - 2x\cos x$ **D.** $-x^3\cos x - 4x^2\sin x + 2x\cos x - \sin x$

22. If $\Delta(x) = \begin{vmatrix} x^2+1 & x^3 \\ 4 & -2 \end{vmatrix}$, then $\Delta'(x) =$

A. 0 **B.** $-24x^2 - 8x$ **C.** $12x^2 + 4x$ **D.** $-12x^2 - 4x$

23. $\int_0^1 \begin{vmatrix} 4x^3 & e^x \\ -5 & 6 \end{vmatrix} dx =$

A. $-5e - 1$ **B.** $2 + 10e$ **C.** $1 + 5e$ **D.** $2 + 5e$

24. $\begin{bmatrix} -1 & -2 \\ 6 & p \end{bmatrix}$ is singular when $p =$

A. 24 **B.** 13 **C.** -12 **D.** 12

25. If A and B are non-zero square matrices and $AB = O$, then

A. only A is singular **B.** both are non-singular

C. $A = O$ or $B = O$ **D.** both A and B are singular

Key sheet

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

Solutions

1. $\begin{vmatrix} -1 & 7 \\ 8 & -4 \end{vmatrix} =$

$(-1)\cdot(-4) - 7\cdot 8 = -52$

Ans: (A) -52

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2. If $\begin{vmatrix} x & -2 \\ 1 & x \end{vmatrix} = 11$, then

$x^2 - (-2) = 11$

$x^2 = 9 \Rightarrow x = \pm 3$

Ans: (D) $x = \pm 3$

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3. The cofactor of the element -3 in $\begin{bmatrix} 0 & 5 & 2 \\ -3 & -5 & -5 \\ -2 & 2 & 6 \end{bmatrix}$ is

$M_{21} = \begin{vmatrix} 5 & 2 \\ 2 & 6 \end{vmatrix} = 26$

$A_{21} = (-1)^3(26) = -26$

Ans: (D) -26

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4. In $\begin{bmatrix} 8 & 1 & -5 \\ 0 & 5 & -6 \\ 8 & 4 & -5 \end{bmatrix}$, the minor M_{23} is

$M_{23} = \begin{vmatrix} 8 & 1 \\ 8 & 4 \end{vmatrix} = 32 - 8 = 24$

Ans: (B) 24

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

$\Delta = -4\begin{vmatrix} -3 & -3 \\ -3 & 3 \end{vmatrix} + 3\begin{vmatrix} -1 & -3 \\ 0 & -3 \end{vmatrix}$

$= -4(-9-9) + 3(3-0)$

$= -4(-18) + 3(3) = 81$

Ans: (B) 81

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

$\Delta = -5\begin{vmatrix} 1 & -1 \\ 5 & -2 \end{vmatrix} + 3\begin{vmatrix} 1 & 2 \\ 5 & 6 \end{vmatrix}$

$= -5(-2-(-5)) + 3(6-10)$

$= -5(3) + 3(-4) = -27$

Ans: (D) -27

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7. If $\begin{vmatrix} a & b & c \\ p & q & r \\ x & y & z \end{vmatrix} = -3$, then $\begin{vmatrix} a & -2b & c \\ p & -2q & r \\ x & -2y & z \end{vmatrix} =$

One column is multiplied by -2, so the value is multiplied by -2.

$\therefore \text{value} = (-2) \times (-3) = 6$

Ans: (B) 6

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8. If $\begin{vmatrix} a & b & c \\ p & q & r \\ x & y & z \end{vmatrix} = 12$, 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.

$\therefore \text{value} = 1 \times 12 = 12$

Ans: (A) 12

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9. Using $C_1 \to C_1 - 6C_2$, the value of $\begin{vmatrix} -14 & -2 & 2 \\ 12 & 1 & 0 \\ 40 & 7 & -1 \end{vmatrix}$ is

$C_1 \to C_1 - 6C_2$ leaves the value unchanged and gives $\begin{vmatrix} -2 & -2 & 2 \\ 6 & 1 & 0 \\ -2 & 7 & -1 \end{vmatrix}$.

$\Delta = 78$

Ans: (C) 78

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10. $\begin{vmatrix} a & b & a+b \\ b & c & b+c \\ x & y & x+y \end{vmatrix} =$

$C_3 \to C_3 - C_1 - C_2$ makes the third column zero.

$\therefore \Delta = 0$

Ans: (B) 0

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11. For $A = \begin{bmatrix} -3 & 0 & 4 \\ -1 & 7 & 2 \\ -1 & -4 & 4 \end{bmatrix}$ with cofactors A_{ij}, $a_{11}A_{21} + a_{12}A_{22} + a_{13}A_{23} =$

Elements of one line times the cofactors of a different line give 0.

$a_{11}A_{21} + a_{12}A_{22} + a_{13}A_{23} = 0$

Ans: (A) 0

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12. The roots of $\begin{vmatrix} x & 4 & 6 \\ 4 & x & 6 \\ 4 & 6 & x \end{vmatrix} = 0$ are

$C_1 \to C_1 + C_2 + C_3$ gives the factor $x + 10$; then $R_2 - R_1$, $R_3 - R_1$ leave $(x-4)(x-6)$.

$x = 4,\ 6,\ -10$

Ans: (C) $4,\ 6,\ -10$

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

$|-2A| = (-2)^3|A| = -24$

Ans: (C) -24

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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: (A) -6

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15. The determinant of $\begin{bmatrix} 2 & -6 & -8 \\ 0 & 6 & -3 \\ 0 & 0 & -5 \end{bmatrix}$ is

Triangular: product of the diagonal elements.

$2 \times 6 \times (-5) = -60$

Ans: (B) -60

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16. The determinant of an orthogonal matrix is

$AA^T = I \Rightarrow |A|^2 = 1$, so $|A| = \pm 1$.

Ans: (A) 1 **or** -1

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17. $\begin{vmatrix} 1 & 1 & 1 \\ 1 & 4 & 8 \\ 1 & 25 & 125 \end{vmatrix} =$

Result 5 with $a, b, c = 1, 2, 5$:

$(ab + bc + ca)(a - b)(b - c)(c - a) = (17)(12) = 204$

Ans: (B) 204

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18. $\begin{vmatrix} 1 & 7 & 49 \\ 1 & 4 & 16 \\ 1 & -2 & 4 \end{vmatrix} =$

Use result 3, $(a - b)(b - c)(c - a)$ with $a, b, c = 7, 4, -2$.

$(7 - 4)(4 - (-2))(-2 - 7) = -162$

Ans: (C) -162

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19. $\begin{vmatrix} 1 & x & x^3 \\ 1 & y & y^3 \\ 1 & z & z^3 \end{vmatrix} =$

Result 4 with $a, b, c = x, y, z$.

Ans: (C) $(x + y + z)(x - y)(y - z)(z - x)$

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20. Multiplying $\begin{vmatrix} 2 & 5 \\ 6 & 4 \end{vmatrix}$ and $\begin{vmatrix} -3 & 3 \\ 6 & -3 \end{vmatrix}$ row by row, the element in row 1, column 1 of the product is

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

$2 \cdot (-3) + 5 \cdot 3 = 9$

Ans: (A) 9

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

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

$= x^3\cos x + 4x^2\sin x - 2x\cos x + \sin x$

Ans: (B) $x^3\cos x + 4x^2\sin x - 2x\cos x + \sin x$

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22. If $\Delta(x) = \begin{vmatrix} x^2+1 & x^3 \\ 4 & -2 \end{vmatrix}$, then $\Delta'(x) =$

$\Delta'(x) = \begin{vmatrix} 2x & 3x^2 \\ 4 & -2 \end{vmatrix} + \begin{vmatrix} x^2+1 & x^3 \\ 0 & 0 \end{vmatrix}$

$= -12x^2 - 4x$

Ans: (D) $-12x^2 - 4x$

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23. $\int_0^1 \begin{vmatrix} 4x^3 & e^x \\ -5 & 6 \end{vmatrix} dx =$

Only one row contains x, so integrate that row:

$\begin{vmatrix} \int_0^1 4x^3\,dx & \int_0^1 e^x\,dx \\ -5 & 6 \end{vmatrix} = \begin{vmatrix} 1 & -1+e \\ -5 & 6 \end{vmatrix}$

$= 1 + 5e$

Ans: (C) $1 + 5e$

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24. $\begin{bmatrix} -1 & -2 \\ 6 & p \end{bmatrix}$ is singular when $p =$

$12 - p = 0$

$p = 12$

Ans: (D) 12

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25. If A and B are non-zero square matrices and $AB = O$, then

If one of them were non-singular, multiplying by its inverse would make the other O.

So both are singular.

Ans: (D) both A and B are singular
