EXPRESSWALA ACADEMY

Maths 1A: Determinants

MCQ Test, Set 10

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. The value of $\begin{vmatrix} -3 & -1 \\ 7 & -1 \end{vmatrix}$ is

A. -22 **B.** -10 **C.** 10 **D.** -4

2. If $\begin{vmatrix} x & -2 \\ 5 & x \end{vmatrix} = 35$, then

A. $x = 5$ only **B.** $x = \pm 3\sqrt{5}$ **C.** $x = \pm 6$ **D.** $x = \pm 5$

3. The cofactor of the element 7 in $\begin{bmatrix} 5 & 7 & -3 \\ -6 & -4 & 0 \\ 5 & 4 & 5 \end{bmatrix}$ is

A. -30 **B.** 30 **C.** 31 **D.** 28

4. In $\begin{bmatrix} -5 & -5 & -5 \\ 6 & 6 & 0 \\ -6 & 5 & -3 \end{bmatrix}$, the minor M_{32} is

A. -55 **B.** 30 **C.** 33 **D.** -30

5. $\begin{vmatrix} 6 & 1 & -1 \\ 1 & -4 & 5 \\ 0 & 6 & -2 \end{vmatrix} =$

A. -140 **B.** 136 **C.** 48 **D.** -136

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

A. 128 **B.** -90 **C.** -88 **D.** -128

7. If $\begin{vmatrix} a & b & c \\ p & q & r \\ x & y & z \end{vmatrix} = 4$, then $\begin{vmatrix} a & b & c \\ x & y & z \\ -3p & -3q & -3r \end{vmatrix} =$

A. 12 **B.** -12 **C.** 24 **D.** 4

8. If $\begin{vmatrix} a & b & c \\ p & q & r \\ x & y & z \end{vmatrix} = 9$, then $\begin{vmatrix} -2a & -2b & -2c \\ -2p & -2q & -2r \\ -2x & -2y & -2z \end{vmatrix} =$

A. 72 **B.** -72 **C.** 9 **D.** 27

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

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

10. Using $C_1 \to C_1 - 9C_3$, the value of $\begin{vmatrix} 65 & -2 & 7 \\ 54 & 7 & 6 \\ 24 & -2 & 2 \end{vmatrix}$ is

A. 314 **B.** -304 **C.** -314 **D.** -628

11. For $A = \begin{bmatrix} -1 & 2 & 1 \\ -4 & 6 & 3 \\ 0 & -2 & 1 \end{bmatrix}$ with cofactors A_{ij}, $a_{31}A_{11} + a_{32}A_{12} + a_{33}A_{13} =$

A. 0 **B.** 8 **C.** -4 **D.** 4

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

A. $4,\ 8$ **B.** $4,\ -12$ **C.** $-4,\ 8$ **D.** $4,\ -8$

13. A, B are of order 2 with $|A| = -6$, $|B| = -4$. Then $|2AB| =$

A. 96 **B.** 48 **C.** 24 **D.** -96

14. If A is of order 2 and $|A| = 4$, then $|-A^T| =$

A. 4 **B.** -4 **C.** -8 **D.** 16

15. The determinant of the unit matrix of order 4 is

A. 4 **B.** 1 **C.** 0 **D.** 16

16. The determinant of $\begin{bmatrix} -4 & 0 & 0 \\ 7 & 3 & 0 \\ 1 & 0 & 4 \end{bmatrix}$ is

A. -48 **B.** 48 **C.** 3 **D.** -43

17. $\begin{vmatrix} 1 & 9 & -27 \\ 1 & 25 & 125 \\ 1 & 4 & -8 \end{vmatrix} =$

A. 1064 **B.** 0 **C.** -1064 **D.** -56

18. $\begin{vmatrix} 6 & 8 & 7 \\ 8 & 7 & 6 \\ 7 & 6 & 8 \end{vmatrix} =$

A. 63 **B.** -63 **C.** -1071 **D.** 2079

19. $\begin{vmatrix} 1 & x & x^4 \\ 1 & y & y^4 \\ 1 & z & z^4 \end{vmatrix} =$

A. $(x-y)(y-z)(z-x)(x^2+y^2+z^2+xy+yz+zx)$

B. $(x-y)(y-z)(z-x)(x^2+y^2+z^2)$

C. $(x-y)(y-z)(z-x)(x+y+z)^2$

D. $(x-y)(y-z)(z-x)(xy+yz+zx)$

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20. $\begin{vmatrix} -4 & -3 \\ 2 & 6 \end{vmatrix} \times \begin{vmatrix} 1 & -3 \\ 5 & 2 \end{vmatrix} =$

A. -1 **B.** 306 **C.** -306 **D.** 18

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

A. $x^3\cos x - 2x^2e^{2x} + 3x^2\sin x - 2xe^{2x}$

B. $-x^3\cos x + 2x^2e^{2x} - 3x^2\sin x + 2xe^{2x}$

C. $-3x^2\cos x + 4xe^{2x}$

D. $2x^2e^{2x} - 3x^2\sin x$

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

A. $-3x^2e^x + 4xe^{2x}$

B. $-x^3e^x + 2xe^{2x}$

C. $-x^3e^x + 2x^2e^{2x} - 3x^2e^x + 2xe^{2x}$

D. $x^3e^x - 2x^2e^{2x} + 3x^2e^x - 2xe^{2x}$

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23. $\int_0^{\frac{\pi}{2}} \begin{vmatrix} \cos x & \sin x \\ -3 & -2 \end{vmatrix} dx =$

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

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24. $\begin{bmatrix} 3 & 18 \\ -4 & p \end{bmatrix}$ is singular when $p =$

A. -48 **B.** -23 **C.** 24 **D.** -24

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

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

Key sheet

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

Solutions

1. The value of $\begin{vmatrix} -3 & -1 \\ 7 & -1 \end{vmatrix}$ is

$(-3)\cdot(-1) - (-1)\cdot 7 = 10$

Ans: (C) 10

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2. If $\begin{vmatrix} x & -2 \\ 5 & x \end{vmatrix} = 35$, then

$x^2 - (-10) = 35$

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

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

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3. The cofactor of the element 7 in $\begin{bmatrix} 5 & 7 & -3 \\ -6 & -4 & 0 \\ 5 & 4 & 5 \end{bmatrix}$ is

$M_{12} = \begin{vmatrix} -6 & 0 \\ 5 & 5 \end{vmatrix} = -30$

$A_{12} = (-1)^3(-30) = 30$

Ans: (B) 30

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4. In $\begin{bmatrix} -5 & -5 & -5 \\ 6 & 6 & 0 \\ -6 & 5 & -3 \end{bmatrix}$, the minor M_{32} is

$M_{32} = \begin{vmatrix} -5 & -5 \\ 6 & 0 \end{vmatrix} = 0 - (-30) = 30$

Ans: (B) 30

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5. $\begin{vmatrix} 6 & 1 & -1 \\ 1 & -4 & 5 \\ 0 & 6 & -2 \end{vmatrix} =$

$\Delta = -6\begin{vmatrix} 6 & -1 \\ 1 & 5 \end{vmatrix} - 2\begin{vmatrix} 6 & 1 \\ 1 & -4 \end{vmatrix}$

$= -6(30 - (-1)) - 2(-24 - 1)$

$= -6(31) - 2(-25) = -136$

Ans: (D) -136

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

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

$= 2(-10 - (-18)) - 3(30 - (-18))$

$= 2(8) - 3(48) = -128$

Ans: (D) -128

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7. If $\begin{vmatrix} a & b & c \\ p & q & r \\ x & y & z \end{vmatrix} = 4$, then $\begin{vmatrix} a & b & c \\ x & y & z \\ -3p & -3q & -3r \end{vmatrix} =$

Two rows are interchanged (sign changes) and one row is multiplied by -3.

$\therefore$ value $= 3 \times 4 = 12$

Ans: (A) 12

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8. If $\begin{vmatrix} a & b & c \\ p & q & r \\ x & y & z \end{vmatrix} = 9$, then $\begin{vmatrix} -2a & -2b & -2c \\ -2p & -2q & -2r \\ -2x & -2y & -2z \end{vmatrix} =$

Every element is multiplied by -2: each of the 3 rows gives a factor -2.

$\therefore$ value $= (-8) \times 9 = -72$

Ans: (B) -72

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

$C_3 = C_1 + C_2$, so $C_3 \to C_3 - C_1 - C_2$ gives a zero column.

$\therefore \Delta = 0$

Ans: (D) 0

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10. Using $C_1 \to C_1 - 9C_3$, the value of $\begin{vmatrix} 65 & -2 & 7 \\ 54 & 7 & 6 \\ 24 & -2 & 2 \end{vmatrix}$ is

$C_1 \to C_1 - 9C_3$ leaves the value unchanged and gives $\begin{vmatrix} 2 & -2 & 7 \\ 0 & 7 & 6 \\ 6 & -2 & 2 \end{vmatrix}$.

$\Delta = -314$

Ans: (C) -314

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11. For $A = \begin{bmatrix} -1 & 2 & 1 \\ -4 & 6 & 3 \\ 0 & -2 & 1 \end{bmatrix}$ with cofactors A_{ij}, $a_{31}A_{11} + a_{32}A_{12} + a_{33}A_{13} =$

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

$a_{31}A_{11} + a_{32}A_{12} + a_{33}A_{13} = 0$

Ans: (A) 0

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

$\Delta = (x+8)(x-4)^2$

$x = 4$ (twice) or $x = -8$

Ans: (D) $4,\ -8$

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13. A, B are of order 2 with $|A| = -6$, $|B| = -4$. Then $|2AB| =$

$|2AB| = 2^2|A|\,|B| = 96$

Ans: (A) 96

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14. If A is of order 2 and $|A| = 4$, then $|-A^T| =$

$|-A^T| = (-1)^2|A^T| = (-1)^2|A| = 4$

Ans: (A) 4

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15. The determinant of the unit matrix of order 4 is

I is triangular with diagonal elements 1: $1 \times 1 \times 1 \times 1 = 1$.

Ans: (B) 1

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16. The determinant of $\begin{bmatrix} -4 & 0 & 0 \\ 7 & 3 & 0 \\ 1 & 0 & 4 \end{bmatrix}$ is

Triangular: product of the diagonal elements.

$(-4) \times 3 \times 4 = -48$

Ans: (A) -48

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17. $\begin{vmatrix} 1 & 9 & -27 \\ 1 & 25 & 125 \\ 1 & 4 & -8 \end{vmatrix} =$

Result 5 with $a, b, c = -3, 5, -2$:

$(ab + bc + ca)(a - b)(b - c)(c - a) = (-19)(-56) = 1064$

Ans: (A) 1064

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18. $\begin{vmatrix} 6 & 8 & 7 \\ 8 & 7 & 6 \\ 7 & 6 & 8 \end{vmatrix} =$

Use result 1, $-(a^3 + b^3 + c^3 - 3abc)$ with $a, b, c = 6, 8, 7$.

$-(216 + 512 + 343 - 1008) = -63$

Ans: (B) -63

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19. $\begin{vmatrix} 1 & x & x^4 \\ 1 & y & y^4 \\ 1 & z & z^4 \end{vmatrix} =$

Result 6 with $a, b, c = x, y, z$.

Ans: (A) $(x - y)(y - z)(z - x)(x^2 + y^2 + z^2 + xy + yz + zx)$

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20. $\begin{vmatrix} -4 & -3 \\ 2 & 6 \end{vmatrix} \times \begin{vmatrix} 1 & -3 \\ 5 & 2 \end{vmatrix} =$

$(-18) \times 17 = -306$

This equals the determinant of the row by row product.

Ans: (C) -306

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

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

$= -x^3 \cos x + 2x^2 e^{2x} - 3x^2 \sin x + 2xe^{2x}$

Ans: (B) $-x^3 \cos x + 2x^2 e^{2x} - 3x^2 \sin x + 2xe^{2x}$

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

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

$= -x^3 e^x + 2x^2 e^{2x} - 3x^2 e^x + 2xe^{2x}$

Ans: (C) $-x^3 e^x + 2x^2 e^{2x} - 3x^2 e^x + 2xe^{2x}$

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23. $\int_0^{\frac{\pi}{2}} \begin{vmatrix} \cos x & \sin x \\ -3 & -2 \end{vmatrix} dx =$

Only one row contains x, so integrate that row:

$\begin{vmatrix} \int_0^{\frac{\pi}{2}} \cos x\, dx & \int_0^{\frac{\pi}{2}} \sin x\, dx \\ -3 & -2 \end{vmatrix} = \begin{vmatrix} 1 & 1 \\ -3 & -2 \end{vmatrix}$

$= 1$

Ans: (C) 1

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24. $\begin{bmatrix} 3 & 18 \\ -4 & p \end{bmatrix}$ is singular when $p =$

$3p + 72 = 0$

$p = -24$

Ans: (D) -24

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

$36 - 6p = 0$

$p = 6$

Ans: (C) 6
