EXPRESSWALA ACADEMY

Maths 1A: Determinants

MCQ Test, Set 04

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 $\begin{vmatrix} 2 & 6 \\ -9 & 6 \end{vmatrix}$ is

A. -66 **B.** -42 **C.** -54 **D.** 66

2. If $\begin{vmatrix} x & 2 \\ -6 & x \end{vmatrix} = 28$, then

A. $x = \pm 5$ **B.** $x = 4$ only **C.** $x = \pm 4$ **D.** $x = \pm 2\sqrt{10}$

3. The cofactor of the element -4 in $\begin{bmatrix} 0 & -5 & -3 \\ -4 & -5 & 7 \\ 1 & 4 & 8 \end{bmatrix}$ is

A. -52 **B.** 28 **C.** -28 **D.** 52

4. In $\begin{bmatrix} 5 & 4 & -5 \\ -2 & -1 & 0 \\ -5 & 1 & -3 \end{bmatrix}$, the minor M_{12} is

A. 6 **B.** -7 **C.** -6 **D.** 9

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

A. 10 **B.** -12 **C.** -10 **D.** -4

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

A. -10 **B.** 0 **C.** 16 **D.** 10

7. If $\begin{vmatrix} a & b & c \\ p & q & r \\ x & y & z \end{vmatrix} = 11$, then $\begin{vmatrix} a & b & c \\ p & q & r \\ -2x & -2y & -2z \end{vmatrix} =$

A. -22 **B.** 11 **C.** 22 **D.** 33

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

A. -9 **B.** 27 **C.** -18 **D.** 9

9. Using $C_3 \to C_3 - 11C_2$, the value of $\begin{vmatrix} -3 & 1 & 8 \\ 0 & -4 & -39 \\ 3 & -4 & -45 \end{vmatrix}$ is

A. -83 **B.** -93 **C.** 93 **D.** -186

10. $\begin{vmatrix} x & 2x & 3 \\ y & 2y & 5 \\ z & 2z & 7 \end{vmatrix} =$

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

11. For $A = \begin{bmatrix} 0 & 3 & 7 \\ 8 & 1 & -3 \\ -1 & 4 & 8 \end{bmatrix}$ with cofactors A_{ij}, $a_{31}A_{21} + a_{32}A_{22} + a_{33}A_{23} =$

A. -48 **B.** 0 **C.** 96 **D.** 48

12. The roots of $\begin{vmatrix} x & 2 & 2 \\ 2 & x & 2 \\ 2 & 2 & x \end{vmatrix} = 0$ are

A. $2,\ -6$ **B.** $-2,\ 4$ **C.** $2,\ 4$ **D.** $2,\ -4$

13. A, B are of order 3 with $|A| = 4$, $|B| = -3$. Then $|2AB| =$

A. -12 **B.** -96 **C.** 96 **D.** -24

14. If A is of order 3 and $|A| = 2$, then $|-A^T| =$

A. 4 **B.** -2 **C.** 6 **D.** 2

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

A. -18 **B.** 216 **C.** 0 **D.** 81

16. The determinant of a skew-symmetric matrix of order 5 is

A. 1

B. -1

C. the product of its diagonal elements squared

D. 0

17. $\begin{vmatrix} 100 & 121 & 144 \\ 169 & 196 & 225 \\ 256 & 289 & 324 \end{vmatrix} =$

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

18. $\begin{vmatrix} 7 & 1 & 3 \\ 1 & 3 & 7 \\ 3 & 7 & 1 \end{vmatrix} =$

A. -308 **B.** 434 **C.** 308 **D.** -371

19. $\begin{vmatrix} 1 & p & qr \\ 1 & q & pr \\ 1 & r & pq \end{vmatrix} =$

A. pqr

B. $(p+q+r)(p-q)(q-r)(r-p)$

C. $-(p-q)(q-r)(r-p)$

D. $(p-q)(q-r)(r-p)$

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

A. 7

B. 1040

C. 14

D. -1040

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

A. $-9x^2 + 4x - e^{2x}\sin x + 2e^{2x}\cos x$

B. $-6x^2 + 4x + 2e^{2x}\cos x$

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

D. $-6x - 2e^{2x}\sin x$

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

A. $-x^2e^x - x^2\sin x - e^x$

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

C. $-2xe^x - 2x\sin x$

D. $x^2e^x + x^2\sin x + 2xe^x - 2x\cos x + e^x$

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23. $\int_0^1 \begin{vmatrix} 4x^3 & 2x+1 \\ -5 & -3 \end{vmatrix} dx =$

A. -7

B. 8

C. 7

D. 14

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24. $\begin{bmatrix} p & -6 \\ -16 & -4 \end{bmatrix}$ is singular when $p =$

A. -24

B. -23

C. -48

D. 24

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25. Every orthogonal matrix is

A. skew-symmetric

B. nilpotent

C. non-singular

D. singular

Key sheet

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

Solutions

1. The value of $\begin{vmatrix} 2 & 6 \\ -9 & 6 \end{vmatrix}$ is

$2 \cdot 6 - 6 \cdot (-9) = 66$

Ans: (D) 66

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2. If $\begin{vmatrix} x & 2 \\ -6 & x \end{vmatrix} = 28$, then

$x^2 - (-12) = 28$

$x^2 = 16 \Rightarrow x = \pm 4$

Ans: (C) $x = \pm 4$

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3. The cofactor of the element -4 in $\begin{bmatrix} 0 & -5 & -3 \\ -4 & -5 & 7 \\ 1 & 4 & 8 \end{bmatrix}$ is

$M_{21} = \begin{vmatrix} -5 & -3 \\ 4 & 8 \end{vmatrix} = -28$

$A_{21} = (-1)^3(-28) = 28$

Ans: (B) 28

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4. In $\begin{bmatrix} 5 & 4 & -5 \\ -2 & -1 & 0 \\ -5 & 1 & -3 \end{bmatrix}$, the minor M_{12} is

$M_{12} = \begin{vmatrix} -2 & 0 \\ -5 & -3 \end{vmatrix} = 6 - 0 = 6$

Ans: (A) 6

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

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

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

$= 2(-5) = -10$

Ans: (C) -10

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

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

$= 2(-10 - (-15))$

$= 2(5) = 10$

Ans: (D) 10

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7. If $\begin{vmatrix} a & b & c \\ p & q & r \\ x & y & z \end{vmatrix} = 11$, then $\begin{vmatrix} a & b & c \\ p & q & r \\ -2x & -2y & -2z \end{vmatrix} =$

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

$\therefore \text{value} = (-2) \times 11 = -22$

Ans: (A) -22

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

Interchanging two columns changes the sign.

$\therefore \text{value} = (-1) \times 9 = -9$

Ans: (A) -9

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9. Using $C_3 \to C_3 - 11C_2$, the value of $\begin{vmatrix} -3 & 1 & 8 \\ 0 & -4 & -39 \\ 3 & -4 & -45 \end{vmatrix}$ is

$C_3 \to C_3 - 11C_2$ leaves the value unchanged and gives $\begin{vmatrix} -3 & 1 & -3 \\ 0 & -4 & 5 \\ 3 & -4 & -1 \end{vmatrix}$.

$\Delta = -93$

Ans: (B) -93

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10. $\begin{vmatrix} x & 2x & 3 \\ y & 2y & 5 \\ z & 2z & 7 \end{vmatrix} =$

$C_2 = 2C_1$: two columns are proportional.

$\therefore \Delta = 0$

Ans: (C) 0

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11. For $A = \begin{bmatrix} 0 & 3 & 7 \\ 8 & 1 & -3 \\ -1 & 4 & 8 \end{bmatrix}$ with cofactors A_{ij}, $a_{31}A_{21} + a_{32}A_{22} + a_{33}A_{23} =$

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

$a_{31}A_{21} + a_{32}A_{22} + a_{33}A_{23} = 0$

Ans: (B) 0

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12. The roots of $\begin{vmatrix} x & 2 & 2 \\ 2 & x & 2 \\ 2 & 2 & x \end{vmatrix} = 0$ are

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

$x = 2 \text{ (twice)}$ or $x = -4$

Ans: (D) $2,\ -4$

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13. A, B are of order 3 with $|A| = 4$, $|B| = -3$. Then $|2AB| =$

$|2AB| = 2^3 |A|\,|B| = -96$

Ans: (B) -96

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14. If A is of order 3 and $|A| = 2$, then $|-A^T| =$

$|-A^T| = (-1)^3|A^T| = (-1)^3|A| = -2$

Ans: (B) -2

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

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

Ans: (C) 0

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16. The determinant of a skew-symmetric matrix of order 5 is

A skew-symmetric matrix of odd order has determinant 0.

Ans: (D) 0

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17. $\begin{vmatrix} 100 & 121 & 144 \\ 169 & 196 & 225 \\ 256 & 289 & 324 \end{vmatrix} =$

The entries are squares of consecutive numbers, three to a row; this is result 12 with $n = 10$.

$\Delta = -216$

Ans: (B) -216

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18. $\begin{vmatrix} 7 & 1 & 3 \\ 1 & 3 & 7 \\ 3 & 7 & 1 \end{vmatrix} =$

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

$-(343 + 1 + 27 - 63) = -308$

Ans: (A) -308

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19. $\begin{vmatrix} 1 & p & qr \\ 1 & q & pr \\ 1 & r & pq \end{vmatrix} =$

Result 3 (second form) with $a, b, c = p, q, r$.

Ans: (D) $(p-q)(q-r)(r-p)$

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

$(-26) \times 40 = -1040$

This equals the determinant of the row by row product.

Ans: (D) -1040

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

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

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

Ans: (A) $-9x^2 + 4x - e^{2x}\sin x + 2e^{2x}\cos x$

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

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

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

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

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23. $\int_0^1 \begin{vmatrix} 4x^3 & 2x+1 \\ -5 & -3 \end{vmatrix} dx =$

Only one row contains x, so integrate that row:

$\begin{vmatrix} \int_0^1 4x^3\,dx & \int_0^1 (2x+1)\,dx \\ -5 & -3 \end{vmatrix} = \begin{vmatrix} 1 & 2 \\ -5 & -3 \end{vmatrix}$

$= 7$

Ans: (C) 7

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24. $\begin{bmatrix} p & -6 \\ -16 & -4 \end{bmatrix}$ is singular when $p =$

$-4p - 96 = 0$

$p = -24$

Ans: (A) -24

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25. Every orthogonal matrix is

$|A| = \pm 1 \neq 0.$

Ans: (C) non-singular
