EXPRESSWALA ACADEMY

Maths 1A: Determinants

MCQ Test, Set 06

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 $\begin{vmatrix} -2 & -1 \\ 6 & -5 \end{vmatrix}$ is

A. 4 **B.** -16 **C.** 16 **D.** -17

2. If $\begin{vmatrix} x & 5 \\ 5 & x \end{vmatrix} = 56$, then

A. $x = 9$ only **B.** $x = \pm\sqrt{31}$ **C.** $x = \pm 10$ **D.** $x = \pm 9$

3. The cofactor of the element -1 in $\begin{bmatrix} 2 & -3 & 0 \\ -1 & 7 & 5 \\ 2 & 9 & 5 \end{bmatrix}$ is

A. 13 **B.** 15 **C.** 16 **D.** -15

4. In $\begin{bmatrix} -5 & -4 & 0 \\ 6 & -3 & 1 \\ 4 & 1 & 8 \end{bmatrix}$, the minor M_{12} is

A. 44 **B.** 52 **C.** -44 **D.** -32

5. $\begin{vmatrix} -2 & 6 & 2 \\ 1 & -3 & 5 \\ 0 & 1 & 0 \end{vmatrix} =$

A. 18 **B.** 12 **C.** -12 **D.** 0

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

A. 0 **B.** -112 **C.** -48 **D.** 112

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

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

8. If $\begin{vmatrix} a & b & c \\ p & q & r \\ x & y & z \end{vmatrix} = 10$, then $\begin{vmatrix} 3a & 3b & 3c \\ 3p & 3q & 3r \\ 3x & 3y & 3z \end{vmatrix} =$

A. 10 **B.** 30 **C.** -270 **D.** 270

9. Using $C_2 \to C_2 - 10C_1$, the value of $\begin{vmatrix} 2 & 25 & 2 \\ -2 & -22 & -1 \\ 4 & 45 & 0 \end{vmatrix}$ is

A. -4 **B.** 14 **C.** -28 **D.** -14

10. $\begin{vmatrix} p & q & r \\ a & b & c \\ a+p & b+q & c+r \end{vmatrix} =$

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

11. For $A = \begin{bmatrix} 4 & 8 & 0 \\ 2 & 3 & 6 \\ -4 & 7 & 2 \end{bmatrix}$ with cofactors A_{ij}, $a_{21}A_{21} + a_{22}A_{22} + a_{23}A_{23} =$

A. -736 **B.** 368 **C.** 0 **D.** -368

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

A. $-6,\ 12$ **B.** $6,\ -12$ **C.** $-6,\ -12$ **D.** $-6,\ 18$

13. A, B are of order 3 with $|A| = -6$, $|B| = -1$. Then $|2AB| =$

A. 12 **B.** -48 **C.** 48 **D.** 6

14. If A is of order 3 and $|A| = 4$, then $|-A^T| =$

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

15. $\begin{vmatrix} 0 & -5 & -9 \\ 5 & 0 & 2 \\ 9 & -2 & 0 \end{vmatrix} =$

A. 180 **B.** 110 **C.** -10 **D.** 0

16. If A is a square matrix with $A^3 = O$, then $|A| =$

A. -1 **B.** 3 **C.** 1 **D.** 0

17. $\begin{vmatrix} 8 & 1 & 1 \\ 1 & 9 & 1 \\ 1 & 1 & 4 \end{vmatrix} =$

A. 186 **B.** 270 **C.** 269 **D.** 168

18. $\begin{vmatrix} 1 & 1 & 1 \\ 1 & 8 & 512 \\ 1 & 4 & 64 \end{vmatrix} =$

A. -1092 **B.** -84 **C.** 1092 **D.** -3696

19. $\begin{vmatrix} 1 & p^2 & p^3 \\ 1 & q^2 & q^3 \\ 1 & r^2 & r^3 \end{vmatrix} =$

A. $pqr(p-q)(q-r)(r-p)$ **B.** $(pq+qr+rp)(p-q)(q-r)(r-p)$

C. $(p+q+r)(p-q)(q-r)(r-p)$ **D.** $(p^2+q^2+r^2)(p-q)(q-r)(r-p)$

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

A. 27 **B.** 36 **C.** -238 **D.** 238

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

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

C. $-x^2e^x - 2x\sin x - e^x - \sin x$ **D.** $-2xe^x - 2\sin x$

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

A. $6e^{2x} + e^x$ **B.** $-6e^{2x} - e^x$ **C.** $12e^{2x} + 2e^x$ **D.** 0

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

A. -19 **B.** 20 **C.** -20 **D.** -40

24. $\begin{bmatrix} p & 4 \\ 1 & -1 \end{bmatrix}$ is singular when $p =$

A. 4 **B.** -3 **C.** -4 **D.** -8

25. $\begin{bmatrix} p & -3 \\ -2 & -2 \end{bmatrix}$ is singular when $p =$

A. 3 **B.** -2 **C.** -6 **D.** -3

Key sheet

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

Solutions

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

$(-2)\cdot(-5) - (-1)\cdot 6 = 16$

Ans: (C) 16

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2. If $\begin{vmatrix} x & 5 \\ 5 & x \end{vmatrix} = 56$, then

$x^2 - 25 = 56$

$x^2 = 81 \Rightarrow x = \pm 9$

Ans: (D) $x = \pm 9$

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3. The cofactor of the element -1 in $\begin{bmatrix} 2 & -3 & 0 \\ -1 & 7 & 5 \\ 2 & 9 & 5 \end{bmatrix}$ is

$M_{21} = \begin{vmatrix} -3 & 0 \\ 9 & 5 \end{vmatrix} = -15$

$A_{21} = (-1)^3(-15) = 15$

Ans: (B) 15

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4. In $\begin{bmatrix} -5 & -4 & 0 \\ 6 & -3 & 1 \\ 4 & 1 & 8 \end{bmatrix}$, the minor M_{12} is

$M_{12} = \begin{vmatrix} 6 & 1 \\ 4 & 8 \end{vmatrix} = 48 - 4 = 44$

Ans: (A) 44

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5. $\begin{vmatrix} -2 & 6 & 2 \\ 1 & -3 & 5 \\ 0 & 1 & 0 \end{vmatrix} =$

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

$= -(-10 - 2)$

$= -(-12) = 12$

Ans: (B) 12

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

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

$= -4(0 - (-20)) - 2(4 - (-12))$

$= -4(20) - 2(16) = -112$

Ans: (B) -112

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

Two rows are interchanged (sign changes) and one row is multiplied by 2.

$\therefore \text{value} = (-2) \times 7 = -14$

Ans: (A) -14

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8. If $\begin{vmatrix} a & b & c \\ p & q & r \\ x & y & z \end{vmatrix} = 10$, then $\begin{vmatrix} 3a & 3b & 3c \\ 3p & 3q & 3r \\ 3x & 3y & 3z \end{vmatrix} =$

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

$\therefore \text{value} = 27 \times 10 = 270$

Ans: (D) 270

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9. Using $C_2 \to C_2 - 10C_1$, the value of $\begin{vmatrix} 2 & 25 & 2 \\ -2 & -22 & -1 \\ 4 & 45 & 0 \end{vmatrix}$ is

$C_2 \to C_2 - 10C_1$ leaves the value unchanged and gives $\begin{vmatrix} 2 & 5 & 2 \\ -2 & -2 & -1 \\ 4 & 5 & 0 \end{vmatrix}$.

$\Delta = -14$

Ans: (D) -14

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10. $\begin{vmatrix} p & q & r \\ a & b & c \\ a+p & b+q & c+r \end{vmatrix} =$

$R_3 \to R_3 - R_1 - R_2$ gives a row of zeros.

$\therefore \Delta = 0$

Ans: (A) 0

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11. For $A = \begin{bmatrix} 4 & 8 & 0 \\ 2 & 3 & 6 \\ -4 & 7 & 2 \end{bmatrix}$ with cofactors A_{ij}, $a_{21}A_{21} + a_{22}A_{22} + a_{23}A_{23} =$

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

$a_{21}A_{21} + a_{22}A_{22} + a_{23}A_{23} = |A| = -368$

Ans: (D) -368

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

$\Delta = (x-12)(x+6)^2$

$x = -6 \text{ (twice) or } x = 12$

Ans: (A) $-6,\ 12$

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13. A, B are of order 3 with $|A| = -6$, $|B| = -1$. Then $|2AB| =$

$|2AB| = 2^3|A|\,|B| = 48$

Ans: (C) 48

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14. If A is of order 3 and $|A| = 4$, then $|-A^T| =$

$|-A^T| = (-1)^3|A^T| = (-1)^3|A| = -4$

Ans: (B) -4

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15. $\begin{vmatrix} 0 & -5 & -9 \\ 5 & 0 & 2 \\ 9 & -2 & 0 \end{vmatrix} =$

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

Ans: (D) 0

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16. If A is a square matrix with $A^3 = O$, then $|A| =$

$|A|^3 = |A^3| = 0$, so $|A| = 0$ (A is nilpotent).

Ans: (D) 0

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17. $\begin{vmatrix} 8 & 1 & 1 \\ 1 & 9 & 1 \\ 1 & 1 & 4 \end{vmatrix} =$

Result 9 with $a, b, c = 7, 8, 3$:

$abc\left(1 + \frac{1}{a} + \frac{1}{b} + \frac{1}{c}\right) = 168 + 24 + 21 + 56 = 269$

Ans: (C) 269

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18. $\begin{vmatrix} 1 & 1 & 1 \\ 1 & 8 & 512 \\ 1 & 4 & 64 \end{vmatrix} =$

Use result 4, $(a+b+c)(a-b)(b-c)(c-a)$ with $a, b, c = 1, 8, 4$.

$(13)(1-8)(8-4)(4-1) = -1092$

Ans: (A) -1092

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19. $\begin{vmatrix} 1 & p^2 & p^3 \\ 1 & q^2 & q^3 \\ 1 & r^2 & r^3 \end{vmatrix} =$

Result 5 with $a, b, c = p, q, r$.

Ans: (B) $(pq + qr + rp)(p-q)(q-r)(r-p)$

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

$34 \times (-7) = -238$

This equals the determinant of the row by row product.

Ans: (C) -238

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

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

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

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

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

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

$= 6e^{2x} + e^x$

Ans: (A) $6e^{2x} + e^x$

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

Only one column contains x, so integrate that column:

$\begin{vmatrix} \int_0^2 x^3\,dx & 4 \\ \int_0^2 x\,dx & -3 \end{vmatrix} = \begin{vmatrix} 4 & 4 \\ 2 & -3 \end{vmatrix}$

$= -20$

Ans: (C) -20

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24. $\begin{bmatrix} p & 4 \\ 1 & -1 \end{bmatrix}$ is singular when $p =$

$-p - 4 = 0$

$p = -4$

Ans: (C) -4

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25. $\begin{bmatrix} p & -3 \\ -2 & -2 \end{bmatrix}$ is singular when $p =$

$-2p - 6 = 0$

$p = -3$

Ans: (D) -3
