MATHS

BOOKS - DHANPAT RAI & CO MATHS (HINGLISH)

DETERMINANTS

Illustration

1. $\begin{vmatrix} \log_3 512 & \log_4 3 \\ \log_3 8 & \log_4 9 \end{vmatrix} \times \begin{vmatrix} \log_2 3 & \log_8 3 \\ \log_3 4 & \log_3 4 \end{vmatrix} =$

A. 7

B. 10

C. 13

D. 17

Answer: B

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2. If [ ] denotes the greatest integer less than or equal to the real number under consideration, and $-1 \leq x < 0, \ \leq y < 1, 1 \leq z < 2,$ then find the value of the following determinant: $|[x] + 1[y][z][x][y] + 1[z][x][y][z] + 1|$

A. [z]

B. [y]

C. [x]

D. none of these

Answer: A

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3. If the value of the determinants $\begin{vmatrix} a & 1 & 1 \\ 1 & b & 1 \\ 1 & 1 & c \end{vmatrix}$ is positive then:

A. $abc > 1$

B. $abc > -8$

C. $abc < -8$

D. $abc > -2$

Answer: B

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4. If $\begin{vmatrix} a & b & 0 \\ 0 & a & b \\ b & 0 & a \end{vmatrix} = 0$, then which one of the following is correct ?

A. a/b is one of the cube roots of unity

B. a is one of the cube roots of unity

C. b is one of the cube roots of unity

D. a/b is one of the cube roots of -1

Answer: D

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5. The largest value of a third order determinant whose elements are equal to $1 \text{ or } 0$ is

A. 1

B. 0

C. 2

D. 3

Answer: C

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6. The determinant $\Delta = \begin{vmatrix} a^2 & a & 1 \\ \cos(nx) & \cos(n+1)x & \cos(n+2)x \\ \sin(nx) & \sin(n+1)x & \sin(n+2)x \end{vmatrix}$ is independent of

A. n

B. a

C. x

D. none of these

Answer: A

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7. Let $\begin{vmatrix} x^2+3x & x-1 & x+3 \\ x+1 & -2x & x-4 \\ x-3 & x+4 & 3x \end{vmatrix} = ax^4+bx^3+cx^2+dx+e$be an identity in x, where a, b, c, d, e are independent of x. Then, the value of e is

A. 4

B. 0

C. 1

D. none of these

Answer: B

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8. The value of x for which the matrix $\begin{vmatrix} -x & x & 2 \\ 2 & x & -x \\ x & -2 & -x \end{vmatrix}$ will be non-singular, are

A. $-2 \leq x \leq -2$

B. for all x other than 2 and -2

C. $x > 2$

D. $x \leq -2$

Answer: B

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9. The sum of the products of the elements of any row of a matrix A with the corresponding cofactors of the elements of the same row is always equal to

A. $|A|$

B. $\frac{1}{2}|A|$

C. 1

D. 0

Answer: A

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10. Let $\{D_1, D_2, D_3, D_n\}$ be the set of third order determinant that can be made with the distinct non-zero real numbers a_1, a_2, a_q. Then $\sum_{i=1}^{n} D_i = 1$ b. $\sum_{i=1}^{n} D_i = 0$ c. $D_i - D_j, \forall i, j$ d. none of these

A. $\sum_{i=1}^{n} D_i = 1$

B. $\underset{i=1_1}{\overset{n}{D}} = 0$

C. $D_i = D_j$ for all i, j

D. none of these

Answer: B

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11. If $\begin{vmatrix} a & b & c \\ m & n & p \\ x & y & z \end{vmatrix} = k, \quad \text{then} \quad \begin{vmatrix} 6a & 2b & 2c \\ 3m & n & p \\ 3x & y & z \end{vmatrix} =$

A. $\dfrac{k}{6}$

B. 2k

C. 3k

D. 6k

Answer: D

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12. The value of $\begin{vmatrix} 5^2 & 5^3 & 5^4 \\ 5^3 & 5^4 & 5^5 \\ 5^4 & 5^5 & 5^6 \end{vmatrix}$, is

A. 5^2

B. 0

C. 5^{13}

D. 5^9

Answer: B

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13. If every element of a third order determinant of value $Det < a$ is multiplied by 5, then the value of new determinant, is

A. Δ

B. 5Δ

C. 25Δ

D. 125Δ

Answer: D

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14. Let $P = [a_{ij}]$ be a 3×3 matrix and let $Q = [b_{ij}]$, where $b_{ij} = 2^{I+j} a_{ij}$ for $1 \leq i, j \leq 3$. If the determinant of P is 2, then the determinant of the matrix Q is

A. 2^{10}

B. 2^{11}

C. 2^{12}

D. 2^{13}

Answer: D

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15. If A is a square matrix such that $|A| = 2$, then for any positive integer n, $|A^n|$ is equal to

A. 2^n

B. n^2

C. 0

D. 2n

Answer: A

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16. If the value of a third order determinant is 11 then the value of the square of the determinant formed by the cofactors will be

A. 11

B. 121

C. 1331

D. 14641

Answer: D

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17. If $\begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix} = 5$, then the value of

$\Delta = \begin{vmatrix} b_2c_3 - b_3c_2 & a_3c_2 - a_2c_3 & a_2b_3 - a_3b_2 \\ b_3c_1 - b_1c_3 & a_1c_3 - a_3c_1 & a_3b_1 - a_1b_3 \\ b_1c_2 - b_2c_1 & a_2c_1 - a_1c_2 & a_1b_2 - a_2b_1 \end{vmatrix}$ is

A. 5

B. 25

C. 125

D. 0

Answer: B

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18. Let $A = [a_{ij}]$ be a 3×3 matrix and let A_1 denote the matrix of the cofactors of elements of matrix A and A_2 be the matrix of cofactors of elements of matrix A_1 and so on. If A_n denote the matrix of cofactros of elements of matrix A_{n-1}, then $|A_n|$ equals

A. $|A|^{2n}$

B. $|A|^{2n}$

C. $|A|^{n^2}$

D. $|A|^2$

Answer: B

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19. If A and B are square matrices of order 3 such that $|A| = -1, |B| = 3, \text{ then } |3AB|$ equals

A. -9

B. -81

C. -27

D. 81

Answer: B

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20. If $\Delta = \begin{vmatrix} 0 & b-a & c-a \\ a-b & 0 & c-b \\ a-c & b-c & 0 \end{vmatrix}$, then Δ equals

A. $a+b+c$

B. $-(a+b+c)$

C. abc

D. 0

Answer: D

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21. If w is a complex cube root of unity, then the value of the determinant

$$\Delta = \begin{bmatrix} 1 & w & w^2 \\ w & w^2 & 1 \\ w^2 & 1 & w \end{bmatrix}, \text{is}$$

A. 1

B. 0

C. w^2

D. w

Answer: B

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22. The value of $\Delta = \begin{vmatrix} 1 & a & b+c \\ 1 & b & c+a \\ 1 & c & a+b \end{vmatrix}$, is

A. 1

B. -1

C. $a+b+c$

D. 0

Answer: D

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23. The value of $\Delta = \begin{vmatrix} b-c & c-a & a-b \\ c-a & a-b & b-c \\ a-b & b-c & c-a \end{vmatrix}$ is

A. $a+b+c$

B. 0

C. 1

D. none of these

Answer: B

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24. Without expanding evaluate the determinant

$|\sin\alpha\cos\alpha\sin(a+\delta)\sin\beta\cos\beta\sin(\beta+\delta)\sin\gamma\cos\gamma\sin(\gamma+\delta)|$

A. 0

B. $\sin\alpha\sin\beta\sin\gamma$

C. $\cos\alpha\cos\beta\cos\gamma$

D. none of these

Answer: A

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25. The value of $\Delta = \begin{vmatrix} (a^x+a^{-x})^2 & (a^x-a^{-x})^2 & 1 \\ (a^y+a^{-y})^2 & (a^y-a^{-y})^2 & 1 \\ (a^z+a^{-z})^2 & (a^z-a^{-z})^2 & 1 \end{vmatrix}$, is

A. 1

B. -1

C. 0

D. none of these

Answer: C

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26. Choose the correct answer from the following :

The value of $\begin{vmatrix} 1 & a & a^2 \\ 1 & b & b^2 \\ 1 & c & c^2 \end{vmatrix} is:$

A. $(a-b)(b-c)(c-a)$

B. $(a^2-b^2)(b^2-c^2)(c^2-a^2)$

C. $(a-b+c)(b-c+a)(c-a+b)$

D. none of these

Answer: A

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27. $\Delta = \begin{vmatrix} a = x & b & c \\ b & x + c & a \\ c & a & x + b \end{vmatrix}$. Which of the following is a factor for the above determinant ?

A. $x - (a + b + c)$

B. $x + (a + b + c)$

C. $a + b + c$

D. $-(a + b + c)$

Answer: B

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28. What is $\begin{vmatrix} -a^2 & ab & ac \\ ab & -b^2 & bc \\ ac & bc & -c^2 \end{vmatrix}$ equal to ?

A. $4a^2b^2$

B. $4b^2c^2$

C. $4c^2a^2$

D. $4a^2b^2c^2$

Answer: D

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29. Given that $xyz = -1$, the value of the determinant $\begin{vmatrix} x & x^2 & 1+x^3 \\ y & y^2 & 1+y^3 \\ z & z^2 & 1+z^3 \end{vmatrix}$ is

A. 0

B. positive

C. negative

D. none of these

Answer: A

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30. Let a, b, c be positive and not all equal. Show that the value of the determinant $\begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix}$ is negative

A. $+ive$

B. $-ive$

C. zero

D. none of these

Answer: B

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31. If $\Delta_r = \begin{vmatrix} r & x & \frac{n(n+1)}{2} \\ 2r-1 & y & n^2 \\ 3r-2 & z & \frac{n(3n-1)}{2} \end{vmatrix}$, then $\sum_{r=1}^{n} \Delta_r$ is equal o

A. xyz

B. n xyz

C. 0

D. none of these

Answer: C

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32. If $\Delta_r = \begin{vmatrix} 2^{r-1} & 2.3^{r-1} & 4.5^{r-1} \\ x & y & z \\ 2^n - 1 & 3^n - 1 & 5^n - 1 \end{vmatrix}$, then $\sum_{r=1}^{n} \Delta_r$ is equal to

A. xyz

B. 1

C. -1

D. 0

Answer: D

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33. $\begin{bmatrix} a & b & ax+by \\ b & c & bx+cy \\ ax+by & bx+cy & 0 \end{bmatrix} = (b^2-ac)(ax^2+2bxy+cy^2)$

A. zero

B. positive

C. negative

D. b^2+ac

Answer: C

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34. The value of the determinant $\begin{vmatrix} b+c & a-b & a \\ c+a & b-c & b \\ a+b & c-a & c \end{vmatrix}$, is

A. $a^3+b^3+c^3-3abc$

B. $3abc-a^3-b^3-c^3$

C. $3abc+a^3+b^3+c^3$

D. none of these

Answer: B

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35. The value of $\begin{vmatrix} a_1x_1+b_1y_1 & a_1x_2+b_1y_2 & a_1x_3+b_1y_3 \\ a_2x_1+b_2y_1 & a_2x_2+b_2y_2 & a_2x_3+b_2y_3 \\ a_3x_1+b_3y_1 & a_3x_2+b_3y_2 & a_3x_3+b_3y_3 \end{vmatrix}$, is

A. $a_1a_2a_3b_1b_2b_3$

B. $x_1x_2x_3y_1y_2y_3$

C. 0

D. none of these

Answer: C

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36. The value of $\begin{vmatrix} 2y_1z_1 & y_1z_2+y_2z_1 & y_1z_3+y_3z_1 \\ y_1z_2y_2z_1 & 2y_2z_2 & y_2z_3+y_3z_2 \\ y_1z_3+y_3z_1 & y_2z_3+y_3z_2 & 2y_3z_3 \end{vmatrix}$, is

A. $y_1y_2y_3z_1z_2z_3$

B. $y_1 + y_2 + y_3$

C. $z_1 + z_2 + z_3$

D. 0

Answer: D

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37. $\begin{vmatrix} 1 & \cos(\beta-\alpha) & \cos(\gamma-\alpha) \\ \cos(\alpha-\beta) & 1 & \cos(\gamma-\beta) \\ \cos(\beta-\alpha) & \cos(\beta-\gamma) & 1 \end{vmatrix} =$

A. $\cos\alpha\cos\beta\cos\gamma$

B. $\cos\alpha + \cos\beta + \cos\gamma$

C. 1

D. 0

Answer: D

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38. If $l_1, m_1, n_1, l_2, m_2, n_2$ and l_3, m_3, n_3 are direction cosines of three mutuallyy perpendicular lines then, the value of $\begin{vmatrix} l_1 & m_1 & n_1 \\ l_2 & m_2 & n_2 \\ l_3 & m_3 & n_3 \end{vmatrix}$ is

A. $l_3 m_3 n_3$

B. ± 1

C. $l_1 m_1 n_1$

D. $l_2 m_2 n_2$

Answer: B

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39. If f(x) g(x) and h(x) are three polynomials of degree 2 and Δ = $\begin{vmatrix} f(x) & g(x) & h(x) \\ f'(x) & g'(x) & h'(x) \\ f''(x) & g''(x) & h''(x) \end{vmatrix}$ then $\Delta(x)$ is a polynomial of degree (dashes denote the differentiation).

A. 2

B. 3

C. 4

D. none of these

Answer: D

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40. Let f, g, h be differentiable functions of x. if

$$\Delta = \begin{vmatrix} f & g & h \\ (xf)' & (xg)' & (xh)' \\ (x^2 f)'' & (x^2 g)'' & (x^2 h)'' \end{vmatrix} \text{ and } , \Delta' = \begin{vmatrix} f & g & \\ f' & g' & \\ (x^n f'')' & (x^n g'')' & (x \end{vmatrix}$$

, then n =

A. 1

B. 2

C. 3

D. 4

Answer: C

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41. If $A(x_1, y_1), B(x_2, y_2)$ and $C(x_3, y_3)$ are vertices of an equilateral triangle whose each side is equal to a, then prove that

$\begin{vmatrix} x_1 & y_1 & 2 \\ x_2 & y_2 & 2 \\ x_3 & y_3 & 2 \end{vmatrix}$ is equal to

A. $2a^2$

B. $2a^4$

C. $3a^2$

D. $3a^4$

Answer: D

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42. If the system of equations $x - ky - z = 0, kx - y - z = 0, x + y - z = 0$ has a nonzero solution, then the possible value of k are

A. $-1, 2$

B. $1, 2$

C. 0, 1

D. $-1, 1$

Answer: D

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43. If the system of equations $ax + by + c = 0, bx + cy + a = 0, cx + ay + b = 0$ has infinitely many solutions then the system of equations $(b + c)x + (c + a)y + (a + b)z = 0(c + a)x + (a + b)y + (b + c)z = 0(a$

has

A. only one solution

B. no solution

C. infinite number of solutions

D. none of these

Answer: C

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44. if $a > b > c$ and the system of equations $ax + by + cz = 0, bx + cy + az0$ and $cx + ay + bz = 0$ has a non-trivial solution, then the quadratic equation $ax^2 + bx + c = 0$ has

A. at least one positive root

B. roots opposite in sign

C. positive roots

D. imaginary roots

Answer: A

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45. The number of values of k for which the system of the equations $(k+1)x+8y=4kandkx+(k+3)y=3k-1$ has infinitely many solutions is 0 b. 1 c. 2 d. infinite

A. 0

B. 1

C. 2

D. infinite

Answer: B

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Section I Solved Mcqs

1. If α, β and γ are the roots of the equation $x^3 + px + q = 0$ (with $p \neq 0$ and $p \neq 0$ and $q \neq 0$), the value of the determinant

$$\begin{vmatrix} \alpha & \beta & \gamma \\ \beta & \gamma & \alpha \\ \gamma & \alpha & \beta \end{vmatrix}$$, is

A. p

B. q

C. $p^2 - 2q$

D. none of these

Answer: D

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2. If m is a positive integer and

$$\Delta_r = \begin{vmatrix} 2r - 1 & {}^mC_r & 1 \\ m^2 - 1 & 2^m & m + 1 \\ \sin^2(m^2) & \sin^2(m) & \sin^2(m + 1) \end{vmatrix}$$

Then, the value of $\Sigma_{r=0}^{m} \Delta_r$, is

A. 0

B. $m^2 - 1$

C. 2^m

D. $2^m \sin^2(2^m)$

Answer: A

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3. If x,y, z are in A.P., then the values of the determinant $\begin{vmatrix} a+2 & a+3 & a+2x \\ a+3 & a+4 & a+2y \\ a+4 & a+5 & a+2z \end{vmatrix}$, is

A. 1

B. 0

C. 2a

D. a

Answer: B

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4. The value of the determinant $\begin{vmatrix} x+2 & x+3 & x+5 \\ x+4 & x+6 & x+9 \\ x+8 & x+11 & x+15 \end{vmatrix}$ is

A. 2

B. -2

C. 3

D. $x-1$

Answer: B

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5. If α, β, γ are the roots of $x^3 + ax^2 + b = 0$, then the value of $\begin{vmatrix} \alpha & \beta & \gamma \\ \beta & \gamma & \alpha \\ \gamma & \alpha & \beta \end{vmatrix}$, is

A. $-a^3$

B. a^3-3b

C. a^3

D. a^2-3b

Answer: C

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6. If $f(x)=\begin{vmatrix} a & -1 & 0 \\ ax & a & -1 \\ ax^2 & ax & a \end{vmatrix}$, then $f(2x)-f(x)$ equals

A. $a(2a+3x)$

B. $ax(2x+3a)$

C. $ax(2a+3x)$

D. $x(2a+3x)$

Answer: C

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7. If w is a complex cube root of unity.

$\begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix} = -(a+b+c)\left(a+bk+ck^2\right)\left(a+bk^2+ck\right),$ then k equals

A. 1

B. -1

C. ω

D. $-\omega$

Answer: C

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8. If $\omega$is an imaginary cube root of unity, then the value of the determinant $\begin{vmatrix} 1+\omega & \omega^2 & -\omega \\ 1+\omega^2 & \omega & -\omega^2 \\ \omega+\omega^2 & \omega & -\omega^2 \end{vmatrix}$

A. 0

B. 2ω

C. $2\omega^2$

D. $-3\omega^2$

Answer: D

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9. If $\begin{vmatrix} x^n & x^{n+2} & x^{n+3} \\ y^n & y^{n+2} & y^{n+3} \\ z^n & z^{n+2} & z^{n+3} \end{vmatrix}$

$=(x-y)(y-z)(z-x)\left(\frac{1}{x}+\frac{1}{y}+\frac{1}{z}\right)$, then n equals

A. 1

B. -1

C. 2

D. -2

Answer: B

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10. If $f(x)=\begin{vmatrix}1 & x & (x+1)\\ 2x & x(x-1) & (x+1)x\\ 3x(x-1) & x(x-1)(x-2) & x(x-1)(x+1)\end{vmatrix}$ then $f(50)+f(51)..+f(99)$ is equal to

A. 0

B. 1

C. 100

D. -100

Answer: A

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11. Given

$a_i^2 + b_i^2 + c_i^2 = 1, i = 1, 2, 3$ and $a_i a_j + b_i b_j + c_i c_j = 0(i \neq j, i, j = 1, 2, 3$

, then the value of the determinant

$\begin{vmatrix} a_1 & a_2 & a_3 \\ b_1 & b_2 & b_3 \\ c_1 & c_2 & c_3 \end{vmatrix}$, is

A. $\frac{1}{2}$

B. 0

C. 2

D. 1

Answer: D

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12. If α, β and γ are such that $\alpha + \beta + \gamma = 0$, then

$\begin{vmatrix} 1 & \cos\gamma & \cos\beta \\ \cos\gamma & 1 & \cos\alpha \\ \cos\beta & \cos\alpha & 1 \end{vmatrix}$

A. $\cos\alpha\cos\beta\cos\gamma$

B. $\cos\alpha+\cos\beta+\cos\gamma$

C. 1

D. none of these

Answer: D

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13. The value of the determinant $\begin{vmatrix}\cos\alpha & -\sin\alpha & 1\\ \sin\alpha & \cos\alpha & 1\\ \cos(\alpha+\beta) & -\sin(\alpha+\beta) & 1\end{vmatrix}$ is equal

A. independent of α

B. independent of β

C. independent of α and β

D. none of these

Answer: A

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14. If $\Delta = \begin{vmatrix} \cos\alpha & -\sin\alpha & 1 \\ \sin\alpha & \cos\alpha & 1 \\ \cos(\alpha+\beta) & -\sin(\alpha+\beta) & 1 \end{vmatrix}$, then

A. $\Delta \in \left[1-\sqrt{2}, 1+\sqrt{2}\right]$

B. $\Delta \in \left[-1, 1\right]$

C. $\Delta \in \left[-\sqrt{2}\sqrt{2}\right]$

D. none of these

Answer: A

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15. Let $D_r = \begin{vmatrix} a & 2^r & 2^{16}-1 \\ b & 3(4^r) & 2\left(14^{16}-1\right) \\ c & 7(8^r) & 4\left(8^{16}-1\right) \end{vmatrix}$, then the value of $\Sigma_{k=1}^{16} D_k$, is

A. 0

B. $a+b+c$

C. $ab + bc + ca$

D. none of these

Answer: A

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16. If $\Delta = \begin{vmatrix} \cos(\alpha_1 - \beta_1) & \cos(\alpha_1 - \beta_2) & \cos(\alpha_1 - \beta_3) \\ \cos(\alpha_2 - \beta_1) & \cos(\alpha_2 - \beta_2) & \cos(\alpha_2 - \beta_3) \\ \cos(\alpha_3 - \beta_1) & \cos(\alpha_3 - \beta_2) & \cos(\alpha_3 - \beta_3) \end{vmatrix}$ then Δ equals

A. $\cos\alpha_1\cos\alpha_2\cos\alpha_3\cos\beta_1\cos\beta_2\cos\beta_3$

B. $\cos\alpha_1 + \cos\alpha_2 + \cos\alpha_3 + \cos\beta_1 + \cos\beta_2 + \cos\beta_3$

C. $\cos(\alpha_1 - \beta_1)\cos(\alpha_2 - \beta_2)\cos(\alpha_3 - \beta_3)$

D. none of these

Answer: D

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17. The determinant $\begin{vmatrix} y^2 & -xy & x^2 \\ a & b & c \\ a' & b' & c' \end{vmatrix}$ is equal to

A. $\begin{vmatrix} bx+ay & cx+by \\ b'x+a'y & c'x+b'y \end{vmatrix}$

B. $\begin{vmatrix} ax+by & bx+cy \\ a'x+b'y & b'x+c'y \end{vmatrix}$

C. $\begin{vmatrix} bx+cy & ax+by \\ b'x+c'y & d'x+b'y \end{vmatrix}$

D. none of these

Answer: B

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18. If $\begin{vmatrix} p & q-y & r-z \\ p-x & q & r-z \\ p-x & q-y & r \end{vmatrix} = 0$ find the value of $\frac{p}{x}+\frac{q}{y}+\frac{r}{z}$

A. 0

B. 1

C. 2

D. 4 pqr

Answer: C

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19. The number of distinct real roots of $\begin{vmatrix} \sin x & \cos x & \cos x \\ \cos x & \sin x & \cos x \\ \cos x & \cos x & \sin x \end{vmatrix} = 0$ in the interval $-\frac{\pi}{4} \leq x \leq t\frac{\pi}{4}$ is

A. 0

B. 2

C. 1

D. 3

Answer: C

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20. The value of a for which system of equation ,

$a^3x + (a+1)^3 y + (a+2)^3 z = 0, ax + (a+1)y + (a+2)z = 0, x + y +$

has a non-zero solution is:

A. 0

B. -1

C. 1

D. none of these

Answer: B

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21. Let $A = \begin{bmatrix} 1 & \sin\theta & 1 \\ -\sin\theta & 1 & \sin\theta \\ -1 & -\sin\theta & 1 \end{bmatrix}$, where $0 \leq \theta < 2\pi$. then, which of the following is not correct ?

A. $D = 0$

B. $D \in (0, \infty)$

C. $D \in [2, 4]$

D. $D \in [2, \infty)$

Answer: C

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22. Let $\begin{vmatrix} x & 2 & x \\ x^2 & x & 6 \\ x & x & 6 \end{vmatrix} = ax^4 + bx^3 + cx^2 + dx + e$ Then, the value of $5a + 4b + 3c + 2d + e$ is equal to

A. 0

B. -16

C. 16

D. none of these

Answer: D

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23. If $\Delta_1 = \begin{vmatrix} 1 & 1 & 1 \\ a & b & c \\ a^2 & b^2 & c^2 \end{vmatrix}, \Delta_2 = \begin{vmatrix} 1 & bc & a \\ 1 & ca & b \\ 1 & ab & c \end{vmatrix}$, then

A. $\Delta_1 + \Delta_2 = 0$

B. $\Delta_1 + 2\Delta_2 = 0$

C. $\Delta_1 = \Delta_2$

D. none of these

Answer: A

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24. If $D_k = \left|1 \cap 2kn^2 + n + 2n^2 + n2k - 1n^2n^2 + n + 2\right| and$ $\sum_{k=1}^{n} D_k = 48, the \cap equals$ 4 (b) 6 (c) 8 (d) none of these

A. 4

B. 6

C. 8

D. none of these

Answer: A

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25. Let $\begin{vmatrix} 1+x & x & x^2 \\ x & 1+x & x^2 \\ x^2 & x & 1+x \end{vmatrix} = ax^5 + bx^4 + cx^3 + dx^2 + \lambda x + \mu$

be an identity in x, where a, b, c, λ, μ are independent of x. Then, the value of λ is

A. 3

B. 2

C. 4

D. none of these

Answer: A

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26. If $A = \int_1^{\sin\theta} \frac{t}{1+r^2} dt$ and $B = \int_1^{\text{cosec}\theta} \frac{1}{t(1+t^2)} dt$, then the value of the determinant

$\begin{vmatrix} A & A^2 & B \\ e^{A+B} & B^2 & -1 \\ 1 & A^2+B^2 & -1 \end{vmatrix}$ is

A. $\sin\theta$

B. $\cos ec\theta$

C. 0

D. 1

Answer: C

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27. If $I_n = \begin{vmatrix} 1 & k & k \\ 2n & k^2+k+1 & k^2+k \\ 2n-1 & k^2 & k^2+k+1 \end{vmatrix}$ and $\sum_{n=1}^{k} I_n = 72$, then k

=

A. 8

B. 9

C. 6

D. none of these

Answer: A

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28. If x is a positive integer, then $\begin{vmatrix} x! & (x+1)! & (x+2)! \\ (x+1)! & (x+2)! & (x+3)! \\ (x+2)! & (x+3)! & (x+4)! \end{vmatrix}$ is equal to

A. $2x!(x+1)!$

B. $2x!(x+1)!(x+2)!$

C. $2x!(x+3)!$

D. $2(x+1)!(x+2)!(x_3)!$

Answer: B

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29. If $f(x) = \begin{vmatrix} x+\lambda & x & x \\ x & x+\lambda & x \\ x & x & x+\lambda \end{vmatrix}$, then $f(3x) - f(x) =$

A. $3x\lambda^2$

B. $6x\lambda^2$

C. $x\lambda^2$

D. none of these

Answer: B

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30. The value of the determinant $\begin{vmatrix} bc & ca & ab \\ p & q & r \\ 1 & 1 & 1 \end{vmatrix}$, where a, b and c respectively the pth,qth and rth terms of a H.P., is

A. 0

B. abc

C. pqr

D. none of these

Answer: A

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31. Prove that all values of theta:

$$\begin{vmatrix} \sin\theta & \cos\theta & \sin 2\theta \\ \sin\left(\theta+\frac{2\pi}{3}\right) & \cos\left(\theta\frac{2\pi}{3}\right) & \sin\left(2\theta+\frac{4\pi}{3}\right) \\ \sin\left(\theta-\frac{2\pi}{3}\right) & \cos\left(\theta-\frac{2\pi}{3}\right) & \sin\left(2\theta-\frac{4\pi}{3}\right) \end{vmatrix} = 0$$

A. $\sin\theta$

B. $\cos\theta$

C. $\sin\theta\cos\theta$

D. none of these

Answer: D

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32. If a, b, c are distinct, then the value of x satisfying $\left|0x^2 - ax^3 - bx^2 + a0x^2 + cx^4 + bx - c0\right| = 0 is$ c (b) a (c) b (d) 0

A. c

B. a

C. b

D. 0

Answer: D

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33. If the determinant $\left|ab2a\alpha + 3\mathbf{c}2b\alpha + 3c2a\alpha + 3b2b\alpha + 3c0\right| = 0$ then a, b, c are in H.P. α is root of $4ax^2 + 12bx + 9c = 0$ or a, b, c are in

G.P. $a, b, c,$ are in G.P. only a, b, c are in A.P.

A. a, b, c are in H.P.

B. α is a root of $4ax^2+12bx+9c=0$ or , a, b, c are in G.P.

C. a, b, c are in G.P. only

D. a, b, c are in A.P.

Answer: B

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34. If the system of linear equation

$x+4ay+ax=0,$

$x+3b+bz=0$

$x+2cy+cz=0$

have a non-trivial solution, then a, b, c are in

A. H.P.

B. G.P.

C. A.P.

D. none of these

Answer: A

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35. If α is a non-real cube root of -2, then the value of $\begin{vmatrix} 1 & 2\alpha & 1 \\ \alpha^2 & 1 & 3\alpha^2 \\ 2 & 2\alpha & 1 \end{vmatrix}$, is

A. -11

B. -12

C. -13

D. 0

Answer: C

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36. The value of the determinant

$$\Delta = \begin{vmatrix} \cos(\alpha+\beta) & -\sin(\alpha+\beta) & \cos 2\beta \\ \sin\alpha & \cos\alpha & \sin\beta \\ -\cos\alpha & \sin\alpha & -\cos\beta \end{vmatrix}, \text{ is}$$

A. $\cos^2\alpha$

B. $\sin^2\alpha$

C. $\sin(\alpha-\beta)$

D. 0

Answer: D

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37. If $1. \omega, \omega^2$ are the roots of unity, then $\Delta = \begin{vmatrix} 1 & \omega^n & \omega^{2n} \\ \omega^n & \omega^{2n} & 1 \\ \omega^{2n} & 1 & \omega^n \end{vmatrix}$ is equal to

A. 0

B. ω

C. ω^2

D. 1

Answer: A

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38. If ω is a non-real cube root of unity, then
$$\Delta = \begin{vmatrix} a_1 + b_1\omega & a_1\omega^2 + b_1 & a_1 + b_1 + c_1\omega^2 \\ a_2 + b_2\omega & a_2\omega^2 + b_2 & a_2 + b_2\omega + c_2\omega^2 \\ a_3 + b_3\omega & a_3\omega^2 + b_3 & a_3 + b_3\omega + c_3\omega^2 \end{vmatrix}$$ is equal to

A. -1

B. 0

C. $-\omega^2$

D. none of these

Answer: B

Watch Video Solution

39. If $\Delta_r = \begin{vmatrix} 1 & r & 2^r \\ 2 & n & n^2 \\ n & \frac{n(n_1)}{2} & 2^{n+1} \end{vmatrix}$, then the value of $\sum_{r=1}^{n} \Delta_r$ is

A. n

B. 2n

C. $-2n$

D. n^2

Answer: C

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40. If $\Delta_r = \begin{vmatrix} 2^{r-1} & \frac{(r+1)!}{(1+1/r)} & 2r \\ a & b & c \\ 2^n - 1 & (n+1)! - 1 & n(n+1) \end{vmatrix}$, then $\sum_{r=1}^{n} \Delta_r$ is equal to

A. 0

B. $n + 3!$

C. $a(n!) + b$

D. none of these

Answer: A

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41. The value of the determinant $\Delta = \begin{vmatrix} 1+a_1b_1 & 1+a_1b_2 & 1+a_1b_3 \\ 1+a_2b_1 & 1+a_2b_2 & 1+a_2b_3 \\ 1+a_3b_1 & 1+a_3b_2 & 1+a_3b_3 \end{vmatrix}$, is

A. $a_1a_2a_3 + b_1b_2b_3$

B. $(a_1a_2a_3)(b_1b_2b_3)$

C. $a_1a_2b_1b_2 + a_2a_3b_2b_3 + a_3a_1b_3b_1$

D. none of these

Answer: D

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42. If a, b, c are complex numbers, then the determinant

$$\Delta = \begin{vmatrix} 0 & -b & -c \\ \bar{b} & 0 & -a \\ \bar{c} & \bar{a} & 0 \end{vmatrix}, \text{ is}$$

A. is a non-zero real number

B. purely imaginary

C. 0

D. none of these

Answer: B

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43. The value of the determinant

$$\Delta = \begin{vmatrix} \sin 2\alpha & \sin(\alpha+\beta) & \sin(\alpha+\gamma) \\ \sin(\beta+\gamma) & \sin 2\beta & \sin(\gamma+\beta) \\ (\sin\gamma+\alpha) & \sin(\gamma+\beta) & \sin 2\gamma \end{vmatrix}, \text{ is}$$

A. 0

B. $\sin^2\alpha + \sin^2\beta + \sin^2\gamma$

C. $\frac{3}{2}$

D. None of these

A. 0

B. $\sin^2 \alpha + \sin^2 \beta + \sin^2 \gamma$

C. $\frac{3}{2}$

D. none of these

Answer: A

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44. If A, B and C denote the angles of a triangle, then

$$\Delta = \begin{vmatrix} -1 & \cos C & \cos B \\ \cos C & -1 & \cos A \\ \cos B & \cos A & -2 \end{vmatrix}$$ is independent of

A. A

B. B

C. C

D. none of these

Answer: B

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45. If X, Y and Z are positive numbers such that Y and Z have respectively 1 and 0 at their unit's place and Δ is the determinant

$$\begin{vmatrix} X & 4 & 1 \\ Y & 0 & 1 \\ Z & 1 & 0 \end{vmatrix}$$

If $(\Delta + 1)$ is divisible by 10, then x has at its unit's place

A. 1

B. 0

C. 2

D. none of these

Answer: C

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46. If $a > 0$ and discriminant of $ax^2 + 2bx + c$ is negative, then

$$\Delta = \begin{vmatrix} a & b & ax+b \\ b & c & bx+c \\ ax+b & bx+c & 0 \end{vmatrix}, \text{ is}$$

A. positive

B. $(ac - b^2)(ax^2 + 2bx + c)$

C. negative

D. 0

Answer: C

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47. If $C = 2\cos\theta$, then the value of the determinant $\Delta = \begin{vmatrix} C & 1 & 0 \\ 1 & C & 1 \\ 6 & 1 & c \end{vmatrix}$, is

A. $\dfrac{\sin 4\theta}{\sin \theta}$

B. $\dfrac{2\sin^2 2\theta}{\sin \theta}$

C. $4\cos^2\theta(2\cos\theta - 1)$

D. none of these

Answer: D

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48. If $x^a y^b = e^m, x^c y^d = e^n, \Delta_1 = \begin{vmatrix} m & b \\ n & d \end{vmatrix}$, and $\Delta_2 = \begin{vmatrix} a & m \\ c & n \end{vmatrix}$ and $\Delta_3 = \begin{vmatrix} a & b \\ c & d \end{vmatrix}$

then the values of x and y are

A. $\dfrac{\Delta_1}{\Delta_3}$ and $\dfrac{\Delta_2}{\Delta_3}$

B. $\dfrac{\Delta_2}{\Delta_1}$ and $\dfrac{\Delta_3}{\Delta_1}$

C. $\log\left(\dfrac{\Delta_1}{\Delta_3}\right), \log\left(\dfrac{\Delta_2}{\Delta_3}\right)$

D. e^{Δ_1 / Δ_3} and e^{Δ_2 / Δ_3}

Answer: D

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49. If $s=(a+b+c)$,then value of $\begin{vmatrix} s+c & a & b \\ c & s+a & b \\ c & a & s+b \end{vmatrix}$ is

A. $2s^2$

B. $2s^3$

C. s^3

D. $3s^3$

Answer: B

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50. In a ΔABC if $\begin{vmatrix} 1 & a & b \\ 1 & c & a \\ 1 & b & c \end{vmatrix}=0$, then $\sin^2 A+\sin^2 B+\sin^2 C$ is

A. $\frac{9}{4}$

B. $\frac{4}{9}$

C. $\frac{3\sqrt{3}}{2}$

D. 1

Answer: A

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51. If ω is a complex cube root of unity, then a root of the equation

$$\begin{vmatrix} x+1 & \omega & \omega^2 \\ \omega & x+\omega^2 & 1 \\ \omega^2 & 1 & x+\omega \end{vmatrix} = 0, \text{ is}$$

A. x = 1

B. $x = \omega$

C. $x = \omega^2$

D. $x = 0$

Answer: D

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52. The value of $\Delta = \begin{vmatrix} 1 & 1+ac & 1+bc \\ 1 & 1+ad & 1+bd \\ 1 & 1+ae & 1+be \end{vmatrix}$, is

A. 1

B. 0

C. 3

D. $a+b+c$

Answer: B

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53. If the system of equations $x+ay=0, az+y=0$ and $ax+z=0$ has infinite solutions, then the value of a is -1 (b) 1 (c) 0 (d) no real values

A. -1

B. 1

C. 0

D. no real values

Answer: A

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54. If the system of linear equations

$x + 2ay + az = 0$

$x + 3by + bz = 0$

$x + 4cy + cz = 0$

has a non-zero solution, then a, b, c

A. satisfy $a + 2b + 3c = 0$

B. are in A.P.

C. are in G.P.

D. are in H.P.

Answer: D

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55. Given, $2x - y + 2z = 2, x - 2y + z = -4, x + y + \lambda z = 4$,then the value of λ such that the given system of equations has no solution, is

A. 3

B. 1

C. 0

D. -3

Answer: B

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56. The value of the determinant $\begin{vmatrix} 10! & 11! & 12! \\ 11! & 12! & 13! \\ 12! & 13! & 14! \end{vmatrix}$, is

A. $2(10!11!)$

B. $2(10!13!)$

C. $2(10!11!12!)$

D. $2(11!12!13!)$

Answer: C

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57. If $A = \begin{vmatrix} \sin(\theta+\alpha) & \cos(\theta+\alpha) & 1 \\ \sin(\theta+\beta) & \cos(\theta+\beta) & 1 \\ \sin(\theta+\gamma) & \cos(\theta+\gamma) & 1 \end{vmatrix}$, then

A. $A = 0 \quad \text{for all} \quad \theta$

B. A is an odd function of θ

C. A = 0 for $\theta = \alpha + \beta + \gamma$

D. A is independent of θ

Answer: D

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58. $a \neq p, b \neq q, c \neq r$ and $\begin{vmatrix} p & b & c \\ a & q & c \\ a & b & r \end{vmatrix} = 0$ the value of $\frac{p}{p-a} + \frac{q}{q-b} + \frac{r}{r-c} =$

A. 3

B. 2

C. 1

D. 0

Answer: B

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59. If $a = 1 + 2 + 4 + \ldots \text{to n terms}$
$b = 1 + 3 + 9 + \ldots \text{to n terms}$
$c = 1 + 5 + 25 + \ldots \text{to n terms}$
then $\begin{vmatrix} a & 2b & 4c \\ 2 & 2 & 2 \\ 2^n & 3^n & 5^n \end{vmatrix} =$

A. 30^n

B. 10^n

C. 0

D. $2^n + 3^n + 5^n$

Answer: C

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60. If $D_r = \begin{vmatrix} r & 1 & \frac{n(n+1)}{2} \\ 2r-1 & 4 & n^2 \\ 2^{r-1} & 5 & 2^n - 1 \end{vmatrix}$, then the value of $\sum_{r=1}^{n} D_r$, is

A. 0

B. 1

C. $\dfrac{n(n+1)(2n+1)}{6}$

D. none of these

Answer: A

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61. If $a^2+b^2+c^2=-2$ and $f(x)=\begin{vmatrix}1+a^2x & (1+b^2)x & (1+c^2)x \\ (1+a^2)x & 1+b^2x & (1+c^2)x \\ (1+a^2)x & (1+b^2)x & 1+c^2x\end{vmatrix}$,

then f(x) is a polynomial of degree

A. 2

B. 3

C. 0

D. 1

Answer: A

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62. The system of equations $\alpha x+y+z=\alpha-1, x+\alpha y+z=\alpha-1, x+y+\alpha z=\alpha-1$ has no solution if alpha is (A) 1 (B) not -2 (C) either -2 or 1 (D) -2

A. 1

B. not -2

C. either -2 or 1

D. -2

Answer: D

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63. Let a,b,c be such that b(a+c) $\neq 0$. If

$$\begin{vmatrix} a & a+1 & a-1 \\ -b & b+1 & b-1 \\ c & c-1 & c+1 \end{vmatrix} + \begin{vmatrix} a+1 & b+1 & c-1 \\ a-1 & b-1 & c+1 \\ (-1)^{n+2}a & (-1)^{n+1}b & (-1)^{n}c \end{vmatrix} = 0,$$

Then the value of 'n' is:

A. zero

B. any even integer

C. any odd integer

D. any integer

Answer: C

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64. The greatest value of n for which the determinant

$\Delta = \begin{vmatrix} 1 & 1 & 1 \\ .^{n}C_1 & .^{n+3}C_1 & .^{n+6}C_1 \\ .^{n}C_2 & .^{n+3}C_2 & .^{n+6}C_2 \end{vmatrix}$ is divisible by 3^n, is

A. 7

B. 5

C. 3

D. 1

Answer: C

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65. The number of 3 3 non-singular matrices, with four entries as 1 and all other entries as 0, is (1) 5 (2) 6 (3) at least 7 (4) less than 4

A. 6

B. at least 7

C. less than 4

D. 5

Answer: B

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66. Consider the system of linear equations:

$x_1 + 2x_2 + x_3 = 3$

$2x_1 + 3x_2 + x_3 = 3$

$3x_1 + 5x_2 + 2x_3 = 1$

The system has

A. a unique solution

B. no solution

C. infinite number of solutions

D. exactly three solution

Answer: B

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67. If

$$f(\theta) = \begin{vmatrix} 1 & \tan\theta & 1 \\ -\tan\theta & 1 & \tan\theta \\ -1 & -\tan\theta & 1 \end{vmatrix}, \quad \text{then the set } \left\{ f(\theta) : 0 \leq \theta \leq \frac{\pi}{2} \right\}$$

is

A. $(-\infty, 0] \cup [2, \infty)$

B. $[2, \infty)$

C. $(-\infty, 0) \cup (0, \infty)$

D. $(-\infty, -1] \cup [1, \infty)$

Answer: B

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68. If a, b, c are non zero complex numbers satisfying $a^2+b^2+c^2=0$ and $\begin{vmatrix} b^2+c^2 & ab & ac \\ ab & c^2+a^2 & bc \\ ac & bc & a^2+b^2 \end{vmatrix} = ka^2b^2c^2$, then k is equal to

A. 3

B. 2

C. 4

D. 1

Answer: C

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69. In a ΔABC if $\begin{vmatrix} 1 & a & b \\ 1 & c & a \\ 1 & b & c \end{vmatrix} = 0$, then $\sin^2 A + \sin^2 B + \sin^2 C$ is

A. $\dfrac{3\sqrt{3}}{2}$

B. $\dfrac{9}{4}$

C. $\dfrac{5}{4}$

D. 2

Answer: B

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70. $\begin{vmatrix} (1+\alpha)^2 & (1+2\alpha)^2 & (1+3\alpha)^2 \\ (2+\alpha)^2 & (2+2\alpha)^2 & (2+3\alpha)^2 \\ (3+\alpha)^2 & (3+2\alpha)^2 & (3+3\alpha)^2 \end{vmatrix} = -648\alpha$ FInd the value of α

A. -4

B. 9

C. -9

D. 4

Answer: B::C

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71. The set of all values of λ for which the system of linear equations : $2x_1 - 2x_2 + x_3 = \lambda x_1$ $2x_1 - 3x_2 + 2x_3 = \lambda x_2$ $-x_1 + 2x_2 = \lambda x_3$ has a non-trivial solution, (1) is an empty set (2) is a singleton (3) contains two elements (4) contains more than two elements

A. contains two elements

B. contains more than two elements

C. is an empty set

D. is a singleton set

Answer: A

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72. If $a^2+b^2+c^3+ab+bc+ca\leq 0$ for all, $a, b, c\in R$, then the value of the determinant

$$\begin{vmatrix}(a+b+2)^2 & a^2+b^2 & 1\\ 1 & (b+c+2)^2 & b^2+c^2\\ c^2+a^2 & 1 & (c+a+2)^2\end{vmatrix}$$, is equal to

A. 65

B. $a^2+b^2+c^2+31$

C. $4(a^2+b^2+c^2)$

D. 0

Answer: A

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73. For all values of $\theta\in\left(0,\frac{\pi}{2}\right)$, the determinant of the matrix

$$\begin{bmatrix}-2 & \tan\theta+\sec^2\theta & 3\\ -\sin\theta & \cos\theta & \sin\theta\\ -3 & -4 & 3\end{bmatrix}$$ always lies in the interval :

A. $\left[\frac{7}{2},\frac{21}{4}\right]$

B. [3, 5]

C. (4, 6)

D. $\left(\frac{5}{2}, \frac{19}{4}\right)$

Answer: B

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74. The total number of distinct $x \in R$ for which $\begin{vmatrix} x & x^2 & 1+x^3 \\ 2x & 4x^2 & 1+8x^3 \\ 3x & 9x^2 & 1+27x^3 \end{vmatrix} = 10$ is (A) 0 (B) 1 (C) 2 (D) 3

A. 1

B. 2

C. 3

D. 4

Answer: B

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Section Ii Assertion Reason Type

1. Consider the system of equations $x - 2y + 3z = -1, x - 3y + 4z = 1$ and $-x + y - 2z = k$ Statement 1: The system of equation has no solution for $k \neq 3$ and Statement 2: The determinant $\begin{vmatrix} 1 & 3 & -1 \\ -1 & -2 & k \\ 1 & 4 & 1 \end{vmatrix} \neq 0$ for $k \neq 0$

A. Statement 1 is true, Statement 2 is true, Statement 2 is a correct explanation for Statement 1

B. Statement 1 is true, Statement 2 is true, Statement 2 is not a correct explanation for Statement 1

C. Statement 1 is true, Statement 2 is False

D. Statement 1 is False, Statement 2 is true

Answer: A

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2. Let D be the determinant given by

$$D = \begin{vmatrix} 1 & \cos(\beta-\alpha) & \cos(\gamma-\alpha) \\ \cos(\alpha-\beta) & 1 & \cos(\gamma-\beta) \\ \cos(\alpha-\gamma) & \cos(\beta-\gamma) & 1 \end{vmatrix}$$

where $\alpha, \beta \text{ and } \gamma$ are real number

Statement -1: The value of D is zero

Statement 2: The determinant D is expressible as the product of two determinant each equal to zero

A. Statement 1 is true, Statement 2 is true, Statement 2 is a correct explanation for Statement 2

B. Statement 1 is true, Statement 2 is true, Statement 2 is not a correct explanation for Statement 2

C. Statement 1 is true, Statement 2 is False

D. Statement 1 is False, Statement 2 is true

Answer: A

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3. Consider the system of equations

$(a-1)x - y - z = 0$

$x - (b-1)y + z = 0$

$x + y - (c-1)z = 0$

Where a, b and c are non-zero real number

Statement1 : If x,y,z are not all zero, then $ab + bc + ca + abc$

Statement 2 : $abc \geq 27$

A. Statement 1 is true, Statement 2 is true, Statement 2 is a correct explanation for Statement 3

B. Statement 1 is true, Statement 2 is true, Statement 2 is not a correct explanation for Statement 3

C. Statement 1 is true, Statement 2 is False

D. Statement 1 is False, Statement 2 is true

Answer: B

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4. Statement I If $A = \begin{bmatrix} a^2+x^2 & ab-cx & ac+bx \\ ab+cx & b^2+x^2 & bc-ax \\ ac-bx & bc+ax & c^2+x^2 \end{bmatrix}$ and $B \begin{bmatrix} x & c & -b \\ -c & x & a \\ b & -a & x \end{bmatrix}$, then $|A| = |B|^2$ Statement II A^c is cofactor of a square matrix A of order n, then $|A^c| = |A|^{n-1}$

A. Statement 1 is true, Statement 2 is true, Statement 2 is a correct explanation for Statement 4

B. Statement 1 is true, Statement 2 is true, Statement 2 is not a correct explanation for Statement 4

C. Statement 1 is true, Statement 2 is False

D. Statement 1 is False, Statement 2 is true

Answer: A

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5. Let a, b, c be distinct real number and D be the determinant given by

$$D = \begin{vmatrix} a & 1 & 1 \\ 1 & b & 1 \\ 1 & 1 & c \end{vmatrix}$$

Statement1 : If $D > 0 \text{ then } abc > -8$

Statement - 2: $A.\,M. > G.\,M.$.

A. Statement 1 is true, Statement 2 is true, Statement 2 is a correct explanation for Statement 5

B. Statement 1 is true, Statement 2 is true, Statement 2 is not a correct explanation for Statement 5

C. Statement 1 is true, Statement 2 is False

D. Statement 1 is False, Statement 2 is true

Answer: A

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6. Statement -1 : Determinant of a skew-symmetric matrix of order 3 is zero.

Statement -2 : For any matrix A, Det $(A) = \text{Det}(A^T)$ and $\text{Det}(-A) = -\text{Det}(A)$

where Det (B) denotes the determinant of matrix B. Then,

A. Statement 1 is true, Statement 2 is true, Statement 2 is a correct explanation for Statement 6

B. Statement 1 is true, Statement 2 is true, Statement 2 is not a correct explanation for Statement 6

C. Statement 1 is true, Statement 2 is False

D. Statement 1 is False, Statement 2 is true

Answer: C

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Exercise

1. if a,b,c are in A.P. show that : $\begin{vmatrix} x+1 & x+2 & x+a \\ x+2 & x+3 & x+b \\ x+3 & x+4 & x+c \end{vmatrix} = 0$

A. 3

B. -3

C. 0

D. none of these

Answer: C

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2. If $p+q+r=0=a+b+c$, then the value of the determnalnt $|paqbrcqcrapbrbpcqa| is\ 0$ b. $pa+qb+rc$ c. 1 d. none of these

A. 0

B. $pa+qb+rc$

C. 1

D. none of these

Answer: A

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3. If a,b,c are positive and are the pth, qth and rth terms respectively of as G.P., the the value of $|(\log a, p, 1), (\log b, q, 1), (\log c, r, 1) =$ (A) 1 (B) $pqr(\log a + \log b + \log c)$ (C) 0 (D) $a^p b^q c^r$

A. 1

B. 0

C. -1

D. none of these

Answer: B

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4. If A is an invertible matrix then $\det(A^{-1})$ is equal to (A) 1 (B) $\frac{1}{|A|}$ (C) $|A|$ (D) none of these

A. det(A)

B. $\frac{1}{\det(A)}$

C. 1

D. none of these

Answer: B

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5. The value of the determinant $\begin{vmatrix} 1 & 1 & 1 \\ .^{m}C_1 & .^{m+1}C_1 & .^{m+2}C_1 \\ .^{m}C_2 & .^{m+1}C_2 & .^{m+2}C_2 \end{vmatrix}$ is equal to

A. 1

B. -1

C. 0

D. none of these

Answer: A

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6. If A, B, C are the angles of a triangle, then the determinant

$\Delta = \begin{vmatrix} \sin 2A & \sin C & \sin B \\ \sin C & \sin 2B & \sin A \\ \sin B & \sin A & \sin 2C \end{vmatrix}$ is equal to

A. 1

B. -1

C. $\sin A + \sin B + \sin C$

D. none of these

Answer: D

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7. The determinant $\Delta = \begin{vmatrix} a^2+x^2 & ab & ac \\ ab & b^2+x^2 & bc \\ ac & bc & c^2+x^2 \end{vmatrix}$ is divisible

A. x^5

B. x^4

C. x^4+1

D. x^4-1

Answer: B

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8. $D_r = \begin{vmatrix} 2^{r-1} & 2.3^{r-1} & 4.5^{r-1} \\ \alpha & \beta & \gamma \\ 2^n-1 & 3^n-1 & 5^n-1 \end{vmatrix}$. Then, the value of $\Sigma_{r=1}^{n} D_r$ is

A. $\alpha\beta\gamma$

B. $2^n\alpha+2^n\beta+4^n\gamma$

C. $2\alpha+3\beta+4\gamma$

D. none of these

Answer: D

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9. The non-zero roots of the equation

$$\Delta = \begin{vmatrix} a & b & ax+b \\ b & c & bx+c \\ ax+b & bx+c & c \end{vmatrix} = 0 \text{ are}$$

A. a,b ,c are in A.P

B. a, b, c are in G.P

C. a, b, c are in H.P

D. α is a root of $ax^2 + bx + c = 0$

Answer: B

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10. If $\Delta_m = \begin{vmatrix} m-1 & n & 6 \\ (m-1)^2 & 2n^2 & 4n-2 \\ (m-1)^3 & 3n^3 & 3n^2-3n \end{vmatrix}$, then $\Sigma_{m=1}^{n}\Delta_m$ is equal to

A. 0

B. 1

C. $\left\{\frac{n(n+1)}{2}\right\}\left\{\frac{a(a+1)}{2}\right\}$

D. none of these

Answer: A

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11. If $a_1, a_2, a_3, \ldots\ldots$ are in G.P. then the value of determinant $\begin{vmatrix} \log(a_n) & \log(a_{n+1}) & \log(a_{n+2}) \\ \log(a_{n+3}) & \log(a_{n+4}) & \log(a_{n+5}) \\ \log(a_{n+6}) & \log(a_{n+7}) & \log(a_{n+8}) \end{vmatrix}$ equals (A) 0 (B) 1 (C) 2 (D) 3

A. 0

B. 1

C. 2

D. none of these

Answer: A

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12. If $x \neq y \neq z$ and $\begin{vmatrix} x & x^2 & 1+x^3 \\ y & y^2 & 1+y^3 \\ z & z^2 & 1+z^3 \end{vmatrix} = 0,$ then xyz =

A. -2

B. -1

C. -3

D. none of these

Answer: B

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13. If $\begin{vmatrix} b+c & c+a & a+b \\ a+b & b+c & c+a \\ c+a & a+b & b+c \end{vmatrix} = k\begin{vmatrix} a & b & c \\ c & a & b \\ b & c & a \end{vmatrix}$, then the value of k, is

A. 1

B. 2

C. 3

D. 4

Answer: B

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14. If A is a square matrix of order n such that its elements are polynomila in x and its r-rows become identical for x = k, then

A. $(x-k)^r$ is a factor of $|A|$

B. $(x-k)^r - 1$ is a factor of $|A|$

C. $(x-k)^r + 1$ is a factor $|A|$

D. $(x-k)^r$ is a factor of A

Answer: A

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15. If $a^2+b^2+c^2=0$ and $\begin{vmatrix} b^2+c^2 & ab & ac \\ ab & c^2+a^2 & bc \\ ac & bc & a^2+b^2 \end{vmatrix} = ka^2b^2c^2$, then the value of k is

A. 2

B. 1

C. 4

D. 3

Answer: C

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16. If $a^{-1}+b^{-1}+c^{-1}=0$ such that $\begin{vmatrix}1+a & 1 & 1 \\ 1 & 1+b & 1 \\ 1 & 1 & 1+c\end{vmatrix}=\lambda$, then what is λ equal to ?

A. 0

B. abc

C. $-abc$

D. none of these

Answer: B

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17. If $\alpha, \beta \text{and} \gamma$ are real number without expanding at any stage prove that

$$\begin{vmatrix}1 & \cos(\beta-\alpha) & \cos(\gamma-\alpha) \\ \cos(\alpha-\beta) & 1 & \cos(\gamma-\beta) \\ \cos(\alpha-\gamma) & \cos(\beta-\gamma) & 1\end{vmatrix}=0.$$

A. $4\cos\alpha\cos\beta\cos\gamma$

B. $2\cos\alpha\cos\beta\cos\gamma$

C. $4\sin\alpha\sin\beta\sin\gamma$

D. none of these

Answer: D

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18. If A, B and C denote the angles of a triangle, then

$\Delta = \begin{vmatrix} -1 & \cos C & \cos B \\ \cos C & -1 & \cos A \\ \cos B & \cos A & -2 \end{vmatrix}$ is independent of

A. $\cos A\cos B\cos C$

B. $\sin A\sin B\sin C$

C. 0

D. none of these

Answer: C

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19. If $\begin{vmatrix} \alpha & x & x & x \\ x & \beta & x & x \\ x & x & \gamma & x \\ x & x & x & \delta \end{vmatrix} = f(x) - xf'(x)$ then f(x) is equal to

A. $(x-\alpha)(x-\beta)(x-\gamma)(x-\delta)$

B. $(x+\alpha)(x+\beta)(x+\gamma)(x+\delta)$

C. $2(x-\alpha)(x-\beta)(x-\gamma)(x-\delta)$

D. none of these

Answer: A

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20. If x, y , z are in A.P., then the value of the det (A) is , where

$$A = \begin{bmatrix} 4 & 5 & 6 & x \\ 5 & 6 & 7 & y \\ 6 & 7 & 8 & z \\ x & y & z & 0 \end{bmatrix}$$

A. 0

B. 1

C. 2

D. none of these

Answer: A

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21. If $a \neq b \neq c$, are value of x which satisfies the equation

$$\begin{vmatrix} 0 & x-a & x-b \\ x+a & 0 & x-c \\ x+b & x+c & 0 \end{vmatrix} = 0 \text{ is given by}$$

A. a

B. b

C. c

D. 0

Answer: D

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22. If a, b, c are different, then the value of $\left|0x^2 - ax^3 - bx^2 + a0x^2 + cx^4 + bx - c0\right| = 0$ is c b. c c. b d. 0

A. a

B. b

C. c

D. 0

Answer: D

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23. The system of equation $kx + y + z = 1, x + ky + z = k$ and $x + y + kz = k^2$ has no solution if k equals

A. 0

B. 1

C. -1

D. -2

Answer: D

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24. Show that: $\left|b^2+c^2abacbac^2+a^2bacba^2+b^2\right|=4a^2b^2c^2$

A. 3

B. 2

C. 4

D. none of these

Answer: C

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25. $\begin{vmatrix} 2a_1b_1 & a_1b_2 + a_2b_1 & a_1b_3 + a_3b_1 \\ a_1b_2 + a_2b_1 & 2a_2b_2 & a_2b_3 + a_3b_2 \\ a_1b_3 + a_3b_1 & a_3b_2 + a_2b_3 & 2a_3b_3 \end{vmatrix} =$

A. 1

B. -1

C. 0

D. $a_1a_2a_3b_1b_2b_3$

Answer: C

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26. If B is a non-singular matrix and A is a square matrix, then $\det(B^{-1}AB)$ is equal to (A) $\det(A^{-1})$ (B) $\det(B^{-1})$ (C) $\det(A)$ (D) $\det(B)$

A. Det (B)

B. Det(A)

C. Det $\left(B^{-1}\right)$

D. Det $\left(A^{-1}\right)$

Answer: B

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27. If $0 < \theta < \pi$ and the system of equations

$(\sin\theta)x + y + z = 0$

$x + (\cos\theta)y + z = 0$

$(\sin\theta)x + (\cos\theta)y + z = 0$

has a non-trivial solution, then $\theta =$

A. $\frac{\pi}{6}$

B. $\frac{\pi}{4}$

C. $\frac{\pi}{3}$

D. $\frac{\pi}{2}$

Answer: D

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28. If the determinant $\begin{vmatrix} b-c & c-a & a-b \\ b'-c' & c'-a' & a'-b' \\ b''-c'' & c''-a'' & a''-b'' \end{vmatrix}$ is expressible an $m\begin{vmatrix} a & b & c \\ a' & b' & c' \\ a'' & b'' & c'' \end{vmatrix}$, then the value of m, is

A. -1

B. 0

C. 1

D. 2

Answer: B

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29. If $a \neq b$, then the system of equation $ax+by+bz=0$ $bx+ay+bz=0$ and $bx+by+az=0$ will have a non-trivial solution, if

A. $a+b=0$

B. $a+2b=0$

C. $2a+b=0$

D. $a+4b=0$

Answer: B

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30. If $\begin{vmatrix} 1 & 1 & 1 \\ a & b & c \\ a^3 & b^3 & c^3 \end{vmatrix} = (a-b)(b-c)(c-a)(a+b+c)$

where a, b, c are all different, then the determinant

$\begin{vmatrix} 1 & 1 & 1 \\ (x-a)^2 & (x-b)^2 & (x-c)^2 \\ (x-b)(x-c) & (x-c)(x-a) & (x-a)(x-b) \end{vmatrix}$ vanishes when

A. $a+b+c=0$

B. $x=\frac{1}{3}(a+b+c)$

C. $x=\frac{1}{2}(a+b+c)$

D. $x=a+b+c$

Answer: B

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31. Show that $ax+by+r=0, by+cz+p=0 and cz+ax+q=0$ are perpendicular to $x-y, y-z and z-x$ planes, respectively.

A. -1

B. 0

C. 1

D. 2

Answer: A

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32. One factor of $\begin{vmatrix} a^2+x & ab & ac \\ ab & b^2+x & cb \\ ca & cb & c^2+x \end{vmatrix}$, is

A. x^2

B. $(a^2+x)(b^2+x)(c^2+x)$

C. $\frac{1}{x}$

D. none of these

Answer: A

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33. The equation $\begin{vmatrix} x-a & x-b & x-c \\ x-b & x-a & x-c \\ x-c & x-b & x-a \end{vmatrix} = 0$ (a,b,c are different) is satisfied by (A) $x=(a+b+c0$ (B) $x=\frac{1}{3}(a+b+c)$ (C) $x=0$ (D) none of these

A. $x = 0$

B. $x = a$

C. $x = \frac{1}{3}(a + b + c)$

D. $x = a + b + c$

Answer: C

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34. Let $A = \begin{bmatrix} 1 & \sin\theta & 1 \\ -\sin\theta & 1 & \sin\theta \\ -1 & -\sin\theta & 1 \end{bmatrix}$, where $0 \leq \theta < 2\pi$. then, which of the following is correct ?

A. $Det(A) = 0$

B. $Det(A) \in (-\infty, 0)$

C. $Det(A) \in [2, 4]$

D. $Det(A) \in [-2, \infty)$

Answer: C

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35. If a, b, c are non-zero real number such that $\begin{vmatrix} bc & ca & ab \\ ca & ab & bc \\ ab & bc & ca \end{vmatrix} = 0,$ then

A. $\frac{1}{a} + \frac{1}{b} + \frac{1}{c} = 0$

B. $\frac{1}{a} - \frac{1}{b} - \frac{1}{c} = 0$

C. $\frac{1}{b} + \frac{1}{c} - \frac{1}{a} = 0$

D. $\frac{1}{b} - \frac{1}{c} - \frac{1}{a} = 0$

Answer: A

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36. The value of the determinant $\left|kak^2 + a^2 1kbk^2 + b^2 1kck^2 + c^2 1\right|$ is

$k(a+b)(b+c)(c+a)$ $kabc\left(a^2 + b^{f2} + c^2\right)$ $k(a-b)(b-c)(c-a)$

$k(a+b-c)(b+c-a)(c+a-b)$

A. $k(a+b)(b+c)(c+a)$

B. $kabc(a^2+b^2+c^2)$

C. $k(a-b)(b-c)(c-a)$

D. $k(a+b-c)(b+c-a)(c+a-b)$

Answer: C

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37. The system of simulataneous equations

$kx+2y-z=1$

$(k-1)y-2z=2$

$(k+2)z=3$

have a unique solution if k equals

A. -2

B. -1

C. 0

D. 1

Answer: B

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38. The value of the determinant $\begin{vmatrix} 1 & \omega^3 & \omega^5 \\ \omega^3 & 1 & \omega^4 \\ \omega^5 & \omega^4 & 1 \end{vmatrix}$, where ω is an imaginary cube root of unity, is

A. $(1-\omega)^2$

B. 3

C. -3

D. none of these

Answer: B

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39. If a, b, c are non-zero real number such that $\begin{vmatrix} bc & ca & ab \\ ca & ab & bc \\ ab & bc & ca \end{vmatrix} = 0,$ then

A. $\frac{1}{a} + \frac{1}{b\omega} + \frac{1}{c\omega^2} = 0$

B. $\frac{1}{a} + \frac{1}{b\omega^2} + \frac{1}{c\omega} = 0$

C. $\frac{1}{a\omega} + \frac{1}{b\omega^2} + \frac{1}{c} = 0$

D. all the above

Answer: D

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40. If the system of equations

$x + ay + az = 0$

$bx + y + bz = 0$

$cx + cy + z = 0$

where a, b and c are non-zero non-unity, has a non-trivial solution, then value of $\frac{a}{1-a} + \frac{b}{1-b} + \frac{c}{1-c}$ is

A. 0

B. 1

C. -1

D. $\dfrac{abc}{a^2+b^2+c^2}$

Answer: C

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41. The value of the determinant

$$\Delta = \begin{vmatrix} \cos(\alpha+\beta) & -\sin(\alpha+\beta) & \cos 2\beta \\ \sin\alpha & \cos\alpha & \sin\beta \\ -\cos\alpha & \sin\alpha & -\cos\beta \end{vmatrix}, \text{ is}$$

A. α

B. β

C. $\alpha \text{ and } \beta$

D. neither $\alpha \text{ nor } \beta$

Answer: A

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42. If ω is a cube root of unity, then for polynomila is

$$\begin{vmatrix} x+1 & \omega & \omega^2 \\ \omega & x+\omega^2 & 1 \\ \omega^2 & 1 & x+\omega \end{vmatrix}$$

A. 1

B. ω

C. ω^2

D. 0

Answer: D

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43. If $\Delta_1 = \begin{vmatrix} x & b & b \\ a & x & b \\ a & a & x \end{vmatrix}$ and $\Delta_2 = \begin{vmatrix} x & b \\ a & x \end{vmatrix}$ are given then

A. $\Delta_1 = 3(\Delta_2)^2$

B. $\frac{d}{dx}(\Delta_1) = 3\Delta_2$

C. $\frac{d}{dx}(\Delta_1) = 3\Delta_2^2$

D. $\Delta_1 = 3(\Delta_2)^{3/2}$

Answer: B

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44. If y= sin px and y_n is the nth derivative of y, then

$\begin{vmatrix} y & y_1 & y_2 \\ y_3 & y_4 & y_5 \\ y_6 & y_7 & y_8 \end{vmatrix}$ is

A. m^9

B. m^2

C. m^3

D. none of these

Answer: D

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45. $a \ne p, b \ne q, c \ne r$ and $\begin{vmatrix} p & b & c \\ a & q & c \\ a & b & r \end{vmatrix} = 0$ the value of $\frac{p}{p-a} + \frac{q}{q-b} + \frac{r}{r-c} =$

A. 0

B. 1

C. -1

D. 2

Answer: D

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46. $\begin{vmatrix} x & p & q \\ p & x & q \\ p & q & x \end{vmatrix} =$

A. $(x+p)(x+q)(x-p-q)$

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

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

D. $(x+p)(x+q)(x+p+q)$

Answer: B

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47. The factors of $\begin{vmatrix} x & a & b \\ a & x & b \\ a & b & x \end{vmatrix}$, are

A. $x-a, x-b, \text{ and } x+a+b$

B. $x+a, x+b \text{ and } x+a+b$

C. $x+a, x+b \text{ and } x-a-b$

D. $x-a, x-b \text{ and } x-a-b$

Answer: A

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48. Let $\omega = -\frac{1}{2} + i\frac{\sqrt{3}}{2}$, then the value of the determinant $\begin{vmatrix} 1 & 1 & 1 \\ 1 & -1-\omega^2 & \omega^2 \\ 1 & \omega^2 & \omega^4 \end{vmatrix}$, is

A. 3ω

B. $3\omega(\omega - 1)$

C. $3\omega^2$

D. $3\omega(1-\omega)$

Answer: D

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49. If a + b + c = 0, then one of the solution of $\begin{vmatrix} a-x & c & b \\ c & b-x & a \\ b & a & c-x \end{vmatrix} = 0$ is

A. $x = 1$

B. $x = 2$

C. $x = a^2 + b^2 + c^2$

D. $x = 0$

Answer: D

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50. Suppose

$$D = \begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix} \text{ and } D' = \begin{vmatrix} a_1 + pb_1 & b_1 + qc_1 & c_1 + ra_1 \\ a_2 + pb_2 & b_2 + qc_2 & c_2 + ra_2 \\ a_3 + pb_3 & b_3 + qc_3 & c_3 + ra_3 \end{vmatrix}$$. Then,

A. $D' = D$

B. $D' = D(1 - pqr)$

C. $D' = D(1 + p + q + r)$

D. $D' = D(1 + pqr)$

Answer: A

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51. A and B are two non-zero square matrices such that AB = O`. Then,

A. both A and B are singular

B. either of them is singular

C. neither matrix is singular

D. none of these

Answer: B

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52. The roots of the equation $\begin{vmatrix} x-1 & 1 & 1 \\ 1 & x-1 & 1 \\ 1 & 1 & x-1 \end{vmatrix} = 0$, are

A. 1, 2

B. $-1, 2$

C. $1, \ -2$

D. $-1, \ -2$

Answer: B

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53. From the matrix equation AB = AC we can conclude B = C provided that

A. A is singular

B. A is non-singular

C. A is symmetric

D. A is square

Answer: B

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54. If $\Delta_1 = \begin{vmatrix} 1 & 1 & 1 \\ a & b & c \\ a^2 & b^2 & c^2 \end{vmatrix}, \Delta_2 = \begin{vmatrix} 1 & bc & a \\ 1 & ca & b \\ 1 & ab & c \end{vmatrix}$, then

A. $\Delta_1 + \Delta_2 = 0$

B. $\Delta_1 + 2\Delta_2 = 0$

C. $\Delta_1 = \Delta_2$

D. $\Delta_1 = 2\Delta_2$

Answer: A

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55. The value of $\begin{vmatrix} 11 & 12 & 13 \\ 12 & 13 & 14 \\ 13 & 14 & 15 \end{vmatrix}$ is

A. 1

B. 0

C. -1

D. 67

Answer: B

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56. The vlaue of $\begin{vmatrix} x & 4 & y+z \\ y & 4 & z+x \\ z & 4 & x+y \end{vmatrix}$, is

A. 4

B. $x+y+z$

C. xyz

D. 0

Answer: D

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57. If $a \neq b \neq c$, are value of x which satisfies the equation

$$\begin{vmatrix} 0 & x-a & x-b \\ x+a & 0 & x-c \\ x+b & x+c & 0 \end{vmatrix} = 0$$ is given by

A. a

B. b

C. 0

D. 1

Answer: C

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58. Let a, b, c be the real numbers. The following system of equations in $x, y, and z$

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} - \frac{z^2}{a^2} = 1, \frac{x^2}{a^2} - \frac{y^2}{b^2} + \frac{z^2}{a^2} = 1, -\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{a^2} = 1$$ has

a. no solution b. unique solution c. infinitely many solutions d. finitely many solutions

A. no solution

B. unique solution

C. infinitely many solution

D. finitely many solutions

Answer: B

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59. If A and B are two matrices such that $A + B$ and AB are both defined, then

A. A and B are two matrices not necessarily of same order

B. A and B are square matrices of same order

C. number of column of A = number of rows of B

D. none of these

Answer: B

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60. If ω is an imaginary cube root of unity, then the value of $\begin{vmatrix} a & b\omega^2 & a\omega \\ b\omega & c & b\omega^2 \\ c\omega^2 & a\omega & c \end{vmatrix}$, is

A. $a^3 + b^3 + c^3$

B. $a^2b - b^2c$

C. 0

D. $a^3 + b^3 + c^3 - 3abc$

Answer: C

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61. If α, β, λ are non-real numbers satisfying $x^3 - 1 = 0$, then the value of $\begin{vmatrix} \lambda + 1 & \alpha & \beta \\ \alpha & \lambda + \beta & 1 \\ \beta & 1 & \lambda + 1 \end{vmatrix}$

A. 0

B. λ^3

C. $\lambda^3 + 1$

D. $\lambda^3 - 1$

Answer: B

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62. The value of the determinant $\begin{vmatrix} -1 & 1 & 1 \\ 1 & -1 & 1 \\ 1 & 1 & -1 \end{vmatrix}$ is equal to

A. -4

B. 0

C. 1

D. 4

Answer: D

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63. In a third order determinant, each element of the first column consists of sum oftwo terms, each element of the second column consists of sum of three terms and each element of the third column consits of sum of four terms, Then it can be decomposed into four terms,.Then it can be decomposed into n determinants, where n has value

A. 1

B. 9

C. 16

D. 24

Answer: D

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64. A root of the equation $\begin{vmatrix} 3-x & -6 & 3 \\ -6 & 3-x & 3 \\ 3 & 3 & -6-x \end{vmatrix} = 0$

A. 6

B. 3

C. 0

D. none of these

Answer: C

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65. For positive numbers x, y and z, the numerical value of the determinant $\begin{vmatrix} 1 & \log_x y & \log_x z \\ \log_y x & 1 & \log_y z \\ \log_z x & \log_z y & 1 \end{vmatrix}$ is

A. 0

B. log x log y log z

C. 1

D. 8

Answer: D

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66. The value of the deterimant $\begin{vmatrix} 1 & 1 & 1 & 1 \\ 1 & 2 & 3 & 4 \\ 1 & 3 & 6 & 10 \\ 1 & 4 & 10 & 20 \end{vmatrix}$ is equal to

A. 0

B. -1

C. 2

D. 10

Answer: C

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67. If $\Delta = \begin{vmatrix} 3 & 4 & 5 & x \\ 4 & 5 & 6 & y \\ 5 & 6 & 7 & z \\ x & y & z & 0 \end{vmatrix}$, then Δ equals

A. $(y - 2z + 3x)^2$

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

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

D. $x^2 + y^2 + z^2 - zy - yz - zx$

Answer: B

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68. If A, B and C are the angles of a triangle and $\begin{vmatrix} 1 & 1 & 1 \\ 1 + \sin A & 1 + \sin B & 1 + \sin C \\ \sin A + \sin^2 A & \sin B + \sin^2 B & \sin C + \sin^2 C \end{vmatrix} = 0$, then the triangle ABC is

A. isosceles

B. equilateral

C. right angled isosceles

D. none of these

Answer: A

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69. If $a, b,$ and c are the sides of a triangle and A, B and C are the angles opposite to $a, b,$ and $c,$ respectively, then

$$\Delta = \begin{vmatrix} a^2 & b\sin A & c\sin A \\ b\sin A & 1 & \cos A \\ c\sin A & \cos A & 1 \end{vmatrix}$$

A. $\sin A \sin B \sin C$

B. abc

C. 1

D. 0

Answer: D

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70. If [ ] denotes the greatest integer less than or equal to the real number under consideration, and $-1 \leq x < 0, \leq y < 1, 1 \leq z < 2,$ then find the value of the following determinant: $|[x]+1[y][z][x][y]+1[z][x][y][z]+1|$

A. 2

B. 6

C. 4

D. none of these

Answer: C

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71. Coefficient of x in $f(x) = \begin{vmatrix} x & (1+\sin x)^3 & \cos x \\ 1 & \log(1+x) & 2 \\ x^2 & (1+x)^2 & 0 \end{vmatrix}$ is

A. 0

B. 1

C. -2

D. cannot be determined

Answer: C

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72. The determinant $\begin{vmatrix} \cos C & \tan A & 0 \\ \sin B & 0 & -\tan A \\ 0 & \sin B & \cos C \end{vmatrix}$

has the value, where A, B, C are angled of a triangle

A. 0

B. 1

C. $\sin A \sin B$

D. $\cos A \cos B \cos C$

Answer: A

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73. Using the factor theorem it is found that $a+b, b+candc+a$ are three factors of the determinant $|-2aa+ba+cb+a-2+\ +ac+b-2c|\cdot$ The other factor in the value of the determinant is (a) 4 (b) 2 (c_ $a+b+c$ (d) none of these

A. 4

B. 2

C. $a+b+c$

D. none of these

Answer: A

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74. The value of $\begin{vmatrix} a & a^2 - bc & 1 \\ b & b^2 - ca & 1 \\ c & c^2 - ab & 1 \end{vmatrix}$, is

A. 1

B. -1

C. 0

D. $-abc$

Answer: C

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75. If $\alpha + \beta + \gamma = \pi$, then the value of the determinant

$\begin{vmatrix} e^{2i\alpha} & e^{-i\gamma} & e^{-i\beta} \\ e^{-i\gamma} & e^{2i\beta} & e^{-i\alpha} \\ e^{-i\beta} & e^{-i\alpha} & e^{2i\gamma} \end{vmatrix}$, is

A. 4

B. -4

C. 0

D. none of these

Answer: B

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76. If $a \neq b \neq c$, are value of x which satisfies the equation

$$\begin{vmatrix} 0 & x-a & x-b \\ x+a & 0 & x-c \\ x+b & x+c & 0 \end{vmatrix} = 0 \text{ is given by}$$

A. $x = 0$

B. $x = c$

C. $x = b$

D. $x = a$

Answer: A

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77. The repeated factor of the determinant

$$\begin{vmatrix} y+z & x & y \\ z+x & z & x \\ x+y & y & z \end{vmatrix}, \text{ is}$$

A. $z - x$

B. $x - y$

C. $y - z$

D. none of these

Answer: A

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78. The value of the determinant

$$\Delta = \begin{vmatrix} \frac{1-a_1^3b_1^3}{1-a_1b_1} & \frac{1-a_1^3b_2^3}{1-a_1b_2} & \frac{1-a_1^3b_3^3}{1-a_1b_3} \\ \frac{1-a_2^3b_1^3}{1-a_2b_1} & \frac{1-a_2^3b_2^3}{1-a_2b_2} & \frac{1-a_2^3b_3^3}{1-a_2b_3} \\ \frac{1-a_3^3b_1^3}{1-a_3b_1} & \frac{1-a_3^3b_2^3}{1-a_3b_2} & \frac{1-a_3^3b_3^3}{1-a_3b_3} \end{vmatrix}, \text{ is}$$

A. 0

B. dependent only on a_1, a_2, a_3

C. dependent only b_1, b_2, b_3

D. dependent on $a_1, a_2, a_3 b_1, b_2, b_3$

Answer: D

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79. The determinant

$$\Delta = \begin{vmatrix} b & c & b\alpha + c \\ c & d & c\alpha + d \\ b\alpha + c & c\alpha + d & a a^3 - c\alpha \end{vmatrix}$$

is equal to zero, if

A. b, c, d are in A.P

B. b, c, d are in G.P

C. b, c, d are in H.P

D. α is a root of $ax^3 - cx - d = 0$

Answer: B

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80. $\Delta=\begin{vmatrix}1/a & 1 & bc\\ 1/b & 1 & ca\\ 1/c & 1 & ab\end{vmatrix}=$

A. 0

B. abc

C. $\frac{1}{abc}$

D. none of these

Answer: A

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81. If $\begin{vmatrix}1+ax & 1+bx & 1+bx\\ 1+a_1x & 1+b_1x & 1+c_1x\\ 1+a_2x & 1+b_2x & 1+c_2x\end{vmatrix}=A_0+A_1x+A_2x^2+A_3x^3$, then A_1 is equal to

A. abc

B. 0

C. 1

D. none of these

Answer: B

Watch Video Solution

82. If $a \neq 0, b \neq 0, c \neq 0$, then

$$\begin{vmatrix} 1+a & 1 & 1 \\ 1 & 1+b & 1 \\ 1 & 1 & 1+c \end{vmatrix}$$ is equal to

A. abc

B. $abc\left(1+\frac{1}{a}+\frac{1}{b}+\frac{1}{c}\right)$

C. 0

D. $1+\frac{1}{a}+\frac{1}{b}+\frac{1}{c}$

Answer: B

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83. If $1+\frac{1}{a}+\frac{1}{b}+\frac{1}{c}=0$, then

$$\Delta=\begin{vmatrix}1+a & 1 & 1\\ 1 & 1+b & 1\\ 1 & 1 & 1+c\end{vmatrix}$$ is equal to

A. 0

B. abc

C. $-abc$

D. none of these

Answer: A

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84. If a, b and c are all different from zero and

$$\Delta=\begin{vmatrix}1+a & 1 & 1\\ 1 & 1+b & 1\\ 1 & 1 & 1+c\end{vmatrix}=0$$, then the value of $\frac{1}{a}+\frac{1}{b}+\frac{1}{c}$ is

A. abc

B. $\frac{1}{abc}$

C. $-a-b-c$

D. -1

Answer: D

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85. In a ΔABC, a, b, c are sides and A, B, C are angles opposite to them, then the value of the determinant

$$\begin{vmatrix} a^2 & b\sin A & c\sin A \\ b\sin A & 1 & \cos A \\ c\sin A & \cos A & 1 \end{vmatrix}$$, is

A. 0

B. 1

C. 2

D. 3

Answer: A

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86. If $\begin{vmatrix} -12 & 0 & \lambda \\ 0 & 2 & -1 \\ 2 & 1 & 15 \end{vmatrix} = -360$, then the value of λ is

A. -1

B. -2

C. -3

D. 4

Answer: C

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87. If $a_i, i = 1, 2, \ldots\ldots, 9$ are perfect odd squares, then $\begin{vmatrix} a_1 & a_2 & a_3 \\ a_4 & a_5 & a_6 \\ a_7 & a_8 & a_9 \end{vmatrix}$ is always a multiple of

A. 4

B. 7

C. 16

D. 5

Answer: A

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88. If the maximum and minimum values of the determinant

$$\begin{vmatrix} 1+\sin^2 x & \cos^2 x & \sin 2x \\ \sin^2 x & 1+\cos^2 x & \sin 2x \\ \sin^2 x & \cos^2 x & 1+\sin 2x \end{vmatrix}$$ are α and β, then

A. $\alpha + \beta^{99} = 4$

B. $\alpha^3 - \beta^{17} = 26$

C. $\alpha^{2n} - \beta^{2n}$ is always even integer for $n \in N$

D. a triangle can be constructed having its sides as α, β and $\alpha - \beta$

Answer: A::B::C

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89. If [x] denote the greatest integer less than or equal to x then in order that the set of equations $x - 3y = 5, 5x + y = 2, [2\pi]x - [e]y = [2a]$ may be consistent then 'a' should lie in

A. $[3, 7/2)$

B. $(3, 7/3)$

C. $(3, 7/3]$

D. none of these

Answer: A

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90. If $a, b > 0$ and $\Delta(x) = \begin{vmatrix} x & a & a \\ b & x & a \\ b & b & x \end{vmatrix}$, then

A. $\Delta(x)$ is increasing on $\left(-\sqrt{ab}, \sqrt{ab}\right)$

B. $\Delta(x)$ is decreasing on $\left(\sqrt{ab}, \infty\right)$

C. $\Delta(x)$ has a local maximum at $x = \sqrt{ab}$

D. none of these

Answer: C

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91. Let $f(x) = ax^2 + bx + c, a, b, c, \in R$ and equation $f(x) - x = 0$ has imaginary roots α, β. If r, s be the roots of $f(f(x)) - x = 0$, then $\begin{vmatrix} 2 & \alpha & \delta \\ \beta & 0 & \alpha \\ \gamma & \beta & 1 \end{vmatrix}$ is

A. 0

B. purely real

C. purely imaginary

D. none of these

Answer: B

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92. If $g(x)=\begin{vmatrix} f(x+c) & f(x+2c) & f(x+3c) \\ f(c) & f(2c) & f(3c) \\ f(c) & f'(2c) & f'(3c) \end{vmatrix}$, where c is a constant, then $\lim_{x\to 0}\frac{g(x)}{x}$ is equal to

A. 0

B. 1

C. -1

D. none of these

Answer: A

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93. If $a^2+b^2+c^2=-2$ and $f(x)=\begin{vmatrix}1+a^2x & (1+b^2)x & (1+c^2)x \\ (1+a^2)x & 1+b^2x & (1+c^2)x \\ (1+a^2)x & (1+b^2)x & 1+c^2x\end{vmatrix}$,

then f(x) is a polynomial of degree

A. 0

B. 1

C. 2

D. 3

Answer: C

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94. Coefficient of x in $f(x)=\begin{vmatrix}x & (1+\sin x)^3 & \cos x \\ 1 & \log(1+x) & 2 \\ x^2 & (1+x)^2 & 0\end{vmatrix}$ is

A. Δ_2^3

B. Δ_2^2

C. $D \leq ta_2^4$

D. none of these

Answer: A

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Chapter Test

1. Consider the system of equations

$a_1x + b_1y + c_1z = 0$

$a_2x + b_2y + c_2z = 0$

$a_3x + b_3y + c_3z = 0$

If $\begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix} = 0$, then the system has

A. more than two solutions

B. one trivial and one non-trivial solutions

C. no solution

D. only trivial solution $(0, 0, 0)$

Answer: A

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2. If $D = \begin{vmatrix} 1 & 1 & 1 \\ 1 & 1+x & 1 \\ 1 & 1 & 1+y \end{vmatrix}$ for $x \neq 0, y \neq 0$, then D is divisible by

A. x but not y

B. y but not x

C. neither x nor y

D. both x and y

Answer: D

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3. If $\begin{vmatrix} x+a & b & c \\ a & x+b & c \\ a & b & x+c \end{vmatrix} = 0$, then x equals

A. $a+b+c$

B. $-(a+b+c)$

C. $0, a+b+c$

D. $0, \ -(a+b+c)$

Answer: D

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4. $\begin{vmatrix} \sin^2 x & \cos^2 x & 1 \\ \cos^2 x & \sin^2 x & 1 \\ -10 & 12 & 2 \end{vmatrix} =$

A. 0

B. $12\cos^2 x - 10\sin^2 x$

C. $12\sin^2 x - 10\cos^2 x - 2$

D. $10\sin 2x$

Answer: A

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5. The system of linear equations

$x + y + z = 2$

$2x + y - z = 3$

$3x + 2y + kz = 4$

has a unique solution, if

A. $k \neq 0$

B. $-1 < k < 1$

C. $-2 < k < 2$

D. $k = 0$

Answer: A

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6. The roots of the equation

$$\begin{vmatrix} 3x^2 & x^2 + x\cos\theta + \cos^2\theta & x^2 + x\sin\theta + \sin^2\theta \\ x^2 + x\cos\theta + \cos^2\theta & 3\cos^2\theta & 1 + \frac{\sin 2\theta}{2} \\ x^2 + x\sin\theta + \sin^2\theta & 1 + \frac{\sin 2\theta}{2} & 3\sin^2\theta \end{vmatrix} = 0$$

A. $\sin\theta, \cos\theta$

B. $\sin^2\theta, \cos^2\theta$

C. $\sin\theta, \cos^2\theta$

D. $\sin^2\theta, \cos\theta$

Answer: A

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7. $\begin{vmatrix} bc & bc' + b'c & b'c' \\ ca & ca' + c'a & c'a' \\ ab & ab' + a'b & a'b' \end{vmatrix}$ is equal to

A. $(ab - a'b')(bc - b'c')(ca - c'a')$

B. $(ab + a'b')(bc + b'c')(ca + c'a')$

C. $(ab' - a'b)(bc' - b'c)(ca' - c'a)$

D. $(ab' + a'b)(bc' + b'c)(ca' + c'a)$

Answer: C

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8. If α, β, γ are the cube roots of 8 , then $\begin{vmatrix} \alpha & \beta & \gamma \\ \beta & \gamma & \alpha \\ \gamma & \alpha & \beta \end{vmatrix} =$

A. 0

B. 1

C. 8

D. 2

Answer: A

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9. One root of the equation $\begin{vmatrix} 3x-8 & 3 & 3 \\ 3 & 3x-8 & 3 \\ 3 & 3 & 3x-8 \end{vmatrix} = 0$ is

A. $8/3$

B. $2/3$

C. $1/3$

D. $\frac{16}{3}$

Answer: B

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10. If a, b, c are non-zero real numbers then $D = \begin{vmatrix} b^2c^2 & bc & b+c \\ c^2a^2 & ca & c+a \\ a^2b^2 & ab & a+b \end{vmatrix} =$

(A) abc (B) $a^2b^2c^2$ (C) bc+ca+ab (D) 0

A. abc

B. $a^2b^2c^2$

C. $ab + bc + ca$

D. 0

Answer: D

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11. If x, y , z are in A.P., then the value of the det (A) is , where

$$A = \begin{bmatrix} 4 & 5 & 6 & x \\ 5 & 6 & 7 & y \\ 6 & 7 & 8 & z \\ x & y & z & 0 \end{bmatrix}$$

A. 0

B. 1

C. 2

D. none of these

Answer: A

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12. The value of $\begin{vmatrix} b+c & a & a \\ b & c+a & b \\ c & c & a+b \end{vmatrix}$, is

A. 6 abc

B. $a+b+c$

C. 4 abc

D. abc

Answer: C

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13. If a, b, c are non-zero real numbers and if the system of equations $(a-1)x = y = z$ $(b-1)y = z+x$ $(c-1)z = x+y$ has a non-trivial solution, then prove that $ab+bc+ca = abc$

A. $a+b+c$

B. abc

C. 1

D. none of these

Answer: B

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14. If $a \ne 6, b, c$ satisfy $\begin{vmatrix} a & 2b & 2c \\ 3 & b & c \\ 4 & a & b \end{vmatrix} = 0$,then abc =

A. $a+b+c$

B. 0

C. b^3

D. $ab+bc$

Answer: C

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15. The value of $\Delta = \begin{vmatrix} 1^2 & 2^2 & 3^2 \\ 2^2 & 3^2 & 4^2 \\ 3^2 & 4^2 & 5^2 \end{vmatrix}$ is

A. -8

B. -96

C. 400

D. 1

Answer: A

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16. The value of $\Delta = \begin{vmatrix} a & a+b & a+2b \\ a+2b & a & a+b \\ a+b & a+2b & a \end{vmatrix}$ is equal to

A. $9a^2(a+b)$

B. $9b^2(a+b)$

C. $a^2(a+b)$

D. $b^2(a+b)$

Answer: B

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17. If all the elements in a square matrix A of order 3 are equal to 1 or - 1, then $|A|$, is

A. an odd number

B. an even number

C. an imaginary number

D. a real number

Answer: B

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18. The roots of the equation $\begin{vmatrix} 1 & 4 & 20 \\ 1 & -2 & 5 \\ 1 & 2x & 5x^2 \end{vmatrix} = 0$ are

A. $-1, \; -2$

B. $-1, 2$

C. $1, \; -2$

D. $1, 2$

Answer: B

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19. If $f(x) = \begin{vmatrix} \sin x & \cos x & \tan x \\ x^3 & x^2 & x \\ 2x & 1 & 1 \end{vmatrix}$, then $\lim_{x \to 0} \frac{f(x)}{x^2}$, is

A. 3

B. -1

C. 0

D. 1

Answer: D

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20. If A, B and C are the angles of a triangle and

$$\begin{vmatrix} 1 & 1 & 1 \\ 1+\sin A & 1+\sin B & 1+\sin C \\ \sin A+\sin^2 A & \sin B+\sin^2 B & \sin C+\sin^2 C \end{vmatrix}=0,$$ then the triangle ABC is

A. equilateral

B. isosceles

C. any triangle

D. right angled

Answer: B

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21. If $\begin{vmatrix} x & 2 & 3 \\ 2 & 3 & x \\ 3 & x & 2 \end{vmatrix} = \begin{vmatrix} 1 & x & 4 \\ x & 4 & 1 \\ 4 & 1 & x \end{vmatrix} = \begin{vmatrix} 0 & 5 & x \\ 5 & x & 0 \\ x & 0 & 5 \end{vmatrix} = 0,$ then the value of x equals $(x \in R)$:

A. 0

B. 5

C. -5

D. none of these

Answer: C

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22. If $\begin{vmatrix} a+x & a-x & a-x \\ a-x & a+x & a-x \\ a-x & a-x & a+x \end{vmatrix} = 0$, then x is equal to

A. $0, 2a$

B. $a, 2a$

C. $0, 3a$

D. none of these

Answer: C

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23. If $\Delta_1 = \begin{vmatrix} 7 & x & 2 \\ -5 & x+1 & 3 \\ 4 & x & 7 \end{vmatrix}$ and $\Delta_2 = \begin{vmatrix} x & 2 & 7 \\ x+1 & 3 & -5 \\ x & 7 & 4 \end{vmatrix}$, then the value of x for which $\Delta_1 + \Delta_2 = 0$, is

A. 2

B. 0

C. any number

D. none of these

Answer: D

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24. If $\Delta = \begin{vmatrix} 10 & 4 & 3 \\ 17 & 7 & 4 \\ 4 & -5 & 7 \end{vmatrix}$, $\Delta_2 = \begin{vmatrix} 4 & x+5 & 3 \\ 7 & x+12 & 4 \\ -5 & x-1 & 7 \end{vmatrix}$ such that $\Delta_1 + \Delta_2 = 0$, then

A. $x = 5$

B. $x = 0$

C. x has no real value

D. none of these

Answer: A

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25. If $\begin{vmatrix} a & a+d & a+2d \\ a^2 & (a+d)^2 & (a+2d)^2 \\ 2a+3d & 2(a+d) & 2a+d \end{vmatrix} = 0$, then

A. $d = 0$

B. $a + d = 0$

C. $d = 0 r o a + d = 0$

D. none of these

Answer: C

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26. If $\Delta_k = \begin{vmatrix} k & 1 & 5 \\ k^2 & 2n+1 & 2n+1 \\ k^3 & 3n^2 & 3n+1 \end{vmatrix}$, then $\sum_{k=1}^{n} \Delta_k$ is equal to

A. $2\sum_{k=1}^{n} k$

B. $2\sum_{k=1}^{n} k^2$

C. $\frac{1}{2}\sum_{k=1}^{n} k^2$

D. 0

Answer: B

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27. If the system of equations

$bx + ay = c, cx + az = b, cy + bz = a$

has a unique solution, then

A. $abc = 1$

B. $abc = -2$

C. $abc \neq 0$

D. none of these

Answer: C

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28. If a, b, c are non-zero, then the system of equations $(\alpha + a)x + \alpha y + \alpha z = 0, \alpha x + (\alpha + b)y + \alpha z = 0, \alpha x + \alpha y + (\alpha + c)z =$ has a non-trivial solution if $\alpha^{-1} = -(a^{-1} + b^{-1} + c^{-1})$ b. $\alpha^{-1} = a + b + c$ c.$\alpha + a + b + c = 1$ d. none of these

A. $\alpha^{-1} = -(a^{-1} + b^{-1} + c^{-1})$

B. $\alpha^{-1} = a + b + c$

C. $\alpha + a + b + c = 1$

D. none of these

Answer: A

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29. If a,b,c be respectively the p^{th}, q^{th} and r^{th} terms of a H.P., then

$$\Delta = \begin{vmatrix} bc & ca & ab \\ p & q & r \\ 1 & 1 & 1 \end{vmatrix}$$ equals

A. $p+q+r$

B. $(a+b+c)$

C. 1

D. none of these

Answer: D

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30. If $A = \begin{vmatrix} a & b & c \\ x & y & z \\ p & q & r \end{vmatrix}$ and $B = \begin{vmatrix} q & -b & y \\ -p & a & -x \\ r & -c & z \end{vmatrix}$, then

A. $A = 2B$

B. $A = B$

C. $A = -B$

D. none of these

Answer: C

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