MATHS

BOOKS - ML KHANNA

DETERMINANTS

Problem Set 1 Multiple Choice Questions

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

A. 1

B. ω

C. ω^2

D. 0

Answer: D

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2. $\begin{vmatrix} a-b & b-c & c-a \\ b-c & c-a & a-b \\ c-a & a-b & b-c \end{vmatrix}$ =

A. 4abc

B. abc

C. 0

D. None

Answer: C

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3. $\begin{vmatrix} a-b & b-c & c-a \\ x-y & y-z & z-x \\ p-q & q-r & r-p \end{vmatrix}$

A. abc

B. $p+q+r$

C. $x^2y^2z^2$

D. 0

Answer: D

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4. If $\begin{vmatrix} a-b & b-c & c-a \\ x-y & y-z & z-x \\ p-q & q-r & r-p \end{vmatrix}$ is expressible as $\lambda\begin{vmatrix} a & b & c \\ x & y & z \\ p & q & r \end{vmatrix}$ then λ is

A. -1

B. 0

C. 1

D. 2

Answer: B

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5. The value of the determinant $\begin{vmatrix} \sin A & \cos A & \sin(A+\theta) \\ \sin B & \cos B & \sin(B+\theta) \\ \sin C & \cos C & \sin(C+\theta) \end{vmatrix}$ is independent of

A. A

B. B

C. C

D. θ

Answer: A::B::C::D

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

A. abc

B. $\sum a$

C. 0

D. $\left(\sum a\right)^2$

Answer: C

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7. If $\Delta = \begin{vmatrix} 1 & bc & bc(b+c) \\ 1 & ca & ca(c+a) \\ 1 & ab & ab(a+b) \end{vmatrix} =$, then its value is equal to

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

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

C. independent of a,b,c

D. zero

Answer: C::D

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

is equal to

A. abc

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

C. $bc+ca+ab$

D. none of these

Answer: D

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9. If $n \neq 3k$ and $1, \omega, \omega^2$ are the cube roots of units , then $\Delta = \Delta = \begin{vmatrix} 1 & \omega^n & \omega^{2n} \\ \omega^{2n} & 1 & \omega^n \\ \omega^n & \omega^{2n} & 1 \end{vmatrix}$ has the value

A. 0

B. ω

C. ω^2

D. 1

Answer: A

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10. Let $A=\begin{bmatrix}5 & 5\alpha & \alpha\\ 0 & \alpha & 5\alpha\\ 0 & 0 & 5\end{bmatrix}$ If $\left|A^2\right|=25$, then $|\alpha|$ equals :

A. 5^2

B. 1

C. $\frac{1}{5}$

D. 5

Answer: C

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11. Let $\omega = -\frac{1}{2} + i\frac{\sqrt{3}}{2}$, then the value of the determinant

$$\begin{vmatrix} 1 & 1 & 1 \\ 1 & -1-\omega^2 & \omega^2 \\ 1 & \omega^2 & \omega^4 \end{vmatrix}, \text{ is}$$

A. 3ω

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

C. $3\omega^2$

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

Answer: B

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12. If $\Delta = \begin{vmatrix} x_1 + y_1\omega & x_1\omega^2 + y_1 & x_1 + y_1\omega + z_1\omega^2 \\ x_2 + y_2\omega & x_2\omega^2 + y_2 & x_2 + y_2\omega + z_2\omega^2 \\ x_3 + y_3\omega & x_3\omega^2 + y_3 & x_3 + y_3\omega + z_3\omega^2 \end{vmatrix}$

where $1, \omega, \omega^2$ are cube roots of unity then Δ is equal to

A. 0

B. 1

C. -1

D. none of these

Answer: A

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13. If $\Delta = \begin{vmatrix} a_1x + b_1y & a_2x + b_2y & a_3x + b_3y \\ b_1x + a_1y & b_2x + a_2y & b_3x + a_3y \\ b_1x + a_1 & b_2x + a_2 & b_3x + a_3 \end{vmatrix}$ then Δ is equal to

A. $a_1a_2a_3x^2 + b_1b_2b_3y^2$

B. $x^2 + y^2$

C. 0

D. None

Answer: C

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14. If $\Delta = \begin{vmatrix} x_1 + iy_1 & x_1 i - y_1 & z_1 \\ x_2 + iy_2 & x_2 i - y_2 & z_2 \\ x_3 + iy_3 & x_3 i - y_3 & z_3 \end{vmatrix}$ then Δ is

A. -1

B. 2i

C. 0

D. 3i

Answer: C

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15. If $\Delta = \begin{vmatrix} i^n & i^{n+1} & i^{n+2} \\ i^{n+5} & i^{n+4} & i^{n+3} \\ i^{n+6} & i^{n+7} & i^{n+8} \end{vmatrix}$ where $i = \sqrt{-1}$, then its value is

A. $0 \forall n \in R$

B. 1 if $n = 4k$

C. $-i$ if $n = 3k$

D. none

Answer: A

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16. $\begin{vmatrix} 1 & \log_x y & \log_x z \\ \log_y x & 1 & \log_y z \\ \log_z x & \log_z y & 1 \end{vmatrix}$ x, y, z being +ive

A. $\log_y x$

B. $\log_z y$

C. $\log_x z$

D. 0

Answer: D

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17. For positive numbers x,y,s the numberical value of the determinant $\begin{vmatrix} 1 & \log_x y & \log_x z \\ \log_y x & 3 & \log_y z \\ \log_z x & \log_z y & 5 \end{vmatrix}$ is

A. 0

B. log x log y log z

C. 1

D. 8

Answer: D

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18. Prove that $\begin{vmatrix} 1 & a & a^2 - bc \\ 1 & b & b^2 - ca \\ 1 & c & c^2 - ab \end{vmatrix} = 0$

A. abc

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

C. 0

D. none

Answer: C

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19. $\begin{vmatrix} 1 & a & a^2 & a^3+bcd \\ 1 & b & b^2 & b^3+cda \\ 1 & c & c^2 & c^3+abd \\ 1 & d & d^2 & d^3+abc \end{vmatrix}$ =

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

B. $b^3c^3d^3$

C. $c^3d^3a^3$

D. 0

Answer: D

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20. If $\Delta = \begin{vmatrix} \frac{1}{z} & \frac{1}{z} & -\frac{(x+y)}{z^2} \\ -\frac{(y+z)}{x^2} & \frac{1}{x} & \frac{1}{x} \\ -\frac{y(y+z)}{x^2 z} & \frac{x+2y+z}{xz} & -\frac{y(x+y)}{xz^2} \end{vmatrix}$ then Δ is independent of

A. x

B. y

C. z

D. $\Delta = 0$

Answer: A::B::C::D

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

A. λ^2

B. $1/\lambda$

C. $(a^2+\lambda)(b^2+\lambda)(c^2+\lambda)$

D. none

Answer: A

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22. $\begin{vmatrix} 0 & b & -c \\ -b & 0 & a \\ c & -a & 0 \end{vmatrix} =$

A. 0

B. abc

C. $-abc$

D. none

Answer: A

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23. If $a \neq b \neq c$, then one value of x which satisfies the equation.

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

A. x = a

B. x = b

C. x = c

D. x = 0

Answer: D

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24. 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 $\Delta_1 - \Delta_2 = 0$ for values of x equal to

A. 0

B. 2

C. $x \in R$

D. none

Answer: C

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25. If $\Delta_1 = \begin{vmatrix} a & b & 2c \\ p & q & 2r \\ x & y & 2z \end{vmatrix}$ and $\Delta_2 = \begin{vmatrix} r & 2p & q \\ 2z & 4x & 2y \\ c & 2a & b \end{vmatrix}$ then Δ_1 / Δ_2 is equal to

A. 1

B. 2

C. -1

D. $1/2$

Answer: D

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26. If $f(x) = ax^4 + bx^3 + cx^2 + dx + e$

$$= \begin{vmatrix} x^3 + 3x & x - 1 & x + 3 \\ x + 1 & -2x & x - 4 \\ x - 3 & x + 4 & 3x \end{vmatrix}$$ then e=

A. 1

B. -1

C. 2

D. 0

Answer: D

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27. If the determinant $\begin{vmatrix} \cos 2\theta & \sin^2\theta & \cos 4\theta \\ \sin^2\theta & \cos 2\theta & \cos^2\theta \\ \cos 4\theta & \cos^2\theta & \cos 2\theta \end{vmatrix}$ is expanded in powers of $\sin\theta$, then the constant term in the expansion is

A. -1

B. 1

C. 2

D. none

Answer: A

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28. The value of $\Delta = \begin{vmatrix} 1 & \sin 3\theta & \sin^3 \theta \\ 2\cos\theta & \sin 6\theta & \sin^3 2\theta \\ 4\cos^2\theta - 1 & \sin 9\theta & \sin^3 3\theta \end{vmatrix}$ equal to

A. -2

B. -1

C. 1

D. 0

Answer: D

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29. If $A+B+C=\pi$, then the value of $\begin{vmatrix} \sin(A+B+C) & \sin B & \cos C \\ -\sin B & 0 & \tan A \\ \cos(A+B) & -\tan A & 0 \end{vmatrix}$ is equal to

A. 0

B. 1

C. $2\sin B\tan A\cos C$

D. none of these

Answer: A

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30. $\begin{vmatrix} 0 & p-q & p-r \\ q-q & 0 & q-r \\ r-p & r-q & 0 \end{vmatrix}$ is equal to

A. 0

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

C. pqr

D. $3pqr$

Answer: A

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31. 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. any integer

B. zero

C. any even integer

D. any odd integer

Answer: D

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32. If $D_r = \begin{vmatrix} 2^{r-1} & 2(3^{r-1}) & 4(5^{r-1}) \\ x & y & z \\ 2^n - 1 & 3^n - 1 & 5^n - 1 \end{vmatrix}$ then $\sum_{r=1}^{n} D_r =$

A. n

B. n^2

C. n^3

D. 0

Answer: D

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33. If $U_n = \begin{vmatrix} n & 1 & 5 \\ n^2 & 2N+1 & 2N+1 \\ n^3 & 3N^2 & 3N \end{vmatrix}$ then $\sum_{n=1}^{N} U_n =$

A. N

B. $N+1$

C. $N+2$

D. 0

Answer: D

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34. If $\Delta_r = \begin{vmatrix} 2r & x & n(n+1) \\ 6r^2-1 & y & n^2(2n+3) \\ 4r^3-2nr & z & n^3(n+1) \end{vmatrix}$ then the value of $\sum_{r=1}^{n} \Delta_r$ is independent of

A. x

B. y

C. z

D. x, y, z, n

Answer: A , B , C , D

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35. If $\Delta_a = \begin{vmatrix} a-1 & n & 6 \\ (a-1)^2 & 2n^2 & 4n-2 \\ (a-1)^3 & 3n^3 & 3n^2-3n \end{vmatrix}$ then $\sum_{a=1}^{n} \Delta_a$ in 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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36. If $D_r = \begin{vmatrix} 1 & n & n \\ 2r & n^2+n+1 & n^2+n \\ 2r-1 & n^2 & n^2+n+1 \end{vmatrix}$ and $\sum_{r=1}^{n} D_r = 56$ then n equals

A. 4

B. 6

C. 7

D. 8

Answer: C

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37. Let m be a positive integer and $\Delta_r = \begin{vmatrix} 2r-1 & {}^mC_r & 1 \\ m^2-1 & 2^m & m+1 \\ \sin^2(m^2) & \sin^2(m) & \sin^2(m+1) \end{vmatrix} (0 \leq r \leq m)$ Then the value of $\sum_{r=0}^{m} \Delta_r$ is given by a)0 b)m^2-1 c)2^m d)$2^m \sin^2(2^m)$

A. 0

B. m^2-1

C. 2^m

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

Answer: A

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38. The value of the determinant expansion $\begin{vmatrix} b^2-ab & b-c & bc-ac \\ ab-a^2 & a-b & b^2-ab \\ bc-ac & c-a & ab-a^2 \end{vmatrix}$ =

A. abc

B. $a+b+c$

C. 0

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

Answer: C

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39. The value of the determinant $\begin{vmatrix} a+b & a+2b & a+3b \\ a+2b & a+3b & a+4b \\ a+4b & a+5b & a+6b \end{vmatrix}$ is

A. 4abc

B. 0

C. $a^2 + b^2$

D. none

Answer: B

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40. The value of the determinant $\Delta = \begin{vmatrix} \log x & \log y & \log z \\ \log 2x & \log 2y & \log 2z \\ \log 3x & \log 3y & \log 3z \end{vmatrix}$ is

A. 0

B. $\log(xyz)$

C. $\log(6xyz)$

D. $6 \log(xyz)$

Answer: A

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41. If p + q + r = a + b + c = 0, then the determinant $\begin{vmatrix} pa & qb & rc \\ qc & ra & pb \\ rb & pc & qa \end{vmatrix}$ equal to

:

A. 0

B. $ap + bq + cr$

C. 1

D. none of these

Answer: A

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42. If A,B,C be the angles of a triangle , then
$\Delta = \begin{vmatrix} -1+\cos B & \cos C+\cos B & \cos B \\ \cos C+\cos A & -1+\cos A & \cos A \\ -1+\cos B & -1+\cos A & -1 \end{vmatrix}$ is

A. -1

B. 0

C. 1

D. 2

Answer: B

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43. If A,B,C be the angles of a triangle , then the value of $\Delta = \begin{vmatrix} -1 & \cos C & \cos B \\ \cos C & -1 & \cos A \\ \cos B & \cos A & -1 \end{vmatrix}$ is

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

$\Delta = \begin{vmatrix} 1 & 1 & 1 \\ -\cos C & \cot A & -\cos A \\ -\cot B & \cot B & \cot B \end{vmatrix}$ =

A. $1 + \cot B \cot C$

B. $1 + \cot C \cot A$

C. $1 + \cot A \cot B$

D. $1 + \tan A \tan B$

Answer: C

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45. If $a > 0, b > 0, c > 0$ are respectively the pth , qth , rth terms of G.P., then value of the determinant $\begin{vmatrix} \log a & p & 1 \\ \log b & q & 1 \\ \log c & r & 1 \end{vmatrix}$ is

A. 0

B. 1

C. -1

D. none of these

Answer: A

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46. If a,b,c are respectively the pth , qth and rth terms of an H.P. then

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

A. abc

B. $p+q+r$

C. 0

D. none

Answer: C

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47. If $x, y, z(>0)$ are the pth , qth , rth terms of a G.P then the determinant $\begin{vmatrix} \log x^2, 2p & 2 \\ \log y^3, 3q & 3 \\ \log z^4, 4r & 4 \end{vmatrix}$ is

A. 0

B. $x+y+z$

C. pqr

D. xyz

Answer: A

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48. If T_p be the pth term of a G.P. of all +ive terms then

$$\Delta = \begin{vmatrix} \log T_{P+1} & \log T_{P+3} & \log T_{P+5} \\ \log T_{P+3} & \log T_{P+5} & \log T_{P+7} \\ \log T_{P+5} & \log T_{P+7} & \log T_{P+9} \end{vmatrix}$$

is equal to

A. 0

B. 1

C. 2

D. none of these

Answer: A

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49. If $a_1, a_2, \ldots\ldots a_n$ are in G.P. then

$$\Delta = \begin{vmatrix} \log a_n & \log a_{n+1} & \log a_{n+2} \\ \log a_{n+3} & \log a_{n+4} & \log a_{n+5} \\ \log a_{n+6} & \log a_{n+7} & \log a_{n+8} \end{vmatrix}$$

A. 4

B. 2

C. 1

D. 0

Answer: D

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50. The value of $\begin{vmatrix} t_1 & t_2 & t_3 \\ t_2 & t_3 & t_4 \\ t_3 & t_4 & t_5 \end{vmatrix} + \begin{vmatrix} T_1 & T_2 & T_3 \\ T_2 & T_3 & T_4 \\ T_3 & T_4 & T_5 \end{vmatrix}$ where t_i s are in A.P. (a,d) and T_k s are in G.P (A.R) is

A. a + A

B. d + R

C. 0

D. none

Answer: C

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51. If t_1, t_2, t_3 are in A.P. (a,d) and T_1, T_2, T_3 are in H.P. then the value of

$$\Delta = \begin{vmatrix} t_1 - T_1 & t_1 - T_2 & t_1 - T_3 \\ t_2 - T_1 & t_2 - T_2 & t_2 - T_3 \\ t_3 - T_1 & t_3 - T_2 & t_3 - T_3 \end{vmatrix}$$

A. a + d

B. $a^2 + d^2$

C. 0

D. none

Answer: C

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52. If a,b,c be all +ive and p,q,r $\in$ R, then

$$\Delta = \begin{vmatrix} (a^p + a^{-p})^2 & (a^p - a^{-p})^2 & 1 \\ (a^q + a^{-q})^2 & (a^q - a^{-q})^2 & 1 \\ (a^r + a^{-r})^2 & (a^r - a^{-r})^2 & 1 \end{vmatrix} =$$

A. 1

B. 2

C. 3

D. 0

Answer: D

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53. If $f(a) = \begin{vmatrix} 1 & a & a+1 \\ 2a & a(a-1) & (a+1)a \\ 3a(a-1) & a(a-1)(a-2) & (a+1)(a-1) \end{vmatrix}$ then f(100) is equal to

A. 0

B. 1

C. 100

D. -100

Answer: A

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54. $\begin{vmatrix} 265 & 240 & 219 \\ 240 & 225 & 198 \\ 219 & 198 & 181 \end{vmatrix} =$

A. 779

B. 679

C. 0

D. none

Answer: C

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55. If $f(x) = ax^6 + bx^5 + cx^4 + dx^3 + ex^2 + fx + g$

$$= \begin{vmatrix} x^2 - 2x + 3 & 7x + 2 & x + 4 \\ 2x + 7 & x^2 - x + 2 & 3x \\ 3 & 2x - 1 & x^2 - 4x + 7 \end{vmatrix}$$ then g =

A. -200

B. 100

C. 112

D. -108

Answer: D

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56. If $\Delta = \begin{vmatrix} -2a & a+b & a+c \\ b+a & -2b & b+c \\ c+a & c+b & -2c \end{vmatrix} = \lambda(a+b)(b+c)(c+d)$ then λ is equal to

A. 2

B. 4

C. $a+b+c$

D. none

Answer: B

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57. If $U_n = \begin{vmatrix} n & 15 & 8 \\ n^2 & 35 & 9 \\ n^3 & 25 & 10 \end{vmatrix}$ then $\sum_{n=1}^{5} U_n =$

A. 0

B. 25

C. 625

D. none of these

Answer: D

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58. The value of the determinant $\Delta = \begin{vmatrix} 1! & 2! & 3! \\ 2! & 3! & 4! \\ 3! & 4! & 5! \end{vmatrix}$ is

A. $2!$

B. $3!$

C. $4!$

D. $5!$

Answer: C

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59. $\begin{vmatrix} 6i & -3i & 1 \\ 4 & 3i & -1 \\ 20 & 3 & i \end{vmatrix}$ = x + iy then (x,y) is

A. (3,1)

B. (1,3)

C. (0,3)

D. (0,0)

Answer: D

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60. If $\Delta = \begin{vmatrix} -1 & 2+3i & 5-4i \\ 2-3i & 8 & 1-i \\ 5+4i & 1+i & 3 \end{vmatrix}$ then Δ is

A. purely real

B. purely imaginary

C. complex

D. 0

Answer: A

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61. If x,y,z are complex numbers , then $\Delta = \begin{vmatrix} 0 & -y & -z \\ \bar{y} & 0 & -x \\ \bar{z} & \bar{x} & 0 \end{vmatrix}$ is equal to

A. purely real

B. purely imaginary

C. complex

D. 0

Answer: B

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62. The value of the determinant $\begin{vmatrix} \sqrt{6} & 2i & 3+\sqrt{6} \\ \sqrt{12} & \sqrt{3}+\sqrt{8}i & 3\sqrt{2}+\sqrt{6}i \\ \sqrt{18} & \sqrt{2}+\sqrt{12}i & \sqrt{27}+2i \end{vmatrix}$ is

A. complex

B. real

C. irrational

D. rational

Answer: B::D

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63. If $\begin{vmatrix} x & x+y & x+y+z \\ 2x & 3x+2y & 4x+3y+2z \\ 3x & 6x+3y & 10x+6y+3z \end{vmatrix}$ = 64 then x = ?

A. 2

B. 3

C. 4

D. 6

Answer: C

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64. If $f(x) = \begin{vmatrix} a & -1 & 0 \\ ax & a & -1 \\ ax^2 & ax & a \end{vmatrix}$ then f (2x) - f (x) is equal to

A. ax

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

C. $ax(2+3x)$

D. none of these

Answer: B

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65. If $\begin{vmatrix} x+1 & x+2 & x+a \\ x+2 & x+3 & x+b \\ x+3 & x+4 & x+c \end{vmatrix}$ = 0 then a,b,c are in

A. A.P.

B. G.P.

C. H.P.

D. None

Answer: A

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66. If Δ be the determinant given in last question and $\Delta = 0$ then system of lines given by the equation $ax + by + c = 0$ pass through the point

A. (0,0)

B. (1,2)

C. (1,1)

D. (1,-2)

Answer: D

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67. If a,b,c the three integers lying between 1 and 9 which are in A.P. and a 51, b 41 and c 31 be any three digit numbers , then the value of $\begin{vmatrix} 5 & 4 & 3 \\ a51 & b41 & c31 \\ a & b & c \end{vmatrix}$ is

A. $a+b+c$

B. $a-b-c$

C. 0

D. none

Answer: C

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68. If $A_1B_1C_1$, $A_2B_2C_2$ and $A_3B_3C_3$ are three three-digit numbers each of which is divisible by λ then $\Delta = \begin{vmatrix} A_1 & B_1 & C_1 \\ A_2 & B_2 & C_2 \\ A_3 & B_3 & C_3 \end{vmatrix}$ is divisible by

A. λ

B. λ^2

C. 2λ

D. none

Answer: A

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69. Suppose that digit numbers A28,3B9 and 62 C, where A,B and C are integers between 0 and 9 are divisible by a fixed integer k, prove that the determinant $\begin{vmatrix} A & 3 & 6 \\ 8 & 9 & C \\ 2 & B & 2 \end{vmatrix}$ is also divisible by k.

A. λ

B. λ^2

C. 2λ

D. none

Answer: A

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70. 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

A. divisible by neither x nor y

B. divisible by both x and y

C. divisible by x but not y

D. divisible by y but not x

Answer: B

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71. 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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72. If $\Delta = \begin{vmatrix} 4 & 5 & 6 & x \\ 5 & 6 & 7 & y \\ 6 & 7 & 8 & z \\ x & y & z & 0 \end{vmatrix}$ then Δ is equal to

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

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

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

D. none

Answer: A

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73. The value of $\Delta = \begin{vmatrix} 1 & 1 & 1 \\ 1 & \omega & \omega^2 \\ 1 & \omega^2 & \omega \end{vmatrix}$ is (where $\omega = \dfrac{-1+\sqrt{3}i}{2}$)

A. $3\sqrt{3}i$

B. $-3\sqrt{3}i$

C. $-\sqrt{3}i$

D. $\sqrt{3}i$

Answer: B

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74. If ω is a complex cube root of unity, then the value of the determinant

$$\begin{vmatrix} 1 & \omega & \omega+1 \\ \omega+1 & 1 & \omega \\ \omega & \omega+1 & 1 \end{vmatrix}$$ is

A. 0

B. ω

C. 2

D. 4

Answer: D

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75. If ω is a cube root of unity, then a root of the following equation is

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

A. x = 1

B. $x = \omega$

C. $x = \omega^2$

D. x = 0

Answer: D

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76. If ω be imaginary cube root of unity, then

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

A. 0

B. $\lambda^3 + 1$

C. λ^3

D. none

Answer: C

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77. The value of n for which the determinant $\Delta = \begin{vmatrix} {}^8C_3 & {}^9C_5 & {}^{10}C_7 \\ {}^8C_4 & {}^9C_6 & {}^{10}C_8 \\ {}^9C_n & {}^{10}C_{n+2} & {}^{11}C_{n+4} \end{vmatrix}$ = 0 is

A. 2

B. 3

C. 4

D. none

Answer: C

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78. If ω is imaginary cube root of unity then the value of $\begin{vmatrix} 1+\omega & \omega^2 & -\omega \\ 1+\omega^2 & \omega^2 & -\omega^2 \\ \omega^2+\omega & \omega & -\omega^2 \end{vmatrix}$ is equal to

A. 0

B. 2ω

C. $2\omega^2$

D. $-3\omega^2$

Answer: D

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79. If $0 \leq [x] < 2, \ -1 \leq [y] < 1 \text{ and } 1 \leq [z] < 3$ where [.] denotes the greatest integer functions then the maximum value of Δ where

$$\Delta = \begin{vmatrix} [x]+1 & [y] & [z] \\ [x] & [y]+1 & [z] \\ [x] & [y] & [z]+1 \end{vmatrix}$$ is

A. 2

B. 4

C. 6

D. none

Answer: B

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80. If $i=\sqrt{-1}$ and $(1)^{1/4}=1,\omega,\omega^z,\omega^3$ then

$$\Delta=\begin{vmatrix}1 & \omega & \omega^2 & \omega^3\\ \omega & \omega^2 & \omega^3 & 1\\ \omega^2 & \omega^3 & 1 & \omega\\ \omega^3 & 1 & \omega & \omega^2\end{vmatrix}$$ is equal to

A. i

B. $-i$

C. 1

D. 0

Answer: D

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81. If ω is complex cube root of unity, then $\begin{vmatrix} 1 & 1-i & -i \\ 1+i+\omega^2 & -1 & -1+\omega-i \\ \omega^2 & \omega^2-1 & -1 \end{vmatrix}$ =

A. 1

B. ω

C. i

D. 0

Answer: D

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82. 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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83. The sum of two non - integral roots of

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

A. 4

B. -4

C. 16

D. none

Answer: B

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84. If $\begin{vmatrix} a^2+1 & ab & ac \\ ab & b^2+1 & bc \\ ac & bc & c^2+1 \end{vmatrix} = 1$, where a,b,c are real , then

A. $a+b+c=0$

B. $a+b+c=1$

C. $a^2+b^2+c^2=0$

D. $a=b=c=0$

Answer: C::D

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85. The determinant

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

A. x

B. x^2

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

D. none of these

Answer: A::B::C

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86.

$$\begin{vmatrix} b^2+c^2 & ab & ac \\ ab & c^2+a^2 & bc \\ ca & cb & a^2+b^2 \end{vmatrix} = \begin{vmatrix} b^2+c^2 & a^2 & a^2 \\ b^2 & c^2+a^2 & b^2 \\ c^2 & c^2 & a^2+b^2 \end{vmatrix} = \lambda a^2 b^2 c^2$$

then λ =

A. 2

B. 1

C. 4

D. 3

Answer: C

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87. Let a,b,c cube roots of unity and $\Delta = \begin{vmatrix} a^2+b^2 & c^2 & c^2 \\ a^2 & b^2+c^2 & a^2 \\ b^2 & b^2 & c^2+a^2 \end{vmatrix}$,

then

A. Re $(\Delta) = 0$

B. Im $(\Delta) = 0$

C. Re (Δ) + Im $(\Delta) = 0$

D. Re (Δ) + Im $(\Delta) = 4$

Answer: C

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88. Let

$$f(x) = \begin{vmatrix} a^2 + (b^2+c^2)\cos x & ab(1-\cos x) & ac(1-\cos x) \\ ba(1-\cos x) & b^2 + (c^2+a^2)\cos x & bc(1-\cos x) \\ ca(1-\cos x) & cb(1-\cos x) & c^2 + (a^2+b^2)\cos x \end{vmatrix}$$

where x $\in \left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$ and a,b,c

$f(x) =$

A. $\left(\sum a^2\right)\cos x$

B. $\left(\sum a^2\right)^2 \cos^2 x$

C. $\left(\sum a^2\right)^3 \cos^2 x$

D. None

Answer: C

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89. Let

$$f(x) = \begin{vmatrix} a^2 + \left(b^2 + c^2\right)\cos x & ab(1 - \cos x) & ac(1 - \cos x) \\ ba(1 - \cos x) & b^2 + \left(c^2 + a^2\right)\cos x & bc(1 - \cos x) \\ ca(1 - \cos x) & cb(1 - \cos x) & c^2 + \left(a^2 + b^2\right)\cos x \end{vmatrix}$$

where x $\in \left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$ and a,b,c

Max value of f (x) =

A. -1

B. 0

C. 1

D. None

Answer: B

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90. Let

$$f(x) = \begin{vmatrix} a^2 + (b^2 + c^2)\cos x & ab(1 - \cos x) & ac(1 - \cos x) \\ ba(1 - \cos x) & b^2 + (c^2 + a^2)\cos x & bc(1 - \cos x) \\ ca(1 - \cos x) & cb(1 - \cos x) & c^2 + (a^2 + b^2)\cos x \end{vmatrix}$$

where x $\in \left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$ and a,b,c

Max value of f (x) =

A. $\sum a^2$

B. $\left(\sum a^2\right)^2$

C. $\left(\sum a^2\right)^3$

D. None

Answer: C

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91. Let

$$f(x) = \begin{vmatrix} a^2 + \left(b^2 + c^2\right)\cos x & ab(1 - \cos x) & ac(1 - \cos x) \\ ba(1 - \cos x) & b^2 + \left(c^2 + a^2\right)\cos x & bc(1 - \cos x) \\ ca(1 - \cos x) & cb(1 - \cos x) & c^2 + \left(a^2 + b^2\right)\cos x \end{vmatrix}$$

where $\mathrm{x} \in \left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$ and a,b,c

f (x) is max , at x =

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

B. 0

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

D. None

Answer: B

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92. Let

$$f(x)=\begin{vmatrix} a^2+(b^2+c^2)\cos x & ab(1-\cos x) & ac(1-\cos x) \\ ba(1-\cos x) & b^2+(c^2+a^2)\cos x & bc(1-\cos x) \\ ca(1-\cos x) & cb(1-\cos x) & c^2+(a^2+b^2)\cos x \end{vmatrix}$$

where x $\in\left[-\frac{\pi}{2},\frac{\pi}{2}\right]$ and a,b,c

If a^2, b^2, c^2 be in A.P. then $\int_{-\pi/2}^{\pi/2} f(x)dx=$

A. $27b^6$

B. $27b^2\pi$

C. $27b^6 . \pi/2$

D. None

Answer: C

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93. $\begin{vmatrix} -bc & b^2+bc & c^2+bc \\ a^2+ac & -ac & c^2+ac \\ a^2+ab & b^2+ab & -ab \end{vmatrix}$

A. $(bc+ca+ab)^3$

B. $\left(\sum a\right)^3$

C. $\left(\sum a^2\right)^3$

D. none

Answer: A

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94. If $\begin{vmatrix} x & 1 & 5 \\ 1 & 5 & x \\ 5 & x & 1 \end{vmatrix} = \begin{vmatrix} x & 2 & 4 \\ 2 & 4 & x \\ 4 & x & 2 \end{vmatrix} = \begin{vmatrix} x & -1 & 7 \\ -1 & 7 & x \\ 7 & x & -1 \end{vmatrix}$ = 0 , then x =

A. 6

B. -6

C. 0

D. none of these

Answer: B

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95. If t_1, t_2, t_3, t_4, t_5 be in A.P. common difference d then the value of D

$$= \begin{vmatrix} t_2 - t_3 & t_2 & t_1 \\ t_3 - t_4 & t_3 & t_2 \\ t_4 - t_5 & t_4 & t_3 \end{vmatrix} \text{ is}$$

A. 0

B. $2d^2$

C. $2d^3$

D. $2d^4$

Answer: D

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96. If $\begin{vmatrix} y+z & z & y \\ z & z+x & x \\ y & x & x+y \end{vmatrix}$ = k xyz, then k =

A. 1

B. 2

C. 3

D. 4

Answer: D

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97. If $\begin{vmatrix} a-b-c & 2a & 2a \\ 2b & b-c-a & 2b \\ 2c & 2c & c-a-b \end{vmatrix} = (a+b+c)^{\lambda}$, then $\lambda =$

A. 1

B. 2

C. 3

D. none

Answer: C

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98. The value of the determinant $\begin{vmatrix} a+b+2c & a & b \\ c & b+c+2a & b \\ c & a & c+a+2b \end{vmatrix}$ is

A. $2(a+b+c)$

B. $2(a+b+c)^3$

C. $ab+bc+ca$

D. $2bc(ab+bc+ca)$

Answer: B

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99. $\begin{vmatrix} 1+x & 2 & 3 & 4 \\ 1 & 2+x & 3 & 4 \\ 1 & 2 & 3+x & 4 \\ 1 & 2 & 3 & 4+x \end{vmatrix} =$

A. $x(x+10)$

B. $x^2(x+10)$

C. $x^3(x+10)$

D. none

Answer: C

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100. Let $\Delta = \begin{vmatrix} a & a+b & a+b+c \\ 3a & 4a+3b & 5a+4b+3c \\ 6a & 9a+6b & 11a+9b+6c \end{vmatrix}$ where $a = i, b = \omega$ and $c = \omega^2$, then Δ equals

A. ω

B. $-\omega^2$

C. i

D. $-i$

Answer: C

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

A. $1 + \sum a$

B. $1 + \sum \frac{1}{a}$

C. $abc\left[1 + \sum \frac{1}{a}\right]$

D. none

Answer: C

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102. If $\frac{1}{a}, \frac{1}{b}, \frac{1}{c}$ = 0 then $\begin{vmatrix} 1+a & 1 & 1 \\ 1 & 1+b & 1 \\ 1 & 1 & 1+c \end{vmatrix}$ is equal to

A. 0

B. abc

C. $-abc$

D. none of these

Answer: B

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103. The value of the determinant

$$\begin{vmatrix} 1+a & 1 & 1 \\ 1 & 1+a & 1 \\ 1 & 1 & 1+a \end{vmatrix}$$ is

A. $a^3\left(1-\frac{2}{a}\right)$

B. $a^3\left(1+\frac{3}{a}\right)$

C. $a^3\left(1-\frac{3}{a}\right)$

D. $a^3\left(1+\frac{2}{a}\right)$

Answer: B

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

A. 0

B. 1

C. 2

D. 4 pqr

Answer: C

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105. If $a \neq p, b \neq q, c \neq r$ and $\begin{vmatrix} p & b & c \\ a & q & c \\ a & b & r \end{vmatrix} = 0$, then $\frac{p}{p-a}+\frac{q}{q-b}+\frac{r}{r-c}$ is equal to

A. 0

B. 1

C. -1

D. 2

Answer: D

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106. If $\begin{vmatrix} 1+a & 1 & 1 \\ 1+b & 1+2b & 1 \\ 1+c & 1+c & 1+3c \end{vmatrix} = 0$, where, $a \neq 0, b \neq 0, c \neq 0$ and $a^{-1}+b^{-1}+c^{-1}$ is

A. 4

B. -3

C. -2

D. -1

Answer: B

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107. If $\begin{vmatrix} x^2+2x & 2x+1 & 1 \\ 2x+1 & x+2 & 1 \\ 3 & 3 & 1 \end{vmatrix} = (x-1)^k$ then k =

A. 1

B. 2

C. 3

D. 4

Answer: C

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108. $\begin{vmatrix} (x-2)^2 & (x-1)^2 & x^2 \\ (x-1)^2 & x^2 & (x+1)^2 \\ x^2 & (x+1)^2 & (x+2)^2 \end{vmatrix} =$

A. x^4

B. -4

C. 0

D. -8

Answer: D

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109. If $\sum a^2 = -2$ 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 polynomial of degree

A. 3

B. 2

C. 1

D. 0

Answer: B

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110. The value of θ lying between $\theta = 0$ and $\pi/2$ and satisfying the equation $\begin{vmatrix} 1+\sin^2\theta & \cos^2\theta & 4\sin 4\theta \\ \sin^2\theta & 1+\cos^2\theta & 4\sin 4\theta \\ \sin^2\theta & \cos^2\theta & 1+4\sin 4\theta \end{vmatrix} = 0$ are

A. $7\pi/24$

B. $5\pi/24$

C. $11\pi/24$

D. $\pi/24$

Answer: A::C

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111. If the max and values of

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

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

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

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

D. $\exists$ a triangle having sides as α, β and $\alpha - \beta$

Answer: A::B::C

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112. If $\Delta = \begin{vmatrix} 1+\sin^2 x & \cos^2 x & 4\cos^2 x \\ \sin^2 x & 1+\cos^2 x & 4\sin^2 x \\ \sin^2 x & \cos^2 x & 1+4\sin^2 x \end{vmatrix}$ then the maximum value of Δ is

A. 4

B. 6

C. 8

D. 10

Answer: B

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113. The value of the determinant

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

A. $\sin\theta$

B. $\cos\theta$

C. 0

D. none of these

Answer: C

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114. If 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 $-\frac{\pi}{4} \leq x \leq \frac{\pi}{4}$ is

A. 0

B. 2

C. 1

D. 3

Answer: C

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115. If $\Delta = \begin{vmatrix} 1 & a & a^2 \\ \cos(n-1)x & \cos nx & \cos(n+1)x \\ \sin(n-1)x & \sin nx & \sin(n+1)x \end{vmatrix}$ then Δ is

A. independent of x

B. independent of a

C. independent of n

D. none of these

Answer: C

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116. Let $f(x) = \begin{vmatrix} 1 & a & a^2 \\ \sin(n-1)x & \sin nx & \sin(n+1)x \\ \cos(n-1)x & \cos nx & \cos(n+1)x \end{vmatrix}$ then $\int_0^{\pi/2}$ f (x) dx is equal to

A. $a - (1 + a^2)$

B. $1 + a + a^2$

C. $-a + (1 + a^2)$

D. $-(1 + a + a^2)$

Answer: A

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117. If $\Delta = \begin{vmatrix} \sin x . \cos y & \sin x . \sin y & \cos x \\ \cos x . \cos y & \cos x . \sin y & -\sin x \\ -\sin x . \sin y & \sin x . \cos y & 0 \end{vmatrix}$ then Δ is independent of

A. x

B. y

C. constant

D. none of these

Answer: B

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118. If $f(x) = \begin{vmatrix} x^3 & \cos^2 x & 2x^4 \\ \tan^3 x & 1 & \sec 2x \\ \sin^3 x & x^4 & 5 \end{vmatrix}$ then $\int_{-\pi/2}^{\pi/2} f(x)dx$ =

A. 0

B. 2

C. -2

D. 4

Answer: A

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119. If f(x) = $\begin{vmatrix} \cos^2 x & \cos x . \sin x & -\sin x \\ \cos x \sin x & \sin^2 x & \cos x \\ \sin x & -\cos x & 0 \end{vmatrix}$ then for all x

A. 0

B. 1

C. 2

D. none

Answer: B

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120. The determinant

$\begin{vmatrix} \cos(\theta+\phi) & -\sin(\theta+\phi) & \cos 2\phi \\ \sin\theta & \cos\theta & \sin\phi \\ -\cos\theta & \sin\theta & \cos\phi \end{vmatrix}$ is

A. $\neq 0$

B. independent of θ

C. independent of ϕ

D. independent of both θ and ϕ

Answer: B

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121. Let $\Delta = \begin{vmatrix} 1 & \sin\alpha & 1 \\ -\sin\alpha & 1 & \sin\alpha \\ -1 & -\sin\alpha & 1 \end{vmatrix}$ then Δ lies in the interval

A. [2,3]

B. [3,4]

C. [1,4]

D. [2,4]

Answer: D

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

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

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

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

D. none of these

Answer: A

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123. If $\begin{vmatrix} x-2 & 2x-3 & 3x-4 \\ x-4 & 2x-9 & 3x-16 \\ x-8 & 2x-27 & 3x-64 \end{vmatrix}$ = 0 , then x =

A. 1

B. 2

C. 3

D. 4

Answer: D

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124. If $\begin{vmatrix} p+x & p & x \\ p-x & p & x \\ p-x & p & -x \end{vmatrix}$ = 0 then x is

A. p

B. 2p

C. 0

D. 3p

Answer: C

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125. If $\begin{vmatrix} 3x-8 & 3 & 3 \\ 3 & 3x-8 & 3 \\ 3 & 3 & 3x-8 \end{vmatrix}$ = 0 then x =

A. $8/3$

B. $2/3$

C. $1/3$

D. none

Answer: B

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126. If $\begin{vmatrix} 1 & 3 & 9 \\ 1 & x & x^2 \\ 4 & 6 & 9 \end{vmatrix} = 0$ then

A. x = 3

B. x = 3 or x = 6

C. x = 3 or 3/2

D. none of these

Answer: C

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127. If $\begin{vmatrix} 4x & 6x+2 & 8x+1 \\ 6x+2 & 9x+3 & 12x \\ 8x+1 & 12x & 16x+2 \end{vmatrix}$ = 0 then x =

A. 0

B. -11

C. 97

D. $-11/97$

Answer: D

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128. The value of determinant $\begin{vmatrix} x+1 & x+2 & x+4 \\ x+3 & x+5 & x+8 \\ x+7 & x+10 & x+14 \end{vmatrix}$ is

A. -2

B. x^2+2

C. 2

D. none of these

Answer: A

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129. The roots of the equation $\begin{vmatrix} x & 3 & 7 \\ 2 & x & 2 \\ 7 & 6 & x \end{vmatrix}$ = 0 are

A. 9,2,-7

B. 9,-2,7

C. $-9, 2, 7$

D. none

Answer: C

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130. the determinant $\begin{vmatrix} a & b & a\alpha+b \\ b & c & b\alpha+c \\ a\alpha+b & b\alpha+c & 0 \end{vmatrix} = 0$ is equal to zero

if

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

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

C. α is a root of the equation $ax^2+bx+c=0$

D. $(x-\alpha)$ is a factor of $ax^2+2bx+c$

Answer: B::D

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131. Given that $b^2-ac<0$, $a<0$ then the value of

$$\begin{vmatrix} a & b & ax+by \\ b & c & bx+cy \\ ax+by & bx+cy & 0 \end{vmatrix}$$

A. 0

B. $+ive$

C. $-ive$

D. $b^2 + ac$

Answer: B

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132. If $\Delta = \begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix}$ and $\Delta_1 = \begin{vmatrix} a_1 + pb_1 & b_1 + qc_1 & c_1 + ra_1 \\ a_2 + pb_2 & b_2 + qc^2 & c^2 + ra^2 \\ a_3 + pb_3 & b_3 + qc_3 & c_3 + ra_3 \end{vmatrix}$ then $\Delta_1 =$

A. $D' = D$

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

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

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

Answer: D

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133. If the value of the determinant $\begin{vmatrix} x & 1 & 1 \\ 1 & y & 1 \\ 1 & 1 & z \end{vmatrix}$ is positive, then

A. $xyz > 1$

B. $xyz > -8$

C. $xyz < -8$

D. $xyz > -2$

Answer: B

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134. In a triangle ABC if $\begin{vmatrix} 1 & a & b \\ 1 & b & c \\ 1 & c & a \end{vmatrix} = 0$ then the value of $\sin^2 A + \sin^2 B + \sin^2 C =$

A. 1

B. $9/4$

C. $4/9$

D. $3\sqrt{3}$

Answer: B

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135. If each element of a determinant of third order with value A is multiplied by 3, then the value of newly formed determinant is

A. 3A

B. 9A

C. 27A

D. none of these

Answer: C

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136. (a) A function f (x) is an increasing or decreasing function in a particular interval if f'(x) = +ive or - ive in that interval.

(b) (x - a) (x -b), where $a < b$ is - ive for xlying in the interval (a, b) and is + ive for values of x which lie outside this interval, i.e., $x < a \text{ or } x > b$.

The value of a determinant is not changed if we add or subtract in any row (column) equi-multiples of parallel rows or columns.

$$D = \begin{vmatrix} ax - by - c & bx + ay & cx + a \\ bx + ay & -ax + by - c & cy + b \\ cx + a & cy + b & -ax - by + c \end{vmatrix} = 0$$ where $a^2 + b^2 + c^2$ =1 then D = 0 represents the equation of a line.

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137. Δ is a 3rd order determinant having each element in R_1 is sum of 2 terms and each element in R_2 is sum of three terms and each element in 3rd row is sum of four terms. If $\Delta = n\Delta_1$, where Δ_1 , is a determinant having single elements in each row, then n =

A. 6

B. 12

C. 24

D. none

Answer: C

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

A. 1

B. 9

C. 16

D. 24

Answer: D

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139. The value of determinant A of 3rd order is 9 then the value of Δ'^2 where Δ' is a determinant formed by cofactors of the element of Δ is

A. 9

B. 81

C. 729

D. 6561

Answer: D

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140. 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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141. The value of

$$\Delta = \begin{vmatrix} 2 & a+r+2 & a+r \\ a+r+2 & 2(a+1)(r+1) & a(r+1)+r(a+1) \\ a+r & a(r+1)+r(a+1) & 2ar \end{vmatrix}$$

A. 0

B. $-2a(r+1)$

C. $a(ar+r+a)$

D. -1

Answer: A

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142. For a fixed +ive integer n , let D =
$$\begin{vmatrix} (n-1)! & (n+2)! & (n+3)!/n(n+1) \\ (n+1)! & (n+3)! & (n+5)!/n(n+2)(n+3) \\ (n+3)! & (n+5)! & (n+7)!/n(n+4)(n+5) \end{vmatrix}$$
then $\dfrac{D}{(n-1)!(n+1)!(n+3)}$ is equal to

A. -8

B. -16

C. -32

D. -64

Answer: D

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Problem Set 1 True And False

1. The determinants $\begin{vmatrix} 1 & a & bc \\ 1 & b & ca \\ 1 & c & ab \end{vmatrix}$ and $\begin{vmatrix} 1 & a & a^2 \\ 1 & b & b^2 \\ 1 & c & c^2 \end{vmatrix}$ are identically equal.

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2. If $D_r = \begin{vmatrix} r & x & \frac{n(n+1)}{2} \\ 2r & 1 & n^2 \\ 3r & -2 & \frac{n(3n-1)}{2} \end{vmatrix}$ then $\sum_{r=1}^{n} D_r = 0$

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3. Prove that :

$$\begin{vmatrix} a+b & b+c & c+a \\ b+c & c+a & a+b \\ c+a & a+b & b+c \end{vmatrix} = 2\begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix}.$$

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4. $\begin{vmatrix} 1+a_1 & a_2 & a_3 \\ a_1 & 1+a_2 & a_3 \\ a_1 & a_2 & 1+a_3 \end{vmatrix} = 1 + a_1 + a_2 + a_3$.True or False .

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5. $\begin{vmatrix} x & a & a & a \\ a & x & a & a \\ a & a & x & a \\ a & a & a & x \end{vmatrix} = (x+3a)(x-a)^3$

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6. $\begin{vmatrix} \frac{1}{a} & a^2 & bc \\ \frac{1}{b} & b^2 & ca \\ \frac{1}{c} & c^2 & ab \end{vmatrix} = \ldots\ldots\ldots.$

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7. Solve for x, $\begin{vmatrix} x+2 & 2x+3 & 3x+4 \\ 2x+3 & 3x+4 & 4x+5 \\ 3x+5 & 5x+8 & 10x+17 \end{vmatrix} = 0$

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Problem Set 2 Multiple Choice Questions

1. 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 prove that Δ ABC must be isoceles.

A. isosceles

B. equilateral

C. right angled isosceles

D. none of these

Answer: A

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2. If R be the circum radius of the triangle ABC then the value of

$$\frac{R^3}{(a-b)(b-c)(c-a)}\begin{vmatrix} 1 & 1 & 1 \\ \sin A & \sin B & \sin C \\ \sin^2 A & \sin^2 B & \sin^2 C \end{vmatrix}$$ is

A. 8

B. $1/8$

C. 4

D. $1/4$

Answer: B

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3. If a, b, c are sides of a triangle and $\begin{vmatrix} a^2 & b^2 & c^2 \\ (a+1)^2 & (b+1)^2 & (c+1)^2 \\ (a-1)^2 & (b-1)^2 & (c-1)^2 \end{vmatrix} =$ then

A. ΔABC is an equilateral triangle

B. ΔABC is a right angled isosceles triangle

C. ΔABC is an isosceles triangle

D. none of these

Answer: C

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4. If $A+B+C=\pi,$ show that

$$\begin{vmatrix} \sin^2 A & \sin A\cos A & \cos^2 A \\ \sin^2 B & \sin B\cos B & \cos^2 B \\ \sin^2 C & \sin C\cos C & \cos^2 C \end{vmatrix} = -\sin(A-B)\sin(B-C)\sin(C-A)$$

A. $-\sin(A-B)\sin(B-C)\sin(C-A)$

B. $-\cos(A-B)\cos(B-C)\cos(C-A)$

C. $-\tan(A-B)\tan(B-C)\tan(C-A)$

D. none

Answer: A

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5. If x,y,z are all distinct 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 the value of xyz is

A. -2

B. -1

C. -3

D. none of these

Answer: B

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6. If $\begin{vmatrix} x+a & a^2 & a^3 \\ x+b & b^2 & b^3 \\ x+c & c^2 & c^3 \end{vmatrix} = 0, a \neq b \neq c$ then x =

A. $\dfrac{abc}{\sum ab}$

B. $-\dfrac{abc}{\sum ab}$

C. $\frac{\sum ab}{abc}$

D. $-\frac{\sum ab}{abc}$

Answer: B

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7. If a,b,c be all distinct and

$$\begin{vmatrix} a^3-1 & b^3-1 & c^3-1 \\ a & b & c \\ a^2 & b^2 & c^2 \end{vmatrix} = 0 \text{ then}$$

A. $\sum ab = 0$

B. $\sum a = 0$

C. $abc = 1$

D. $\sum a = 1$

Answer: C

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8. If a,b,c are 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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9. If $\begin{vmatrix} x^{\lambda} & x^{\lambda+2} & x^{\lambda+3} \\ y^{\lambda} & y^{\lambda+2} & y^{\lambda+3} \\ z^{\lambda} & z^{\lambda+2} & z^{\lambda+3} \end{vmatrix} = (x-y)(y-z)(z-x)\left(\frac{1}{x}+\frac{1}{y}+\frac{1}{z}\right)$ then λ is

A. -2

B. -1

C. 0

D. 1

Answer: B

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10. Prove that $\begin{vmatrix} x^2 & x^2-(y-z)^2 & yz \\ y^2 & y^2-(z-x)^2 & zx \\ z^2 & z^2-(x-y)^2 & xy \end{vmatrix}$

$= (x-y)(y-z)(z-x)(x+y+z)\left(x^2+y^2+z^2\right)$

A. $(x-y)(y-z)(z-x)\sum x$

B. $(x-y)(y-z)(z-x)\sum xy$

C. $(x-y)(y-z)(z-x)\sum x^2$

D. $(x-y)(y-z)(z-x)\left(\sum x^2\right)\sum x$

Answer: D

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11. If a,b,c are negative distinct real numbers then the determinant $\begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix}$ is

A. < 0

B. ≤ 0

C. > 0

D. ≥ 0

Answer: C::D

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12. 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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13. If $\begin{vmatrix} x & y & z \\ y & z & x \\ z & x & y \end{vmatrix} = -(x+y+z)(x+yk+zk^2)(x+yk^2+zk)$ then k equals

A. 1

B. -1

C. ω

D. $-\omega$

Answer: C

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14. If a,b,c are the roots of $x^3 + px^2 + q = 0$, then the value of $\begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix}$ is equal to

A. $-p^3$

B. $p^3 - 3q$

C. p^3

D. $p^2 - 3q$

Answer: C

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

Answer: A::B::C::D

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16. If both n and r be greater than 1 and if

$\Delta=\begin{vmatrix} {}^{x}C_r & {}^{n-1}C_r & {}^{n-1}C_{r-1} \\ {}^{x+1}C_r & {}^{n}C_r & {}^{n}C_{r-1} \\ {}^{x+2}C_r & {}^{n+1}C_r & {}^{n+1}C_{r-1} \end{vmatrix}=0$, the value of x is equal to

A. n

B. n + 1

C. n - 1

D. none of these

Answer: A::C

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17. If $\Delta = \begin{vmatrix} {}^{10}C_3 & {}^{10}C_4 & {}^{11}C_n \\ {}^{11}C_5 & {}^{11}C_6 & {}^{12}C_{n+2} \\ {}^{12}C_7 & {}^{12}C_8 & {}^{13}C_{n+4} \end{vmatrix}$ = 0 then n is

A. 6

B. 5

C. 4

D. none

Answer: C

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18. If $\Delta = \begin{vmatrix} {}^5C_0 & {}^5C_3 & 14 \\ {}^5C_1 & {}^5C_4 & 1 \\ {}^5C_2 & {}^5C_5 & 1 \end{vmatrix}$, then its value is

A. 0

B. -576

C. 80

D. none

Answer: B

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

D. none of these

Answer: B

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21. $\begin{vmatrix} bc & bc'+b'c & b'c' \\ ca & ca'+ac' & c'a' \\ ab & ab'+a'b & a'b' \end{vmatrix}$ 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: D

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Problem Set 2 True And False

1. $\begin{vmatrix} ax & by & cz \\ x^2 & y^2 & z^2 \\ 1 & 1 & 1 \end{vmatrix} = \begin{vmatrix} a & b & c \\ x & y & z \\ yz & zx & xy \end{vmatrix}$. True or False

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2. $\begin{vmatrix} {}^{x}C_r & {}^{x}C_{r+1} & {}^{x}C_{r+2} \\ {}^{y}C_r & {}^{y}C_{r+1} & {}^{y}C_{r+2} \\ {}^{z}C_r & {}^{z}C_{r+1} & {}^{z}C_{r+2} \end{vmatrix} = \begin{vmatrix} {}^{x}C_r & {}^{x+1}C_{r+1} & {}^{x+2}C_{r+2} \\ {}^{y}C_r & {}^{y+1}C_{r+1} & {}^{y+2}C_{r+2} \\ {}^{z}C_r & {}^{z+1}C_{r+1} & {}^{z+2}C_{r+2} \end{vmatrix}$

A. True

B. False

C.

D.

Answer: T

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3. $\begin{vmatrix} a & b & c \\ c & a & b \\ b & c & a \end{vmatrix} = (a+b+c)\left(a+b\omega+c\omega^2\right)\left(a+b\omega^2+c\omega\right)$ True or False

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Problem Set 2 Fill In The Blanks

1. If $A+B+C=\pi$, then the value of determinant $\begin{vmatrix} \sin^2 A & \cot A & 1 \\ \sin^2 B & \cot B & 1 \\ \sin^2 C & \cot C & 1 \end{vmatrix}$ is equal to

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Problem Set 3 Multiple Choice Questions

1. The value of the determinant

$$\begin{vmatrix} 1 & \cos(B-A) & \cos(C-A) \\ \cos(A-B) & 1 & \cos(C-B) \\ \cos(A-C) & \cos(B-C) & 1 \end{vmatrix}$$ is

A. $4\cos A\cos B\cos C$

B. $2\cos A\cos B\cos C$

C. $4\sin A\sin B\sin C$

D. zero

Answer: D

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2. For all values of A,B,C and P,Q,R the determinant given below

$$\begin{vmatrix} \cos(A-P) & \cos(A-Q) & \cos(A-R) \\ \cos(B-P) & \cos(B-Q) & \cos(B-R) \\ \cos(C-P) & \cos(C-Q) & \cos(C-R) \end{vmatrix}$$ is

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

B. $\sin P\sin Q\sin R$

C. 0

D. $\sum \sin(A + P)$

Answer: C

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3. If a,b,c are the sides of a ΔABC and A, B, C are respectively the angles opposite to them , then

$\begin{vmatrix} a^2 & b\sin A & c\sin A \\ b\sin A & 1 & \cos(B-C) \\ c\sin A & \cos(B-C) & 1 \end{vmatrix}$ is equal to

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

B. abc

C. 1

D. 0

Answer: D

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4. If a,b,c and d are complex numbers, then the determinant

$$\Delta = \begin{vmatrix} 2 & a+b+c+d & ab+cd \\ a+b+c+d & 2(a+b)(c+d) & ab(c+d)+cd(a+b) \\ ab+cd & ab(c+d)+cd(a+b) & 2abcd \end{vmatrix}$$

is independent of

A. a

B. b

C. c

D. d

Answer: A::B::C::D

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5. The value of the determinant

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

A. 1

B. -1

C. 0

D. $a_1a_2a_3b_1b_2b_3$

Answer: C

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6. If $\Delta = \begin{vmatrix} 1+\alpha & 1+\alpha x & 1+ax^2 \\ 1+\beta & 1+\beta x & 1+\beta x^2 \\ 1+\gamma & 1+\gamma x & 1+\gamma x^2 \end{vmatrix}$ then $\Delta =$

A. 0

B. $(\alpha-\beta)(\beta-\gamma)(\gamma-\alpha)$

C. $\alpha\beta\gamma$

D. none

Answer: A

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7. If $l_1^2 + m_1^2 + n_1^2 = 1$ etc. and $l_1 l_2 + m_1 m_2 + n_1 n_2 = 0$ etc. then

$$\Delta = \begin{vmatrix} l_1 & m_1 & n_1 \\ l_2 & m_2 & n_2 \\ l_3 & m_3 & n_3 \end{vmatrix} =$$

A. 1

B. 2

C. 3

D. ± 1

Answer: D

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

A. $\Delta_1 = \Delta_2$

B. $\Delta_1 \neq \Delta_2$

C. $\Delta_1 = \Delta_2 = \left(a^3 + b^3 + c^3 - 3abc\right)^2$

D. none of these

Answer: A::C

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9. If $\Delta^2 = \begin{vmatrix} b^2 + c^2 & ab & ac \\ ab & c^2 + a^2 & bc \\ ac & bc & a^2 + b^2 \end{vmatrix}$, then Δ is equal to

A. $\begin{vmatrix} 0 & c & b \\ c & 0 & a \\ b & a & 0 \end{vmatrix}$

B. $\begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix}$

C. $\begin{vmatrix} 0 & -c & b \\ c & 0 & -a \\ -b & -a & 0 \end{vmatrix}$

D. none

Answer: A

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10. If $s_r = \alpha^r + \beta^r + \gamma^r$, then $\Delta = \begin{vmatrix} s_0 & s_1 & s_2 \\ s_1 & s_2 & s_3 \\ s_2 & s_3 & s_4 \end{vmatrix} =$

A. $\alpha + \beta + \gamma$

B. $\sum \alpha^2$

C. $\sum \alpha\beta$

D. $[(\alpha - \beta)(\beta - \gamma)(\gamma - \alpha)]^2$

Answer: D

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11. If $\Delta = \begin{vmatrix} py + qz & rz - px & qx + ry \\ bp + cq & -ap + cr & aq + br \\ mp + nq & nr - lp & lq + mr \end{vmatrix}$ then $\Delta =$

A. px

B. qy

C. rz

D. 0

Answer: D

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12. If z is a complex number and all a_i 's and b_i 's are real numbers, then

$$\Delta = \begin{vmatrix} a_1z + b_1\bar{z} & a_2z + b_2\bar{z} & a_3z + b_3\bar{z} \\ b_1z + a_1\bar{z} & b_2z + a_2\bar{z} & b_3z + a_3\bar{z} \\ b_1z + a_1 & b_2z + a_2 & b_3z + a_3 \end{vmatrix} =$$

A. $(a_1a_2a_3 + b_1b_2b_3)^2|z|^2$

B. 0

C. $(a_1a_2a_3 - b_1b_2b_3)^2|z|^2$

D. none

Answer: B

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13. $\Delta_1 = \begin{vmatrix} x & b & b \\ a & x & b \\ a & a & x \end{vmatrix}$ and $\Delta_2 = \begin{vmatrix} x & b \\ a & x \end{vmatrix}$ are the given determinations then

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

B. $(d/dx)\Delta_1 = 3\Delta_2$

C. $(d/dx)\Delta_1 = 3(\Delta_2)^2$

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

Answer: B

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14. If y=sin mx the value of the determinant $\begin{vmatrix} y & y_1 & y_2 \\ y_3 & y_4 & y_5 \\ y_6 & y_7 & y_{98} \end{vmatrix}$ where $y_n = \dfrac{d^n y}{dx^n}$ is

A. m^9

B. m^2

C. m^3

D. 0

Answer: D

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15. If F(X) , G(X) and H(X) are three polynomials of degree 2, then $\phi(x) = \begin{vmatrix} F(X) & G(X) & H(X) \\ F'(X) & G'(X) & H'(X) \\ F''(X) & G''(X) & H''(X) \end{vmatrix}$ is a polynomial of degree

A. 2

B. 3

C. 4

D. 0

Answer: D

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16. If f(x) = $\begin{vmatrix} \cos(x+\alpha) & \cos(x+\beta) & \cos(x+\gamma) \\ \sin(x+\alpha) & \sin(x+\beta) & \sin(x+\gamma) \\ \sin(\beta+\gamma) & \sin(\gamma+\alpha) & \sin(\alpha+\beta) \end{vmatrix}$ then

$f(\theta) - 2f(\phi) + f(\psi)$ is equal to

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17. Let $f(x) = \begin{vmatrix} x^3 & \sin x & \cos x \\ 6 & -1 & 0 \\ p & p^2 & p^3 \end{vmatrix}$, where p is a constant .Then $\frac{d^3}{dx^3}$ [f(x)]

at x = 0 is

A. p

B. $p + p^2$

C. $p + p^3$

D. independent of p

Answer: D

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18. If

$f(x) = \mid (x^n, \sin x, \cos x), \left(n!, \sin\left(\frac{n\pi}{2}\right), \cos\left(\frac{n\pi}{2}\right)\right), (a, a^2, a^3)\right) \mid$, *the*

d^n/dx^n [f(x)] at x=0` is 0

A. 0

B. p

C. p^3

D. independent of p

Answer: A::D

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19. Let

$f(x) = \left|\cos(x + x^2)\sin(x + x^2) - \cos(x + x^2)\sin(x - x^2)\cos(x - x^2)\sin\right.$

. Find the value of $f'(0)$.

A. 4

B. 2

C. 3

D. 0

Answer: B

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20. If a,b,c be real , then determine the interval of monotonicity of the function

$$f(x) = \begin{vmatrix} x+a^2 & ab & ac \\ ab & x+b^2 & bc \\ ac & bc & x+c^2 \end{vmatrix}$$

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21. If $\Delta = \begin{vmatrix} x^2-5x+3 & 2x-5 & 3 \\ 3x^2+x+4 & 6x+1 & 9 \\ 7x^2-6x+9 & 14x-6 & 21 \end{vmatrix} = ax^3+bx^2+cx+d$ then Δ

i.e. $\dfrac{d}{dx}(\Delta)$ =

A. 6

B. 5

C. 4

D. 0

Answer: D

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22. If $\Delta = \begin{vmatrix} x & x^2 & x^3 \\ 1 & 2x & 3x^2 \\ 0 & 2 & 6x \end{vmatrix}$ then $\frac{d}{dx}(\Delta) =$

A. 6

B. 6x

C. $6x^2$

D. 0

Answer: C

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23. If $f(x) = \begin{vmatrix} x+a^2 & x^4+1 & 3 \\ x+b^2 & 2x^4+2 & 3 \\ x+c^2 & 3x^4+7 & 3 \end{vmatrix}$ where $x \neq 0$ and f' (x) = 0 then a^2, b^2, c^2 are in

A. A.P.

B. G.P.

C. H.P.

D. none

Answer: A

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24. If

$$\Delta = \begin{vmatrix} x+1 & x^2+2 & x(x+1) \\ x^2+1 & x+1 & x^2+2 \\ x^2+2 & x(x+1) & x+1 \end{vmatrix} = p_0x^6 + p_1x^5 + p_2x^4 + p_3x^3 + p_4x^2$$

then (p_5, p_6) =

A. (-3,-7)

B. (-5,9)

C. (-3,-5)

D. (-3,7)

Answer: B

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25. If $\Delta(x) = \begin{vmatrix} e^{x^2} & \log(1+x) \\ \tan x & \sin x \end{vmatrix}$, then $\underset{x \to 0}{Lt} \frac{\Delta(x)}{x} =$

A. -1

B. 0

C. 1

D. none

Answer: C

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26. The system of equations

$\alpha x + y + z = \alpha - 1,$

$x + \alpha y + z = \alpha - 1$

$x + y + \alpha z = \alpha - 1$

and has no solution if α is

A. not -2

B. 1

C. -2

D. either - 2 or 1

Answer: D

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Problem Set 3 True And False

1. Prove that $\frac{d}{dx}\begin{vmatrix} u_1 & v_1 & w_1 \\ u_2 & v_2 & w_2 \\ u_3 & v_3 & w_3 \end{vmatrix} = \begin{vmatrix} u_1 & v_1 & w_1 \\ u_2 & v_2 & w_2 \\ u_4 & v_4 & w_4 \end{vmatrix}$ where u, v, w are functions of x and $\frac{du}{dx} = u_1, \frac{d^2u}{dx^2} = u_2,$ etc.

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Problem Set 3 Fill In The Blanks

1. If $f_r(x), g_r(x), h_r(x), r = 1, 2, 3$ are polynomials in x such that $f_r(a) = g_r(a) = h_r(a), r = 1, 2, 3$ and $F(x) = \begin{vmatrix} f_1(x) & f_2(x) & f_3(x) \\ g_1(x) & g_2(x) & g_3(x) \\ h_1(x) & h_2(x) & h_3(x) \end{vmatrix}$

then F' at x = a is ....

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2. If $a_i, b_i \in N$ for i 1,2,3, then coefficient of x in the determinant;

$$\begin{vmatrix} (1+x)^{a_1 b_1} & (1+x)^{a_1 b_2} & (1+x)^{a_1 b_3} \\ (1+x)^{a_2 b_1} & (1+x)^{a_2 b_2} & (1+x)^{a_2 b_3} \\ (1+x)^{a_3 b_1} & (1+x)^{a_3 b_2} & (1+x)^{a_3 b_3} \end{vmatrix}$$

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3. If $\begin{vmatrix} e^x & \sin x \\ \cos x & \log_e(1+x^2) \end{vmatrix} = p + qx + rx^2 + \dots.$ then p =...... and q = ...

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4. Let α, β be the roots of the equation $ax^2 + bx + c = 0$. Let $S_n = \alpha^n + \beta^n$ for $n > 1$.Let $\Delta = \begin{vmatrix} 3 & 1+s_1 & 1+s_2 \\ 1+s_1 & 1+s_2 & 1+s_3 \\ 1+s_2 & 1+s_3 & 1+s_4 \end{vmatrix}$

Then $\Delta = \dots\dots$

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5. If a_1, a_2, a_3 and b_1, b_2, b_3 all $\in R$ be such that product of any member of first set with any member of the other set is not equal to 1, then

$$\Delta = \begin{vmatrix} \frac{1-a_1^3b_1^3}{1-a_1b_1} & (a_1, b_2) & (a_1, b_3) \\ (a_2, b_1) & (a_2, b_2) & (a_2, b_3) \\ (a_3, b_1) & (a_3, b_2) & (a_3, b_3) \end{vmatrix}$$ is

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Problem Set 4 Multiple Choice Questions

1. If the three equations are consistent

$$(a+1)^3x + (a+2)^3y = (a+3)^3$$

$$(a+1)x + (a+2)y = (a+3)$$

x + y = 1, then a =

A. 1

B. 2

C. -2

D. 3

Answer: C

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2. The value of a for which the system of equations

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

$ax + (a+1)y + (a+2)z = 0$

$x + y + z = 0$

has a non-zero solution is

A. 1

B. 0

C. -1

D. none of these

Answer: C

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3. If the system of linear equations.

$x + 4ay + az = 0$

$x + 3by + bz = 0$

$x + 2cy + cz = 0$

have a non-zero solution, then a,b,c are in .

A. A.P.

B. G.P.

C. H.P.

D. None

Answer: C

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4. If $a = \frac{x}{y-z}, b = \frac{y}{z-x}$ and $c = \frac{z}{x-y}$ where x,y,z are not all zero , then $ab + bc + ca =$

A. 0

B. 1

C. -1

D. 2

Answer: C

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5. Given $x = cy + bz, y = az + cx, z = bx + ay$ where x, y, z are not all zero, then $a^2 + b^2 + c^2 + 2abc =$

A. 0

B. 1

C. 2

D. none

Answer: B

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6. $x + ay = 0, y + az = 0, z + ax = 0$ The value of a for which the system of equations has infinitely many solutions is

A. a = 1

B. a = 0

C. a = -1

D. no value

Answer: C

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7. If the system of equations $x = a(y + z), y = b(z + x), z = c(x + y), (a, b, c \neq 1)$ has a non-zero solution, then the value of $\frac{a}{1 + a} + \frac{b}{1 + b} + \frac{c}{1 + c}$ is

A. 2

B. 1

C. 0

D. -1

Answer: B

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8. 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 $\frac{a}{1-a} + \frac{b}{1b} + \frac{c}{1-c}$ is

A. 0

B. 1

C. -1

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

Answer: C

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9. If $a \neq p, b \neq q, c \neq r$ and $\begin{vmatrix} p & b & c \\ a & q & c \\ a & b & r \end{vmatrix} = 0$, then $\frac{p}{p-a} + \frac{q}{q-b} + \frac{r}{r-c}$ is equal to

A. 0

B. 1

C. -1

D. 2

Answer: D

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10. If x,y,z are not all zeros and $ax + y + z = 0, x + by + z = 0, x + y + cz = 0$ then $\frac{1}{1-a} + \frac{1}{1-b} + \frac{1}{1-c} =$

A. 1

B. -1

C. 2

D. 1

Answer: A::D

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11. If the equations $x + ay - z = 0, 2x - y + az = 0$ and $ax + y + 2z = 0$ are consistent, then a is equal to

A. -2

B. 2

C. $1+\sqrt{3}$

D. $1-\sqrt{3}$

Answer: A::C::D

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12. If the equations $ax+by+cz=0, bx+cy+az=0$ and $cx+ay+bz=0$ have a non-zero 'solution, then which one of the following is true

A. $a+b+c=0$

B. $a=b=0$

C. $(a-b)+(b-c)^2+(c-a)^2=0$

D. none of these

Answer: A::B::C

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13. If the equations

$(b+c)x+(c+a)y+(a+b)z=0,$

$cx+ay+bz=0,$

$ax+by+cz=0$

are consistent with more than one solution, then

A. $a+b+c=0$

B. $a=b=c$

C. $a+b+c=2$

D. $2a=3b=4c$

Answer: A::B

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14. If $a > b > c$ and the system of equtions ax +by +by +cz =0,n bx +cy+az=0,cx+ay+bz=0 has a non-trivial solution then both the roots of the equadratic equation

$at^2 + bt + c$ are

A. real

B. of opposite sign

C. positive

D. complex

Answer: A::B

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15. If the system of equations $x - ky - z = 0, kx - y - z = 0, x + y - z = 0$ has a non -zero solution then the possible values of k are

A. $-1, 2$

B. $1, 2$

C. $0, 1$

D. $-1, 1$

Answer: D

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16. The number of values of k for which the system of equations

$(k+1)x + 8y = 4k$

$kx + (k+3)y = 3k - 1$

has infinitely many solutions is

A. 0

B. 1

C. 2

D. infinite

Answer: B

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17. Let a, b, c be the real numbers. The following system of equations in $x, y, andz$

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

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

A. unique

B. finitely many

C. infinitely many

D. does not exist

Answer: A

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18. The system of equations $\lambda x + y + z = 1, x + \lambda y + z = \lambda$ and $x + y + \lambda z = \lambda^2$ has no solution if λ equals

A. 0

B. 1

C. -1

D. -2

Answer: D

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19. $2x - y - 2z = 2, x - 2y + z = -4, x + y + \lambda z = 4$ then the value of λ such that system of equations has no solution, is

A. 1

B. 2

C. 3

D. -3

Answer: A

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20. A line AB in three-dimensional space makes angles 45° and 120° with the positive x-axis and the positive y-axis respectively. If AB makes an acute angle with the positive z-axis, then θ equals

A. 45°

B. 60°

C. 75°

D. 30°

Answer: A

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Problem Set 4 True And False

1. Let α_1, α_2 and β_1, β_2 be the roots of $ax^2 + bx + c = 0$ and $px^2 + qx + r = 0$ respectively. If the system of equations $\alpha_1 y + \alpha_2 z = 0$ and $\beta_1 y + \beta_2 z = 0$ has non-trivial solution, then $\frac{b^2}{q^2} = \frac{ac}{pr}$. True or False

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2. There is no solution for the equations

$x + 4y - 2z = 3$

$3x + y + 5z = 7$

$2x + 3y + z = 5$. True or False.

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3. The system of equations

$(a - b)x + (b - c)y + (c - a)z = 0$

$(b - c)x + (c - a)y + (a - b)z = 0$

$(c-a)x+(a-b)y+(b-c)z=1$

has no solution.

A. True

B. False

C.

D.

Answer: T

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Problem Set 4 Fill In The Blanks

1. If the equations $x=ay+z, y=az+x$ and $z=ax+y, (a \neq 0)$ are consistent having a non-trivial solution, then $a^2+3= ....$

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2. The system of equations ax + y + z = 0 , -x + ay + z = 0 and - x - y + az = 0 has a non-zero solution if the real value of 'a' is

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3. For what values of p and q the system of equations $2x+py+6z=8, x+2y+qz=5, x+y+3z=4$ has i no solution ii a unique solution iii in finitely many solutions.

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4. For what values of p and q the system of equations

$2x+5y+pz=q$

$x+2y+3z=14$

$x+y+z=6$ is consistent ?

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5. The values of λ and μ for which the system of equations

$x + y + z = 6$

$x + 2y + 3z = 10$

and $x + 2y + \lambda z = \mu$

has infinite-number of solutions are ....

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Miscellaneous Exercise

1. Consider the following linear equations

$ax + by + cz = 0, bx + cy + az = 0, cx + ay + bz = 0$

	Column I		Column II
A.	$a+b+c \neq 0$ and $a^2+b^2+c^2 = ab+bc+ca$	p.	The equations represent planes meeting only at a single point
B.	$a+b+c = 0$ and $a^2+b^2+c^2 \neq ab+bc+ca$	q.	The equations represent the line $x = y = z$
C.	$a+b+c \neq 0$ and $a^2+b^2+c^2 \neq ab+bc+ca$	r.	The equations represent identical planes
D.	$a+b+c = 0$ and $a^2+b^2+c^2 = ab+bc+ca$	s.	The equations represent the whole of the three-dimensional space

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Self Assessment Test

1. 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 = a

C. x = b

D. x = c

Answer: A

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

A. abc

B. 2abc

C. 3abc

D. 4abc

Answer: D

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3. $\begin{vmatrix} 1 & 1 & 1 \\ a & b & c \\ a^3 & b^3 & c^3 \end{vmatrix}$ =

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

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

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

D. none of these

Answer: C

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4. $\begin{vmatrix} \frac{1}{a} & a^2 & bc \\ \frac{1}{b} & b^2 & ca \\ \frac{1}{c} & c^2 & ab \end{vmatrix} =$

A. abc

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

C. $ab + bc + ca$

D. 0

Answer: D

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5. If $x = -9$ is a root of $\begin{vmatrix} x & 3 & 7 \\ 2 & x & 2 \\ 7 & 6 & x \end{vmatrix} = 0$ then other two roots are.....................

A. 2,7

B. $-2, 7$

C. $2, -7$

D. $-2, -7$

Answer: A

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6. The solution of the equation $\begin{vmatrix} x & 2 & -1 \\ 2 & 5 & x \\ -1 & 2 & x \end{vmatrix}$ = 0 are

A. $3, \ -1$

B. $-3, 1$

C. $3, 1$

D. $-3, \ -1$

Answer: A

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7. The roots of the equation $\begin{vmatrix} 0 & x & 16 \\ x & 5 & 7 \\ 0 & 9 & x \end{vmatrix}$ = 0 are

A. $0, 12, 12$

B. $0, 12, \ -12$

C. $0, 12, 16$

D. $0, 9, 16$

Answer: B

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8. $\begin{vmatrix} a+b & b+c & c+a \\ b+c & c+a & a+b \\ c+a & a+b & b+c \end{vmatrix} = k \begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix}$ then k =

A. 1

B. 2

C. 3

D. 4

Answer: B

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9. 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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10. If $\begin{vmatrix} -a^2 & ab & ac \\ ab & -b^2 & bc \\ ac & bc & -c^2 \end{vmatrix} = ka^2b^2c^2$, then k =

A. 4

B. 6

C. -4

D. 8

Answer: C

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11. If $\omega \neq 1$ is a cube root of unity and

$$\Delta = \begin{vmatrix} x+\omega^2 & \omega & 1 \\ \omega & \omega^2 & 1+x \\ 1 & x+\omega & \omega^2 \end{vmatrix} = 0$$ then value of x is

A. x = 0

B. x = 1

C. x = 2

D. x = - 1

Answer: A

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12. $\begin{vmatrix} (a^x + a^{-x})^2 & (a^x - a^{-x})^2 & 1 \\ (b^x + b^{-x})^2 & (b^x - b^{-x})^2 & 1 \\ (c^x + c^{-x})^2 & (c^x - c^{-x})^2 & 1 \end{vmatrix}$ =

A. 0

B. abc

C. 2abc

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

Answer: A

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13. The number of values of k which the linear equations

4x+ky+2z=0

kx+4y+z=0

2x+2y+z=0

Possess a non-zero solution is

A. 0

B. 1

C. 2

D. 3

Answer: C

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14. The value of k for which the set of equations $x + ky + 3z = 0, 3x + ky - 2z = 0, 2x + 3y - 4z = 0$ has a non-trivial solution over the set of rationals is

A. 15

B. 16

C. $\frac{31}{2}$

D. $\frac{33}{2}$

Answer: D

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15. If $x+y+z=0, 4x+3y-z=0$ and $3x+5y+3z=0$ is the given system of equations, then which of the following is correct?

A. it is inconsistant

B. it has only single solution x = 0, y =0, z =0

C. determinant of coefficients of matrix is zero

D. none of these

Answer: B

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16. The system of equations $x+y+z=2, 3x-y+2z=6$ and $3x+y+z=-18$ has

A. a unique solution

B. no solution

C. infinite no. of solutions

D. none of these

Answer: A

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17. The system of equations $x+y+z=6, x+2y+3z=10, x+2y+\lambda z=\mu$ has no solution for

A. $\lambda \neq 3, \mu=10$

B. $\lambda=3, \mu \neq 0$

C. $\lambda \neq 3, \mu \neq 0$

D. none of these

Answer: B

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18. 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 has

A. infinite solutions

B. three solutions

C. unique solution

D. no solution

Answer: D

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19. 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. 0

B. an even number

C. an odd integer

D. any integer

Answer: C

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