MATHS

BOOKS - MCGROW HILL EDUCATION MATHS (HINGLISH)

DETERMINANTS

Solved Examples

1. Let

$$\Delta(x, y) = \begin{vmatrix} 1 & x & y \\ 1 & x+y & y \\ 1 & x & x+y \end{vmatrix}$$

Then $\Delta(-3, 2)$ equals

A. 13

B. -6

C. 12

D. -3

Answer: B

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2. Suppose a,b,c are distinct real number and $\Delta = \begin{vmatrix} a & a^2 & b+c \\ b & b^2 & c+a \\ c & c^2 & a+b \end{vmatrix} = 0$

Then $a+b+c$ equals

A. -1

B. 2

C. 0

D. -5

Answer: B

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3. Suppose $A = a_{ij} \_ (3 \times 3),$ where $a_{ij} \varepsilon R$ if det (adjA)=25, then |det (A)| equals

A. 5

B. 12.5

C. $5\sqrt{5}$

D. $5^{2/3}$

Answer: A

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

A. 0

B. abc

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

D. $bc + ca + ab$

Answer: A

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5. Let $A = (a_{ij})_{3 \times 3}$, where $a_{ij} \varepsilon C$ the set of complex number.s If $\det(A) = 2 - 3i$, then $\det(A)$ equals:

A. $\frac{1}{13}(2 - 3i)$

B. $\frac{1}{13}(2 + 3i)$

C. $2 - 3i$

D. $2 + 3i$

Answer: B

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

B. $\frac{5}{4}$

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

D. 2

Answer: A

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7. If $\begin{vmatrix} x^2+x & x+1 & x-2 \\ 2x^2+3x-1 & 3x & 3x-3 \\ x^2+2x+3 & 2x-1 & 2x-1 \end{vmatrix} = xA + B$ then

A. 12

B. 18

C. 24

D. 30

Answer: C

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8. Suppose a,b,c are three integers such $a < b < c$ and p is a prime number

Let $\Delta = \begin{vmatrix} a & a^2 & p + a^3 \\ b & b^2 & p + b^3 \\ c & c^2 & p + c^3 \end{vmatrix}$

If $\Delta = 0$ then which one of the following is not true

A. $a = -1, b = 1$

B. $b = 1, c = p$

C. $a = 0, c = p$

D. $abc + p = 0$

Answer: C

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9. Suppose

$$P(x) = \begin{vmatrix} x & -51 & -71 \\ 51 & x & -73 \\ 71 & 73 & x \end{vmatrix}$$

Product of zeros of P(x) is

A. 0

B. 195

C. -195

D. -26433

Answer: A

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10. Let

$$P(x) = \begin{vmatrix} x & -3+4i & 3-4i \\ x & -7i & 5+6i \\ -x & 7-2i & -7-2i \end{vmatrix}$$

The number of values of x for which $P(x) = 0$ is

A. 0

B. 1

C. 2

D. 3

Answer: B

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11. Let

$$\Delta(\theta) = \begin{vmatrix} 1 & \sin\theta & 1 \\ \sin\theta & 1 & \sin\theta \\ -1 & -\sin\theta & 1 \end{vmatrix}, 0 \le \theta \le 2\pi$$

solution of $\Delta(\theta) = 3$ is

A. $\left\{\frac{\pi}{2}, \frac{3\pi}{2}\right\}$

B. $\left\{\frac{\pi}{4}, \frac{3\pi}{4}, \frac{5\pi}{4}, \frac{7\pi}{4}\right\}$

C. $\left\{\frac{\pi}{4}, \frac{3\pi}{4}\right\}$

D. $\left\{\frac{\pi}{4}, \frac{\pi}{2}, \frac{3\pi}{4}, \pi\right\}$

Answer: B

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12. Suppose $a \varepsilon R$ and $x \neq 0$. Let

$$\Delta(x) = \begin{vmatrix} 1-x & a & a^2 \\ a & a^2-x & a^3 \\ a^2 & a^3 & a^4-x \end{vmatrix}$$

Number of values of x which $\Delta(x) = 0$ is

A. 0

B. 1

C. 2

D. 3

Answer: B

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13. If

$$\begin{vmatrix} a^2 & b^2 & c^2 \\ (a+\lambda)^2 & (b+\lambda)^2 & (c+\lambda)^2 \\ (a-\lambda)^2 & (b-\lambda)^2 & (c-\lambda)^2 \end{vmatrix} = k\lambda \begin{vmatrix} a^2 & b^2 & c^2 \\ a & b & c \\ 1 & 1 & 1 \end{vmatrix}$$

$\lambda \neq 0$ then k is equal to

A. $4\lambda abc$

B. $-4\lambda abc$

C. $4\lambda^2$

D. $-4\lambda^2$

Answer: C

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14. Let

$f(\theta) = \begin{vmatrix} 1 & \cos\theta & -1 \\ -\sin\theta & 1 & -\cos\theta \\ -1 & \sin\theta & 1 \end{vmatrix}$ Suppose A and B are respectively maximum and minimum value of $f(\theta)$. Then (A,B) is equal to

A. (2,1)

B. (2,0)

C. $(\sqrt{2}, 0)$

D. $\left(2, \frac{1}{\sqrt{2}}\right)$

Answer: B

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15. 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. -1

Answer: B

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Solved Examples Level 1 Single Correct Answer Type Questions

1. Let

$$P(x) = \begin{vmatrix} 7 & 6 & x-10 \\ 2 & x-10 & 5 \\ x-10 & 3 & 4 \end{vmatrix}$$

sum of zeros of P(x) is

A. 30

B. 28

C. 27

D. 25

Answer: A

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2. Let

$$P(x)=\begin{vmatrix} x^2-13 & 4 & 2 \\ 3 & x^2-13 & 7 \\ 6 & 5 & x^2-13 \end{vmatrix}$$

If x=-2 is a zero of P(x), then sum of the remaining five zerord id

A. -2

B. 0

C. 2

D. 3

Answer: C

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3. If $\alpha, \beta \neq 0$, and $f(n)=\alpha^n+\beta^n$ and

$|31+f(1)1+f(2)1+f(1)1+f(2)1+f(3)1+f(2)1+f(3)1+f(4)| =$

, then K is equal to (1) $\alpha\beta$ (2) $\frac{1}{\alpha\beta}$ (3) 1 (4) -1

A. 1

B. $4\alpha\beta$

C. 9

D. $\alpha^2\beta^2$

Answer: A

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4. Suppose a,b and c are distinct real numbers. Let

$$\Delta = \begin{vmatrix} a & a+c & a-b \\ b-c & b & a+b \\ c+b & c-a & c \end{vmatrix} = 0$$

Then the straight $a(x-5)+b(y-2)+c=0$ passes through the fixed point

A. (5,2)

B. (6,2)

C. (6,3)

D. (5,3)

Answer: C

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5. Suppose a,b,c and x real numbers. Let

$$\Delta = \begin{vmatrix} 1+a & 1+ax & 1+ax^2 \\ 1+b & 1+bx & 1+bx^2 \\ 1+c & 1+cx & 1+cx^2 \end{vmatrix}$$

Then Δ is independent of

A. a,b,c

B. x

C. a,b,c,x

D. None of these

Answer: C

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6. Suppose $a, b, c, \; > 1$ and

$$f(x) = \begin{vmatrix} a^{-x} & a^{x} & x \\ b^{-3x} & b^{3x} & 3x^3 \\ c^{-5x} & c^{5x} & 5x^5 \end{vmatrix}, x \varepsilon R$$ then f is

A. a constant function

B. a polynomial of degree 5

C. an odd function

D. an even funtion

Answer: D

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7. Suppose n,m are natural numbers and

$$f(x) = \begin{vmatrix} 1 & (1+x)^m & (1+mx)^{mn} \\ (1+mx)^n & 1 & (1+nx)^{mn} \\ (1+nx)^m & (1+x)^n & 1 \end{vmatrix}$$

constant term of the polynomial $f(x)$ is

A. 1

B. $m+n$

C. $m-n$

D. 0

Answer: D

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8. Suppose a,b,c are sides of a scalene triangle. Let

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

Then

A. $\Delta \leq 0$

B. $\Delta < 0$

C. $\Delta > 0$

D. $\Delta \geq 0$

Answer: B

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9. If A,B and C are angle of a triangle of a triangle ,the value of $\begin{vmatrix} e^{2iA} & e^{-iC} & e^{-iB} \\ e^{-iC} & e^{-2iB} & e^{-iA} \\ e^{-iB} & e^{-iBA} & e^{2iC} \end{vmatrix}$ is (where i=$\sqrt{-1}$)

A. -1

B. -4

C. 0

D. 4

Answer: B

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10. Show that if $x_1, x_2, x_3 \neq 0$

$$\begin{vmatrix} x_1 + a_1b_1 & a_1b_2 & a_1b_3 \\ a_2b_1 & x_2 + a_2b_2 & a_2b_3 \\ a_3b_1 & a_3b_2 & x_3 + a_3b_3 \end{vmatrix}$$

$$= x_1x_2x_3\left(1 + \frac{a_1b_1}{x_1} + \frac{a_2b_2}{x_2} + \frac{a_3b_3}{x_3}\right)$$

A. $\frac{a_1b_1}{x_1} + \frac{a_2b_2}{x_2} + \frac{a_3b_3}{x_3}$

B. -1

C. $\frac{a_1a_2a_3 + b_1b_2b_3}{x_1x_2x_3}$

D. 0

Answer: A

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11. Let $p\lambda^4 + q\lambda^3 + r\lambda^2 + s\lambda + t$

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

where p,q,r,s, and t are constant. Then value of t is

A. 0

B. -1

C. 2

D. 3

Answer: A

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12. Let $\Delta = \begin{vmatrix} 1 & -4 & 20 \\ 1 & -2 & 5 \\ 1 & 2 & 5x^2 \end{vmatrix}$ Solution set of $\Delta = 0$ is

A. $\{-2, -3\}$

B. $\{-3, 4\}$

C. $\{4, -6\}$

D. $\{-2, -1\}$

Answer: D

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

A. 0

B. $a+b+c$

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

D. None of these

Answer: A

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14. Suppose $a, b, c, > 0$ and a,b,c are the pth, qth, rth terms of a G.P. Let

$\Delta = \begin{vmatrix} 1 & p & \log a \\ 1 & q & \log b \\ 1 & r & \log c \end{vmatrix}$

the numerical value of Δ is

A. -1

B. 2

C. 0

D. None of these

Answer: C

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15. 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: B

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16. 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. 0

B. -1

C. 1

D. None of these

Answer: A

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17. If $1, \omega, \omega^2$ are the cube 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. 1

C. ω

D. ω^2

Answer: A

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18. Using properties of determinants, prove that

$|b + cq + ry + zc + ar + pz + xc + bp + qx + y| = 2\,|apxbqycrz|$

A. $\Delta = 2\Delta_1$

B. $\Delta = -2\Delta_1$

C. $\Delta = 4\Delta_1$

D. $\Delta = -4\Delta_1$

Answer: A

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19. If $x = -2$ and $\Delta = \begin{vmatrix} x+y & x & x \\ 5x+4y & 4x & 2x \\ 10x+8y & 8x & 3x \end{vmatrix}$ then numerical value of Δ is

A. 8

B. -8

C. 4

D. -4

Answer: B

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20. If $a = \omega \neq 1$, is a cube root of unity $b = 785$, $c = 2008i$ and

$$\Delta = \begin{vmatrix} a & a+b & a+b+c \\ 2a & 3a+2b & 4a+3b+2c \\ 3a & 6a+3b & 10a+6b+3c \end{vmatrix}$$

then Δ equals

A. $-i$

B. i

C. 1

D. $1 - wi$

Answer: C

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21. for $x, x, z > 0$ Prove that $\begin{vmatrix} 1 & \log_x y & \log_x z \\ \log_y x & 1 & \log_y z \\ \log_z x & \log_z y & 1 \end{vmatrix} = 0$

A. -1

B. 0

C. 1

D. None of these

Answer: B

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22. Let $\omega \neq 1$ be a cube root of unit and

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

then Δ equals

A. $-\omega$

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

C. 0

D. $1-\omega^2$

Answer: C

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23. Suppose $x = -\frac{1}{3}\left(1+\sqrt{7}i\right)$ and $y = \cos\frac{\pi}{4} + I\sin\frac{\pi}{4}$

Let $\Delta = \begin{vmatrix} 1 & x & x \\ 1 & x+y & y \\ 1 & x & x+y \end{vmatrix}$

then Δ equals

A. $-\sqrt{7}$

B. 7

C. i

D. -1

Answer: C

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24. Let $x = \cos\frac{\pi}{3} + i\sin\frac{\pi}{3}$ and

$$\Delta = \begin{vmatrix} 1 & x & x^2 \\ x^2 & 1 & x \\ 1 & x^2 & 1 \end{vmatrix}$$

the numerical value of Δ is

A. 0

B. -1

C. 8

D. 4

Answer: D

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25. Let $f(x) = \left[2^{-x^2}\left[2x^2\right]\right], x \varepsilon R$ ([ ] denotes the greatest integer function). Let $x_1 = 0$, $x_2 = \log_2 3$ and $x_3 = \sqrt{2}$. Suppose $0 < x_4 < 1$.

$\Delta = \begin{vmatrix} f(x_1) & f(x_2) & f(x_3) \\ f(x_4) & f(x_4) & f(x_2) \\ f(x_2) & f(x_3) & f(x_1) \end{vmatrix}$ then Δ is equal to

A. -1

B. 0

C. 1

D. $2\log_2^3$

Answer: B

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26. 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. 0

B. 1

C. -1

D. None of these

Answer: A

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27. Let $f: N \rightarrow N$ be defined by

$$f(x) = (x+1)^2 + x - \left[\sqrt{(x+1)^2 + (x+1)}\right]^2$$

([] denotes the greatest integer function). Suppose a,b,c are three distinct natural numbers. Let

$$\Delta = \begin{vmatrix} f(a) & a^2 & a \\ f(b) & b^2 & b \\ f(c) & c^2 & c \end{vmatrix}$$

Then Δ is equal to

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

B. $a+b+c$

C. -1

D. 0

Answer: D

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28. 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. 3,7

B. 2,7

C. 3,6

D. 2,6

Answer: B

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

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

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

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

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

Answer: B

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30. If $x \in R$ and $n \in I$ then the determinant

$$\Delta = \begin{vmatrix} \sin(n\pi) & \sin x - \cos x & \log \tan x \\ \cos x - \sin x & \cos\left\{(2n+1)\frac{\pi}{2}\right\} & \log \cot x \\ \log \cot x & \log \tan x & \tan(n\pi) \end{vmatrix} =$$

A. 0

B. $\log \tan x - lot \cot x$

C. $\tan(\pi/4 - x)$

D. None of these

Answer: A

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31. Prove that $\begin{vmatrix} ax & by & cz \\ x^2 & y^2 & z^2 \\ 1 & 1 & 1 \end{vmatrix} = \begin{vmatrix} a & c & c \\ x & y & z \\ yz & xz & xy \end{vmatrix}$

A. $(x-1)(y-1)(z-1)$

B. $(x-y)(y-z)(z-x)$

C. $abc(x-y)(y-z)(z-x)$

D. 0

Answer: D

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

A. 0

B. -100

C. $100!$

D. $-100!$

Answer: A

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33. If $\Delta(x) = \begin{vmatrix} 1 & 1 & 1 \\ (e^x + e^{-x})^2 & (\pi^x + \pi^{-x})^2 & 2 \\ (e^x - e^{-x})^2 & (\pi^x - \pi^{-x})^2 & -2 \end{vmatrix}$ then $\Delta(x)$ equals

A. x^2

B. $x^2 - 1$

C. $e^{x^2} - \pi^{x^2}$

D. 0

Answer: D

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

$\int_0^{\pi/2} \Delta(x)$ dx is equal to

A. $1/4$

B. $1/2$

C. 0

D. $-1/2$

Answer: D

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35. The determinant $\Delta = \begin{vmatrix} a & b & a\alpha + c \\ b & c & b\alpha + c \\ a\alpha + b & b\alpha + c & 0 \end{vmatrix}$ is equal to zero if

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

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

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

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

Answer: C

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36. 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. $-\sin\theta - \cos\theta$

B. $\sin 2\theta$

C. $1 + \sin 2\theta - \cos 2\theta$

D. 0

Answer: D

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37. If $\alpha, \beta. \gamma$ are the roots of $x^3 + px^2 + q = 0,$ where $q = 0,$ ther

$\Delta = \begin{bmatrix} \frac{1}{\alpha} & \frac{1}{\beta} & \frac{1}{\gamma} \\ \frac{1}{\beta} & \frac{1}{\gamma} & \frac{1}{\alpha} \\ \frac{1}{\gamma} & \frac{1}{\alpha} & \frac{1}{\beta} \end{bmatrix}$ equals (A) $\alpha\beta\gamma$ (B) $\alpha + \beta + \gamma$ (C) 0 (D) none of these

A. $-p/q$

B. $1/q$

C. p^2/q

D. 0

Answer: D

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

$$\begin{vmatrix} -1 & \cos C & \cos B \\ \cos C & -1 & \cos A \\ \cos B & \cos A & -1 \end{vmatrix}$$ is equal to

A. 0

B. -1

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

D. None of these

Answer: A

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39. 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. 1

B. 2

C. -2

D. 4

Answer: D

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40. If $\theta, \phi \varepsilon R$, then the determinant

$$\Delta = \begin{vmatrix} \cos\theta & -\sin\theta & 1 \\ \sin\theta & \cos\theta & 1 \\ \cos(\theta+\phi) & -\sin(\theta+\phi) & 0 \end{vmatrix}$$

lies in the interval

A. $\left[-\sqrt{2}, \sqrt{2}\right]$

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

C. $\left[-\sqrt{2}, 1\right]$

D. $\left[-1, \sqrt{2}\right]$

Answer: A

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41. If $\Delta_1 = \begin{vmatrix} b+c & a-b & a \\ c+a & b-c & b \\ a+b & c-a & c \end{vmatrix}$ and $\Delta_2 = \begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix}$ then $\Delta_1 - \Delta_2$ equual

A. 0

B. $3abc$

C. $6abc$

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

Answer: A

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42. If x, y, z are different from zero and $\text{Delta} = ab - yc - za - xbc - za - xb - yc = 0,$ then the value of the expression $\frac{a}{x} + \frac{b}{y} + \frac{c}{z}$ is 0 b. -1 c. 1 d. 2

A. 0

B. -1

C. 1

D. 2

Answer: D

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

A. 0

B. 1

C. $pa + qb + rc$

D. None of these

Answer: A

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44. The number of real values of λ for which the system of equations $\lambda x + y + z = 0, x - \lambda y - z = 0, x + y - \lambda z = 0$ will have nontrivial solution is

A. 0,1

B. 0,-1

C. 0,2

D. 0

Answer: D

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45. The values of k for which the system of equations

$x + ky - 3z = 0$........1

$3x + ky - 2z = 0$ 2

$2x + 3y - 4z = 0$...............3

has non trivial solution is (are)

A. $\frac{21}{10}$

B. $\frac{31}{10}$

C. -5

D. 4

Answer: A

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46. If the system of equations $x + ay = 0, az + y = 0, and ax + z = 0$ has infinite solutions, then the value of equation has no solution is -3 b. 1 c. 0 d. 3

A. -1

B. 1

C. 0

D. no real value

Answer: A

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47. Given , 2x-y+2z=2, x-2y+z=-4, x+y+λz=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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48. 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. are in G.P.

B. are in H.P.

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

D. are in A.P.

Answer: B

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49. The system of homogenous equations

$(a-1)x + (a+2)y + az = 0$

$(a+1)x + ay + (a+2)z = 0$

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

has a non trivial solution if a equals

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

B. $-\frac{1}{2}$

C. 2

D. -1

Answer: B

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50. 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. -2

B. 1

C. -2

D. either -2 or 1

Answer: A

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51. If a,b,c are non-zeroes then the system of equations

$(\alpha + a)x + \alpha y + \alpha z = 0$ $\alpha x + (\alpha + b)y + \alpha z = 0$

$\alpha x + \alpha y + (\alpha + c)z = 0$

A. -1

B. 0

C. abc

D. $bc + ca + ab$

Answer: A

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52. if the system of equation $ax + y + z = 0, x + by = z = 0,$ and $x + y + cz = 0(a, b, c \neq 1)$ has a nontrival solution , then the value of $\frac{1}{1-a} + \frac{1}{1-b} + \frac{1}{1-c} is:$

A. $a+b=2$

B. $a+b=ab$

C. $a+\frac{1}{b}=2$

D. $a+b=0$

Answer: A

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53. If $a^2+b^2+c^2$=-2 and
$\begin{vmatrix} 1+a^2x & (1+b^2)x & (1+c^2)x \\ (1+a^2)x & 1+b^2x & (1+c^2)x \\ (1+a^2)x & (1+b^2)x & (1+c^2)x \end{vmatrix}$ then f(x) is a polynomial of degree

A. 3

B. 2

C. 1

D. 0

Answer: B

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54. Let f(x) = $\begin{vmatrix} \sec x & \cos x & \sec^2 x + \cot x \cos ecx \\ \cos^2 x & \cos^2 x & \cos ec^2 x \\ 1 & \cos^2 x & \cos^2 x \end{vmatrix}$ then find the value of $\int_0^{\pi/2}$ f(x) dx.

A. 0

B. $\pi/48$

C. $-\frac{\pi}{2} - \frac{\pi}{15\sqrt{2}}$

D. None of these

Answer: D

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55. if $a+b+c=0$ then $\Delta = \begin{vmatrix} a-x & c & b \\ c & b-x & a \\ b & a & c-x \end{vmatrix} = 0$ is

A. 1

B. -1

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

D. 0

Answer: D

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56. 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. $\frac{1}{2}(a+b+c)$

B. 0

C. -1

D. 1

Answer: B

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57. If $\alpha, \beta \text{ and } \gamma$ 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. -1

B. 0

C. 1

D. `cos alpha cos beta cos gamma

Answer: B

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58. If a,b,and c are the side of a triangle and A,B and C are the angles opposite to a,b,and c respectively, then

$$\Delta = \begin{vmatrix} a^2 & b\sin A & C\sin A \\ b\sin A & 1 & \cos A \\ C\sin A & \cos A & 1 \end{vmatrix}$$ is independent of

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

B. abc

C. 1

D. 0

Answer: D

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

B. $x = \frac{2}{3}(a + b + c)$

C. $x = a + b + c$

D. None of these

Answer: A

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

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

C. $x = a + b + c$

D. $x = 0$

Answer: A

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61. If α, β, γ are different from 1 and are the roots of $ax^3 + bx^2 + cx + d = 0 and (\beta - \gamma)(\gamma - \alpha)(\alpha - \beta) = \frac{25}{2}$, then prove that $\left|\frac{\alpha}{1-\alpha}\frac{\beta}{1-\beta}\frac{\gamma}{1-\gamma}\alpha\beta\gamma\alpha^2\beta^2\gamma^2\right| = \frac{25d}{2(a+b+c+d)}$

A. $\frac{25d}{2a}$

B. $\frac{25d}{a}$

C. $\frac{-25d}{a+b+c+d}$

D. None of these

Answer: D

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62. 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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63. 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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64. Let a,b and c be such that (b+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 odd intetger

B. ay integer

C. zero

D. any even integer

Answer: A

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65. Let ω be the complex number $\cos\left(\frac{2\pi}{3}\right) + i\sin\left(\frac{2\pi}{3}\right)$. Then the number of distinct complex cos numbers z satisfying $\Delta = \begin{vmatrix} z+1 & \omega & \omega^2 \\ \omega & z+\omega^2 & 1 \\ \omega^2 & 1 & z+\omega \end{vmatrix} = 0$ is

A. 1

B. 0

C. 2

D. 3

Answer: A

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Solved Examples Level 2 Single Correct Answer Type Questions

1. Consider the system of linear equations in x, y, and z:

$(\sin 3\theta)x - y + z = 0$

$(\cos 2\theta)x + 4y + 3z = 0$

$2x + 7y + 7z = 0$

Which of the following can be the values of θ for which the system has a non-trivial solution ?

A. $\pi\left(n + \frac{1}{3}(-1)^n\right)$

B. $\pi\left(n + \frac{1}{4}(-1)^n\right)$

C. $\pi\left(n + \frac{1}{6}(-1)^n\right)$

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

Answer: C

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2. Let $\Delta(x) = \begin{vmatrix} 3+2\sin^4 x & 2\cos^4 x & \sin^2 2x \\ 2\sin^4 x & 3+2\cos^4 x & \sin^2 2x \\ 2\sin^4 x & 2\cos^4 x & 3+\sin^2 2x \end{vmatrix}$

then $\int_{-\pi/2}^{\pi/2} x\Delta(x)dx$ equals

A. π^2

B. $\pi(\pi - 1)$

C. 1

D. 0

Answer: D

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3. If $f(x), g(x), h(x)$ are polynomials of three degree, 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 (where $f^n(x)$ represents nth derivative of f(x))

A. 3

B. 4

C. 5

D. None of these

Answer: D

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4. 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. $9b^2(a+b)$

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

C. $9(a+b)^3$

D. $9ab(a+b)$

Answer: A

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5. Let $\Delta(x) = \begin{vmatrix} \sin x & \cos x & \sin 2x + \cos 2x \\ 0 & 1 & 1 \\ 1 & 0 & -1 \end{vmatrix}$ then $\Delta'(x)$ vanishes at least once in

A. $(0, \pi/2)$

B. $(\pi/2, \pi)$

C. $(0, \pi/4)$

D. $(-\pi/2, 0)$

Answer: A

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6. Let $\Delta(x) = \begin{vmatrix} \cos^2 x & \cos x \sin x & -\sin x \\ \cos x \sin x & \sin^2 x & \cos x \\ \sin x & -\cos x & 0 \end{vmatrix}$ then $\int_0^{\pi/2} \{\Delta(x) + \Delta'(x)] dx$ equals

A. $\pi/3$

B. $\pi/2$

C. 2π

D. $3\pi/2$

Answer: B

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7. The value of the determinant $\Delta = \begin{vmatrix} \sqrt{13}+\sqrt{3} & 2\sqrt{5} & \sqrt{5} \\ \sqrt{15}+\sqrt{26} & 5 & \sqrt{10} \\ 3+\sqrt{65} & \sqrt{15} & 5 \end{vmatrix}$ is equal to

A. $15\sqrt{2}-25\sqrt{3}$

B. $25\sqrt{3}-15\sqrt{2}$

C. $3\sqrt{5}$

D. $-15\sqrt{2}+7\sqrt{3}$

Answer: A

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8. The values of λ for which the system of equations

$x+y-3=0$

$(1+\lambda)x+(2+\lambda)y-8=0$

$x-(1+\lambda)y+(2+\lambda)=0$

has a non trivial solution are

A. $-5/3, 1$

B. $2/3, \ -3$

C. $-1/3, \ -3$

D. 0

Answer: A

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9. For what value of m does the system of equations $3x + my = m, 2x - 5y = 20$ has solution satisfying the conditions $x > 0, y > 0$?

A. $\left\{m : m < -\frac{13}{2}\right\}$

B. $\left\{m : m > \frac{17}{2}\right\}$

C. $\{m : m < -13/2 \text{ or } m > 17/2\}$

D. None of these

Answer: D

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10. If $a + b + c \neq 0$, the system of equations $(b + c)(y + z) - ax = b - c$, $(c + a)(z + x) - by = c - a$ and $(a + b)(x + y) - cz = a - b$ has

A. a unique solution

B. no solution

C. infinite number of solutions

D. finitely many solutions

Answer: A

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11. 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. inifinitely many solution

D. finitely many solutions

Answer: D

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12. 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 $-1, 2$ b. $1, 2$ c. $0, 1$ d. $-1, 1$

A. $-1, 2$

B. 1,2

C. 0,1

D. $-1, 1$

Answer: D

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13. If the system of equations $\lambda x_1 + x_2 + x_3 + \lambda x_2 + x_3 = 1, x_1 + x_2 + \lambda x_3 = 1$ is inconsistent then λ equals

A. 5

B. $-2/3$

C. -3

D. -2

Answer: D

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14. If $p \neq a, q \neq b, r \neq c$and the system of equations $px + ay + az = 0 \text{ and } bx + qy + bz = 0 \text{ and } cx + cy + rz = 0$ has a non-trivial solution, then the value of $\frac{p}{p-a} + \frac{q}{q-b} + \frac{r}{r-c}$ is

A. -1

B. 0

C. 1

D. 2

Answer: D

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15. Let λ and α be real. Then the numbers of intergral values λ for which the system of linear equations

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

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

$-x + (\sin \alpha) y - (\cos \alpha) z = 0$ has non-trivial solutions is

A. $\lambda = \sin 2\alpha + \cos 2\alpha$

B. $\lambda = |\sin 2\alpha|$

C. $\lambda = |\sin 2\alpha - \cos 2\alpha|$

D. $\lambda = \cos 2\alpha$

Answer: A

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16. 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'(x) at x = a is ..... .

A. -1

B. a

C. 0

D. None of these

Answer: C

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17. The number of real values of a for which the system of equations $x+ay-z=0, 2x-y+az=0, ax+y+2z=0$ has a non trivial solution is

A. 3

B. 1

C. 0

D. infinite

Answer: A

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18. Find the solution set of the system $x+2y+z=1$ $2x-3y-w=2$ $x\geq 0, y\geq 0, z\geq 0, w\geq 0$

A. $x=\frac{1}{7}(y-w), y\geq 2\geq 0, z\geq 0$

B. $x=\frac{1}{8}(y+w), z=\frac{1}{3}(y-w), y\geq w\geq 0$

C. $x = \frac{1}{7}(y - w), z = \frac{1}{3}(y + w), y \geq 0$

D. $x = 1, y = 0, z = 0, w = 0$

Answer: D

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19. 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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20. Suppose $a, b, c \varepsilon R$ and let

$f(x) = \begin{vmatrix} 0 & a-x & b-x \\ -a-x & 0 & c-x \\ -b-x & -c-x & 0 \end{vmatrix}$ Then coefficient of x^2 in f(x) is

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

B. $a+b+c$

C. 0

D. $ab+bc+ca$

Answer: C

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

A. $-1, 2$

B. 1,2

C. 0,1

D. $-1, 1$

Answer: D

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22. Let $a_2, a_3 \varepsilon R$ be such that $|a_2 - a_3| = 6$, Let

$f(x) = \begin{vmatrix} 1 & a_3 & a_2 \\ 1 & a_3 & 2a_2 - x \\ 1 & 2a_3 - x & a_2 \end{vmatrix}$, $x \varepsilon R$ The maximum value of f(x) is

A. 6

B. 9

C. 12

D. 36

Answer: B

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Solved Examples Numerical Answer Type Questions

1. Suppose

$$\frac{3}{(x-1)(x^2+x+1)}=f_1(x)-f_2(x)$$

where $f_1(x)=\frac{1}{x-1}$ and $f_2(x)=\frac{x+2}{x^2+x+1}$

If $\frac{x+1}{(x-1)^2(x^2+x+1)}=af_1(x)+\left(b+\frac{c}{x-1}\right)f_2(x)+\frac{d}{(x-1)^2}$

then $\begin{vmatrix} a & b \\ c & d \end{vmatrix}+9|a+ib|^2=$ __________

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2. Suppose $a_1, a_2, a_3, a_4>0.$ If periods of $\sin(a_1\pi x+b_1), \cos(a_2\pi x+b_2), \tan(a_3\pi x+b_3)$ and $\cot(a_4\pi x+b_4)$ are respectively $\frac{1}{2}, \frac{1}{3}, \frac{1}{2}$ and $\frac{1}{3}$ rthen $\begin{vmatrix} a_1 & a_2 \\ a_3 & a_4 \end{vmatrix}^2$ =________

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3. Suppose

$$f(a,b,x,y)=\begin{vmatrix}1 & x & x^2\\ \cos((a-b)y) & \cos(ay) & \cos((a+b)y)\\ \sin((a-b)y) & \sin(ay) & \sin(a+b)y\end{vmatrix}$$

then $f\left(\pi, \frac{\pi}{2}, \sqrt{3}, 0\right) =$ ______

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4. If

$$\begin{vmatrix}a+b+2c & a & b\\ c & 2a+b+c & b\\ c & a & a+2b+c\end{vmatrix}=\frac{432}{125}$$

then $a+b+c=$ _______

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5. Let

$$f(x)=\begin{vmatrix}5x-8 & 3 & 3\\ 3 & 5x-8 & 3\\ 3 & 3 & 5x-8\end{vmatrix}$$ Sum of the roots of f(x)=0 is ______.

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6. Let

$$N = \begin{vmatrix} 10! & 11! & 12! \\ 11! & 12! & 13! \\ 12! & 13! & 14! \end{vmatrix}$$

Then $\dfrac{N}{(10!)(11!)(12!)} =$ ______

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7. Suppose a,b,c are real numbers such that

$$\begin{vmatrix} 1+a & 1 & 1 \\ 1 & 1+b & 1 \\ 1 & 1 & 1+c \end{vmatrix} = 32.53$$

If $ab + bc + ca = 27.41$ then abc=__________.

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8. Suppose

$$\begin{vmatrix} b+c & a & b \\ c+a & c & a \\ a+b & b & c \end{vmatrix} = 4k(a+b+c)(c-a)^2 \text{..............1}$$

where k is a real number then k=_________.

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9. Evaluate $\begin{vmatrix} 265 & 240 & 219 \\ 240 & 225 & 198 \\ 219 & 198 & 181 \end{vmatrix}$

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10. Suppose $(a_1, b_1), (a_2, b_2)$ and (a_3, b_3) are vertices of an equilateral triangle whose each side is of length2.1 units, then

$\left|\begin{vmatrix} x_1 & y_1 & 8\sqrt{3} \\ x_2 & y_2 & 8\sqrt{3} \\ x_3 & y_3 & 8\sqrt{3} \end{vmatrix}\right| =$ ________

A.

B.

C.

D.

Answer: 13.23

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11. Suppose $a, b, c > 0$. If

$$\begin{vmatrix} x_1 & y_1 & 2a \\ x_2 & y_2 & 2b \\ x_3 & y_3 & 2c \end{vmatrix} = abc,$$

Then area of triangle whose vertices are

$A\left(\frac{x_1}{a}, \frac{y_1}{a}\right), B\left(\frac{x_2}{b}, \frac{y_2}{b}\right)$ and $C\left(\frac{x_3}{c}, \frac{y_3}{c}\right)$ is ___

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12. Let $f(x) = \begin{vmatrix} 1 & x & x^2 \\ x & x^2 & 1 \\ x^2 & 1 & x \end{vmatrix}$ then $\left|f(2.9)^{1/3}\right| =$ __________

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13. If α is a cube root of unity, then find the value of $\begin{vmatrix} \alpha & \alpha^3 & \alpha^5 \\ \alpha^3 & \alpha^5 & \alpha \\ \alpha^5 & \alpha & \alpha^3 \end{vmatrix}$

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14. Suppose $a_1 + a_2 + a_3 + 1.3, b_1 + b_2 + b_3 = 2.1, c_1 + c_2 + c_3 = 1.6$

and

$$\Delta(x) = \begin{vmatrix} 1 + a_1 x & 1 + b_1 x & 1 + c_1 x \\ 1 + a_2 x & 1 + b_2 x & 1 + c_3 x \\ 1 + a_3 x & 1 + b_3 x & 1 + c4x \end{vmatrix}$$

$$= A_0 + A_1 x + A_2 x^2 + A_2 x^3,$$

then $A_1 =$ ________

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15. Suppose a,b,c are three distinct real numbers such that $a, b, c \neq 1.1$

and

$$\begin{vmatrix} a^3 & a^2 - 3.3 & a - 1.1 \\ b^3 & b^2 - 3.3 & b - 1.1 \\ c^3 & c^2 - 3.3 & c - 1.1 \end{vmatrix} = 0$$

If $abc = k[bc + ca + ab - 3(a + b + c)]$ then k=__________

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16. Suppose A is a 3×3 matrix such that det(A)=2.2 then $\frac{\det(adj(adjA))}{(\det(A))^2} =$ ________.

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17. For $x \varepsilon R$ let

$$f(x) = \begin{vmatrix} (x-4)^2 & (x-3)^2 & (x-2)^2 \\ (x-3)^2 & (x-2)^2 & (x-1)^2 \\ (x-2)^2 & (x-1)^2 & x^2 \end{vmatrix}$$

then $|f(3.51) + f(4.49)| =$ ________

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Exercise Concept Based Single Correct Answer Type Questions

1. Suppose $A = (a_{ij})_{3 \times 3}$ where $a_{ij} \varepsilon R$

If det $\left(adj(A)A^{-1}\right) = 3$, then det (adj(A)) equals:

A. $\sqrt{3}$

B. 3

C. $3\sqrt{3}$

D. 9

Answer: D

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2. If a,b,c are in A.P. and p is a real number and

$$\Delta = \begin{vmatrix} p+c & p+2 & p+a \\ p+b & p+5 & p+b \\ p+a & p+8 & p+c \end{vmatrix}$$

then Δ equals

A. $-p^3$

B. p^3

C. $p^3 - 2abc$

D. 0

Answer: D

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3. Let $\Delta = \begin{vmatrix} 1 & x & x^2 \\ x^2 & 1 & x \\ x & x^2 & 1 \end{vmatrix}$,then

A. for exactly two distinct complex numbers

B. for exactly four distinct complex numbrs

C. for exactly two distinct real numbers

D. None of these

Answer: A

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4. Let $D = \begin{vmatrix} 10! & 11! & 12! \\ 11! & 12! & 13! \\ 12! & 13! & 14! \end{vmatrix}$ then $\dfrac{D}{(10!)^3 - 260}$ equals

A. 1

B. 2

C. 3

D. 4

Answer: D

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5. Let

$$P(x) = \begin{vmatrix} x+1 & 2 & 3 \\ 1 & x+2 & 3 \\ 1 & 2 & x+3 \end{vmatrix}$$ the product of zeros of P(x) is

A. 0

B. 6

C. -6

D. 12

Answer: A

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6. An equilateral triangle has each side equal to a, If $(x_1, y_1), (x_2, y_2), (x_3, y_3)$ are the vertices of the triangle then $\begin{vmatrix} x_1 & y_1 & 1 \\ x_2 & y_2 & 1 \\ x_3 & y_3 & 1 \end{vmatrix}^2 =$

A. 64

B. 128

C. 192

D. 256

Answer: C

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7. Suppose a,b,c are in A.P if p,q,r are also in A.P., then value of

$$\Delta = \begin{vmatrix} x^2 + a & x + p & c \\ x^2 + b & x + q & b \\ x^2 + c & x + r & a \end{vmatrix}$$

is dependent on

A. x

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

C. p,q,r

D. No

Answer: D

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8. Suppose a,b are two non zero numbers. Let $\Delta = \begin{vmatrix} 2 & a+b & a^2+b^2 \\ a+b & a^2+b^2 & a^3+b^3 \\ a^2+b^2 & a^3+b^3 & a^4+b^4 \end{vmatrix}$ then Δ is equal to

A. 0

B. ab

C. $a^6 + b^6$

D. $a^3b^5 + a^5b^3$

Answer: A

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9. Suppose $a, b, c > 1$. Let

$$\Delta = \begin{vmatrix} \log a & \log b & \log c \\ \log(2007a) & \log(2007b) & \log(2007c) \\ \log(2017a) & \log(2017b) & \log(2017c) \end{vmatrix}$$ then Δ is equal to

A. 0

B. $\log(4024abc)$

C. $\log\left(\frac{2017}{2007}\right)$

D. None of these

Answer: A

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10. Suppose $a, b, c \in R.$ Let

$$\Delta = \begin{vmatrix} (a+2016)^2 & (b+2016)^2 & (c+2016)^2 \\ (a-2016)^2 & (b-2016)^2 & (c-2016)^2 \\ a^2 & b^2 & c^2 \end{vmatrix}.$$ If

$\Delta = k(2016)^3(a-b)(b-c)(c-a).$ then k is equal to

A. -1

B. -4

C. 4

D. 1

Answer: B

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

A. -6

B. -7

C. $13/5$

D. $-12/5$

Answer: D

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12. Let n be an integer and $x, y, z < 1$. Suppose

$$\Delta = \begin{vmatrix} x^{n+1} & x^{n+2} & x^{n+3} \\ y^{n+1} & y^{n+2} & y^{n+3} \\ z^{n+1} & z^{n+2} & z^{n+3} \end{vmatrix}$$

If $\Delta = (x-y)(y-z)(z-x)x^2y^2z^2$ then n is equal to

A. -1

B. 0

C. 1

D. 2

Answer: C

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13. Suppose a,b,c are distinct real numbers. Let

$$P(x) = \begin{vmatrix} 0 & x^3 - a & x^4 - b \\ x^3 + a & 0 & x^5 + c \\ x^4 + b & x^5 - c & 0 \end{vmatrix}$$

A value of x satisfying $P(x) = 0$ is

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

B. $a+b+c$

C. $a+b-c$

D. 0

Answer: D

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14. Suppose $a, b, c \varepsilon R$ on $abc \neq 0$. Let

$$\Delta = \begin{vmatrix} 1+a & 1 & 1 \\ 1+b & 1+2b & 1 \\ 1+c & 1+c & 1+3c \end{vmatrix}$$

If $\Delta = 0$, then $\frac{1}{a} + \frac{1}{b} + \frac{1}{c}$ is equal to

A. 0

B. -1

C. -2

D. -3

Answer: D

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15. Suppose n and m are natural numbers such that

$$\Delta = \begin{vmatrix} x^m & x^{m+2} & x^{2m} \\ 1 & x^n & 2^n \\ x^{m+5} & x^{n+6} & x^{2m+5} \end{vmatrix}$$

Then a possible relationship between n and m is

A. $n=m+2$

B. $n=m+1$

C. $n=m$

D. $n=m-1$

Answer: A

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Exercise Level 1 Single Correct Answer Type Questions

1. Suppose $a, b, c \in R$ and $a+b+c \neq 0.$ Let $\Delta=\begin{vmatrix} b+c & c+a & a+b \\ c+a & a+b & b+c \\ a+b & b+c & c+a \end{vmatrix}$. If $\Delta=0,$ then

A. $a=b=c$

B. $a^3+b^3-c^3=0$

C. $a=b+c$

D. $a = b = c = 0$

Answer: A

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2. Distance of line

$$y = \begin{vmatrix} x+1 & x & x \\ x & x+2 & x \\ x & x & x+3 \end{vmatrix}$$ from the origin is

A. $\frac{6}{11}$

B. $\frac{7}{13}$

C. $\frac{6}{\sqrt{122}}$

D. $\frac{7}{\sqrt{122}}$

Answer: C

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3. Show that:

$|3a - a + b - a + c - b + a3b - b + c - c + a - c + b3c| = 3(a + b + c)($

A. $3(a + b + c)(bc + ca + ab)$

B. $a + b + c$

C. $3(a + b + c)\left(a^2 + b^2 + c^2\right)$

D. 0

Answer: A

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4. If p,q and r are in AP the value of determinant $\begin{vmatrix} a^2 + 2^{n+1} + 2p & b^2 + 2^{n+2} + 2q & c^2 + p \\ 2^n + p & 2^{n+1} + q & 2q \\ a^2 + 2^n + p & b^2 + 2^{n+1} + 2q & c^2 - r \end{vmatrix}$ is

A. -1

B. 0

C. $p^2q^2r^2 - 3abc$

D. $p^2q^2r^2 - 4(a+b+c)$

Answer: B

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5. Suppose a, b, c, d, e and f are in G.P with common ratio > 1. Let $p.\ q.\ r$ be three real numbers. Let $\Delta = \begin{vmatrix} a & d^2 & p \\ b^2 & e^2 & q \\ c^2 & f & r \end{vmatrix}$. Then Δ depends on

A. a,b,c

B. d,e,f

C. p,q,r

D. None of these

Answer: D

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6. Suppose pont (x,y,z) in space satisfies the equation

$$\begin{vmatrix} x^2+1 & xy & xz \\ yx & y^2+1 & yz \\ zx & zy & z^2+1 \end{vmatrix} = 5$$

Then (x,y,z) lies on a

A. plane

B. Straight line

C. sphere

D. None of these

Answer: C

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

$\begin{vmatrix} -1 & \cos C & \cos B \\ \cos C & -1 & \cos A \\ \cos B & \cos A & -1 \end{vmatrix}$ is equal to

A. 0

B. -1

C. -2

D. -3

Answer: A

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8. Let

$$\Delta = \begin{vmatrix} a & x & x \\ x & b & x \\ x & x & c \end{vmatrix}$$

and $f(x) = (x-a)(x-b)(x-c)$

Determinant Δ is equal to

A. $f(x) - x^3$

B. $f'(x)$

C. $xf'(x) - f(x)$

D. $f'(x) - xf''(x)$

Answer: C

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9. Straight line

$$\begin{vmatrix} 2-x-y & 4 & 4 \\ 2x & x-y-2 & 2x \\ 2y & 2y & y-2-x \end{vmatrix} = 0$$

passes through the fixed point

A. (-2,-2)

B. (-2,0)

C. (0,-2)

D. (-1,-1)

Answer: D

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10. Suppose $a \in R$. Let $f(x) = \begin{vmatrix} x+a & x & x \\ x & x+a & x \\ x & x & x+a \end{vmatrix}$ then $f(2x) - f(x)$ is equal to

A. $3xa^2$

B. $3x^2a$

C. xa^2

D. a^2x

Answer: A

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11. 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. $a^2 - 3b$

D. a^3

Answer: D

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12. If $\alpha, \beta \& \gamma$ are the roots the equations $x^3 + px + q = 0$ then the value of the determinant $\begin{bmatrix} \alpha & \beta & \gamma \\ \beta & \gamma & \alpha \\ \gamma & \alpha & \beta \end{bmatrix}$

A. $-b^3$

B. $b^3 - 3c$

C. $b^2 - 3c$

D. 0

Answer: D

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13. 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. $a^{-1} + b^{-1} + c^{-1} = 0$

B. $a^{-1} + b^{-1} - c^{1} = 0$

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

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

Answer: A

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14. The determinant $\Delta = \begin{vmatrix} \lambda a & \lambda^2 + a^2 & 1 \\ \lambda b & \lambda^2 + b^2 & 1 \\ \lambda c & \lambda^2 + c^2 & 1 \end{vmatrix}$ equals

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

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

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

D. $\lambda^2(a-b)(b-c)(c-a)$

Answer: A

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15. If α, β, γ are real numbers, then determinant $\Delta = \begin{vmatrix} \sin^2\alpha & \cos 2\alpha & \cos^2\alpha \\ \sin^2\beta & \cos 2\beta & \cos^2\beta \\ \sin^2\gamma & \cos 2\gamma & \cos^2\gamma \end{vmatrix}$ equals

A. 0

B. -1

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

D. None of these

Answer: A

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16. If $bc+ca+ab=18$ and

$$\begin{vmatrix} 1 & a^2 & a^3 \\ 1 & b^2 & b^3 \\ 1 & c^2 & c^3 \end{vmatrix} = \lambda \begin{vmatrix} 1 & 1 & 1 \\ a & b & c \\ a^2 & b^2 & c^2 \end{vmatrix}$$

the value of λ is

A. -1

B. 0

C. 9

D. 18

Answer: D

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17. If $x \neq 0$ the determinant

$$\Delta = \begin{vmatrix} a_0 & a_1 & a_2 \\ -x & x & 0 \\ 0 & -x & x \end{vmatrix}$$

vanishes if

A. $a_0 + a_1 + a_2 = 0$

B. $a_0 + a_1 = 2a_2$

C. $a_0 + a_2 = 2a_1$

D. None of these

Answer: A

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18. If $x \varepsilon R$ the determinant

$$\Delta = \begin{vmatrix} 1 & \cos x & 0 \\ -1 & 1 - \cos x & \sin x + \cos x \\ 0 & -1 & 1 - \sqrt{2} \sin(x + \pi/4) \end{vmatrix}$$ equals

A. 0

B. -1

C. 1

D. None of these

Answer: C

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

A. $x-a, x-b$ and $x+a+b$

B. $x-a, x-b$ and $x-a-b$

C. $x+a, x+b$ and $x-a-b$

D. None of these

Answer: A

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20. Find the maximum value of $|11111+\sin\theta 1111+\cos\theta|$

A. $1/2$

B. $\sqrt{3}/2$

C. $\sqrt{2}$

D. $3\sqrt{2}/4$

Answer: A

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21. 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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22. The determinant

$$\begin{vmatrix} \sec^2\theta & \tan^2\theta & 1 \\ \tan^2\theta & \sec^2\theta & -1 \\ 12 & 10 & 2 \end{vmatrix} \text{ equals}$$

A. $2\sin^2\theta$

B. $12\sec^2\theta - 10\tan^2\theta$

C. $12\sec^2\theta - 10\tan^2\theta + 5$

D. 0

Answer: D

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23. If $\Delta = \begin{vmatrix} -a & 2b & 0 \\ 0 & -a & 2b \\ 2b & 0 & -a \end{vmatrix} = 0$ then

A. 1/b is a cube root of unit

B. a is one of the cube roots of unity

C. b is one of thecube roots of 8

D. a/b is a cube root of 8

Answer: D

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24. The determinant

$$\Delta = \begin{vmatrix} 1 & 1+i & i \\ 1+i & i & 1 \\ i & 1 & 1+i \end{vmatrix}$$ equals

A. $7+4i$

B. $-7+4i$

C. $-7-4i$

D. $2(i-1)$

Answer: D

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25. If a,b,c are non zero real numbers then

$$\Delta = \begin{vmatrix} 1 & ab & \frac{1}{a} + \frac{1}{b} \\ 1 & bc & \frac{1}{b} + \frac{1}{c} \\ 1 & ca & \frac{1}{c} + \frac{1}{a} \end{vmatrix} \text{ equals}$$

A. 0

B. $bc + ca + ab$

C. $a^{-1} + b^{-1} + c^{-1}$

D. $abc - 1$

Answer: A

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26. If $a, b, c > 1$ then $\Delta = \begin{vmatrix} \log_a(abc) & \log_a b & \log_a c \\ \log_b(abc) & 1 & \log_b c \\ \log_c(abc) & \log_c b & 1 \end{vmatrix}$ equals

A. 0

B. $\log_a b + \log_b c + \log_c a$

C. $\log_{abc}(a+b+c)$

D. None of these

Answer: A

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27. Prove that $\triangle \begin{vmatrix} a+bx & c+dx & p+qx \\ -ax+b & cx+d & px+q \\ u & v & w \end{vmatrix} = (1-x^2)\begin{bmatrix} a & c & p \\ b & d & q \\ u & v & w \end{bmatrix}$

A. 0

B. 1

C. x

D. $1-x^2$

Answer: D

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28. Let $\Delta = \begin{vmatrix} 1 & \sin\theta & 1 \\ -\sin\theta & 1 & \sin\theta \\ -1 & -\sin\theta & 1 \end{vmatrix} 0, \leq \theta \leq 2\pi$. The

A. $\Delta = 0$

B. $\Delta \varepsilon (2, \infty)$

C. $\Delta \varepsilon (2, 4)$

D. $\Delta \varepsilon [2, 4]$

Answer: D

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29. The determinat $\Delta = \begin{vmatrix} b^2 - ab & b - c & bc - ac \\ ab - a^2 & a - b & b^2 - ab \\ bc - ac & c - a & ab - a^2 \end{vmatrix}$ equals

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

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

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

D. 0

Answer: D

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30. If $\begin{vmatrix} 6i & -3i & 1 \\ 4 & 3i & 1 \\ 20 & 3 & i \end{vmatrix} = x + iy, i = \sqrt{-1}$ then

A. $x = 3, y = 1$

B. $x = 1, y = 3$

C. $x = 0, y = 3$

D. $x = 0, y = 0$

Answer: D

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31. The number of distinct real roots of $|s \in x \cos x \cos x \cos x s \in x \cos x \cos x \cos x s \in x| = 0$ in the interval

$-\frac{\pi}{4} \leq x \leq \frac{\pi}{4}$ is 0 b. 2 c. 1 d. 3

A. 0

B. 2

C. 1

D. 3

Answer: C

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32. if $\omega \neq 1$ is a complex cube root of unity, and

$$x + iy = \begin{vmatrix} 1 & i & -\omega \\ -I & 1 & \omega^2 \\ \omega & -\omega^2 & 1 \end{vmatrix}$$

A. $x = -1, y = 0$

B. $x = 1, y = -1$

C. $x = 1, y = 1$

D. None of these

Answer: A

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33. If $e^{lx} = \cos x + i \sin x$ and

$$x + iy = \begin{vmatrix} 1 & e^{\pi i/4} & e^{\pi i/3} \\ e^{-\pi i/4} & 1 & e^{2\pi i/3} \\ e^{-\pi i/3} & e^{-2\pi i/3} & e^{-2\pi i/3} \end{vmatrix}$$, then

A. $x = -1, y = \sqrt{2}$

B. $x = 1, y = -\sqrt{2}$

C. $x = -\sqrt{2}, y = \sqrt{2}$

D. None of these

Answer: D

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34. If a,b,c, $\in$ R, find the number of real root of the equation
$\begin{vmatrix} x & c & -b \\ -c & x & a \\ b & -a & x \end{vmatrix}$=0

A. 0

B. 1

C. 2

D. 3

Answer: B

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35. If $\begin{vmatrix} 1 & x & x^2 \\ x & x^2 & 1 \\ x^2 & x & x \end{vmatrix}$ =3 then the value of $\begin{vmatrix} x^3-1 & 0 & x-x^4 \\ 0 & x-x^4 & x^3-1 \\ x-x^4 & x^3-1 & 0 \end{vmatrix}$ is

A. $\Delta = 7$

B. $\Delta = 343$

C. $\Delta = -49$

D. $\Delta = 49$

Answer: D

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36. If $\Delta = \begin{vmatrix} \sin\alpha & \cos\alpha & \sin\alpha + \cos\beta \\ \sin\beta & \cos\alpha & \sin\beta + \cos\beta \\ \sin\gamma & \cos\alpha & \sin\gamma + \cos\beta \end{vmatrix}$ then Δ equals

A. $\sin\alpha\sin\beta\sin\gamma$

B. $\cos\alpha\sec\beta\tan\gamma$

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

D. 0

Answer: D

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37. Suppose $a, b, c \varepsilon R$ and $a, b, c > 0$.

Let $\Delta = \begin{vmatrix} \log a & \log b & \log c \\ \log(7a) & \log(49b) & \log(343c) \\ \log(3a) & \log(9b) & \log(27c) \end{vmatrix}$ then Δ is equals to

A. 0

B. -1

C. 1

D. 30

Answer: A

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

A. $\pi/24, 5\pi/24$

B. $7\pi/24, 11\pi/24$

C. $5\pi / 24, 7\pi / 24$

D. $11\pi / 24, \pi / 24$

Answer: B

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39. Solve $\begin{vmatrix} x^2-1 & x^2+2x+1 & 2x^2+3x+1 \\ 2x^2+x-1 & 2x^2+5x-3 & 4x^2+4x-3 \\ 6x^2-x-2 & 6x^2-7x+2 & 12x^2-5x-2 \end{vmatrix} = 0$

A. 6

B. 5

C. 3

D. 4

Answer: D

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40. If $a_r = \cos\frac{2r\pi}{9} + i\sin\frac{2r\pi}{9}$ then value of the determinant

$$\Delta = \begin{vmatrix} 1 & a_8 & a_7 \\ a_3 & a_2 & a_1 \\ a_6 & a_5 & a_4 \end{vmatrix}$$ is

A. -1

B. 1

C. 0

D. -2

Answer: C

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41. If $a \neq p, b \neq q, c \neq r$ and the system of equations

$px + by + cz = 0$

$ax + qy + cz = 0$

$ax + by + rz = 0$

has non zero solution, then value of

$\frac{p+a}{p-a} + \frac{q+b}{q-b} + \frac{r+c}{r-c}$ is

A. 2

B. -3

C. 1

D. 1

Answer: D

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42. For a fixed positive integer n if $D = \begin{vmatrix} n! & (n+1)! & (n+2)! \\ (n+1)! & (n+2)! & (n+3)! \\ (n+2)! & (n+3)! & (n+4)! \end{vmatrix} = theshowt\frac{\widehat{D}}{(n!)^3} - 4$ is divisible by n.

A. -4

B. -2

C. 2

D. 4

Answer: C

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43. If a, b, c are in $A.P.$, and $\Delta = \begin{vmatrix} x+2 & x+7 & a \\ x+5 & x+11 & b \\ x+8 & x+15 & c \end{vmatrix}$ then Δ equals to

A. 0

B. 1

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

D. a+b+c

Answer: A

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44. If $\Delta = \begin{vmatrix} 1+y & 1-y & 1-y \\ 1-y & 1+y & 1-y \\ 1-y & 1-y & 1+y \end{vmatrix} = 0$, then value of y are

A. 0,3

B. 2,-1

C. $-1, 3$

D. 0,2

Answer: A

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45. The determinant

$$\Delta = \begin{vmatrix} al + a'l' & am + a'm' & an + a'n' \\ bl + b'l' & bm + b'm' & bn + b'n' \\ cl + c'l' & cm + c'm' & cn + c'n' \end{vmatrix}$$ is equal to

A. $(abc + a'b'c)(lmn + l'm'n')$

B. $abclmn + a'b'c'l'm'n'$

C.

$$\left(a^2+b^2+c^2\right)\left(l^2+m^2+n^2\right)+\left(a^{'2}+b^{'2}+c^{'2}\right)\left(l^{'2}+m^{'2}+n^{'2}\right)$$

D. 0

Answer: D

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46. If $a = i, b = \omega$ and $C = \omega^2$, then the value of determinant $\begin{vmatrix} a & a+b & a+b+c \\ 3a & 4a+3b & 5a+4b+3c \\ 6a & 9a+6b & 11a+9a+6c \end{vmatrix}$

A. $-\omega$

B. $-\omega^2$

C. i

D. $-i$

Answer: D

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47. If $\Delta = \begin{vmatrix} 1 & 1 & 1 \\ {}^mC_1 & {}^{m+3}C_1 & {}^{m+6}C_1 \\ {}^mC_2 & {}^{m+3}C_2 & {}^{m+6}C_2 \end{vmatrix} = 2^\alpha 3^\beta, 5^\gamma$, then $\alpha + \beta + \gamma$ is equal

A. 3

B. 5

C. 7

D. None of these

Answer: A

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48. Suppose $a, b, c, x, y \varepsilon R$. Let

$$\Delta = \begin{vmatrix} 1 & 2+ax & 3+ay \\ 1 & 2+bx & 3+by \\ 1 & 2+cx & 3+cy \end{vmatrix}$$

Then Δ is independnet is

A. a,b,c

B. x,y

C. a,b,c,y

D. a,b,c,x,y

Answer: D

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

$$\begin{vmatrix} -1 & \cos C & \cos B \\ \cos C & -1 & \cos A \\ \cos B & \cos A & -1 \end{vmatrix}$$ is equal to

A. $\sin^2 A$

B. $\sin^2 B$

C. $\sin^2 C$

D. 0

Answer: A

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50. Let $f(x) = \begin{vmatrix} \cos x & x & 1 \\ 2\sin x & x^2 & 2x \\ \tan x & x & 1 \end{vmatrix}$ then $\lim_{x \to 0} \frac{f(x)}{x^2}$ is given by

A. 0

B. -1

C. 2

D. 3

Answer: B

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

$$\Delta = \begin{vmatrix} a_1 + b_1\omega & a_1\omega^2 + b_1 & c_1 + b_1\omega \\ a_2 + b_2\omega & a_2\omega^2 + b_2 & c_2 + b_2\omega \\ a_3 + b_3\omega & a_3\omega^2 + b_3 & c_3 + b_3\omega \end{vmatrix}$$ is

A. 0

B. -1

C. 2

D. None of these

Answer: A

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52. If $pqr \neq 0$ and the system of equation $(p+a)x + by - cz = 0$ $ax + (q+b)y + cz = 0$ $ac + by + (r+c)z = 0$ has nontrivial solution, then value of $\frac{1}{p} + \frac{b}{q} + \frac{c}{r}$ is -1 b. 0 c.0 d. $\neg - 2$

A. -1

B. 0

C. 1

D. 2

Answer: A

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53. The system of equations

$ax + by + (a\alpha + b)z = 0$

$bx + cy + (b\alpha + c)z = 0$

$(a\alpha + b)x + (b\alpha + c)y = 0$

has a non zero solutions if a,b,c are in

A. A.P.

B. G.P.

C. H.P.

D. A.G.P

Answer: B

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54. If the system of equations

$ax + ay - z = 0$

$bx - y + bz = 0$

$-x+cy+cz=0$

(where $a, b, c \neq -1$) has a non trivial solution, then values of $\frac{1}{1+a}+\frac{1}{1+b}+\frac{1}{1+c}$ is

A. 2

B. -1

C. -2

D. 0

Answer: A

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55. The values of λ for which the system of equations

$(\lambda+5)x+(\lambda-4)y+z=0$

$(\lambda-2)x+(\lambda+3)y+z=0$

$\lambda x+\lambda y+z=0$

has a non trivial solution is (are)

A. $-1, 2$

B. $0, \ -1$

C. 0

D. None of these

Answer: D

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56. If $a+b+c \neq 0,$ the system of equations $(b+c)(y+z)-ax=b-c, (c+a)(z+x)-by=c-a$ and $(a+b)(x+y)-cz=a-b$ has

A. $b-c : c-a : a-b$

B. $b+c : a+a : a+b$

C. $a : b : c$

D. $\frac{a}{b} : \frac{b}{c} : \frac{c}{a}$

Answer: A

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57. If $a, b, c \in R$ and $a+b+c=0$ and th esystem of equations $ax+by+cz=0, bx+cy+az=0, cx+ay+bz=0$ has a non-zero solution, then $a:b:c$ is given by

A. $1:\alpha:\beta$ where α, β are roots of $ax^2+bx+c=0$

B. $1:r:r^2$ where r is some positive real number

C. $1:k:2k$ where k is some positive real number

D. None of these

Answer: D

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58. If $f(x)=\begin{vmatrix} x^3 & x^4 & 3x^2 \\ 1 & -6 & 4 \\ p & p^2 & p^3 \end{vmatrix}$, where p is a constant, then $\dfrac{d^3}{dx^3}(f(x))$, is

A. proportional to x^3

B. proportional tox^2

C. proportional to x

D. a constant

Answer: D

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59. suppose $D=\begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix}$ and

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

A. $D=\Delta$

B. $D=\Delta(1-pqr)$

C. $D = \Delta(1 + pqr)$

D. $D = \Delta(1 + p + q + r)$

Answer: C

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60. Number of real values of λ for which the system of equations

$(\lambda + 3) + (\lambda + 2)y + z = 0$

$3x + (\lambda + 3)y + z = 0$

$2x + 3y + z = 0$

has a non trivial solutions is

A. 0

B. 1

C. 2

D. infinite

Answer: A

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Exercise Level 2 Single Correct Answer Type Questions

1. If $l_i^2 + m_i^2 + n_i^2 = 1,$ (i=1,2,3) and $l_i l_j + m_i m_j + n_i n_j = 0, (i \neq j, i, j = 1, 2, 3)$ and $\Delta = \begin{vmatrix} l_1 & m_1 & n_1 \\ l_2 & m_2 & n_2 \\ l_3 & m_3 & n_3 \end{vmatrix}$ then

A. $|\Delta| = 3$

B. $|\Delta| = 2$

C. $|\Delta| = 1$

D. $\Delta = 0$

Answer: C

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2. If $a, b, \& c$ are nonzero real numbers, then $\begin{vmatrix} b^2c^2 & bc & b+c \\ c^2a^2 & ca & c+a \\ a^2b^2 & ab & a+b \end{vmatrix}$ is equal to

A. abc

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

C. $bc + ca + ab$

D. 0

Answer: D

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3. If $\Delta(x) = \begin{vmatrix} x^2 = 5x+3 & 2x-5 & 3 \\ 3x^2 = x+4 & 6x-1 & 9 \\ 7x^2 = 6x+9 & 14x-6 & 21 \end{vmatrix}$

$=ax^2 + bx^2 + cx + d$, then

A. -1

B. 0

C. 2

D. None of these

Answer: B

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4. The number of distinct values of t for which the system

$(a+t)x+by+cz=0$

$ax+(b+t)y+cz=0$

$ax+by+(c+t)z=0$

has a non trivial solutionis

A. 1

B. 2

C. 3

D. None of these

Answer: B

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5. If $a^2+b^2+c^2=1$ then

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

A. $\cos^2\theta$

B. 0

C. 1

D. $\sin^2\theta$

Answer: A

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6. Suppose $\alpha, \beta, \gamma, \theta \varepsilon R$ and

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

Numerical value of $A\left(-\frac{\pi}{2}, 0, \frac{\pi}{2}, \frac{2\pi}{13}\right)$ is

A. 0

B. -1

C. 2

D. None of these

Answer: C

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7. If a,b,c are positive integers such that $a > b > c$ and

$\begin{vmatrix} 1 & 1 & 1 \\ a & b & c \\ a^2 & b^2 & c^2 \end{vmatrix} = -2$ then $3a + 7b - 10c$ equals

A. 10

B. 11

C. 12

D. 13

Answer: D

View Text Solution

8. If $A, B, C, P, Q, R \in R$ and

$$\Delta = \begin{vmatrix} \cos(A+P) & \cos(A+Q) & \cos(A+R) \\ \cos(B+P) & \cos(B+Q) & \cos(B+R) \\ \cos(C+P) & \cos(C+Q) & \cos(C+R) \end{vmatrix}$$

A. Δ depends on P,Q,R

B. Δ depends on A,B,C

C. Δ depends on A,B,C,P,Q,R

D. None of these

Answer: D

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9. Let $f(x) = \begin{vmatrix} 2\cos x & 1 & 0 \\ 1 & 2\cos x & 1 \\ 0 & 1 & 2\cos x \end{vmatrix}$ then

A. $f\left(\frac{\pi}{3}\right) = 1$

B. $f'\left(\frac{\pi}{3}\right) = -\sqrt{3}$

C. $f\left(\frac{\pi}{2}\right) = -1$

D. None of these

Answer: B

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10. Consider the set A of all determinants of order 3 with entries 0 or 1 only. Let B be the subset of A consisting of all determinants with value 1. Let C be the subset of the set of all determinants with value -1. Then

A. $C = \pi$

B. B has as many elements as C

C. $A = B \cap C$

D. $A = B \cup C$

Answer: B

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11. Let $\omega = e^{\frac{i\pi}{3}}$ and a, b, c, x, y, z be non-zero complex numbers such that $a + b + c = x, a + b\omega + c\omega^2 = y, a + b\omega^2 + c\omega = z$.Then, the value of $\frac{|x|^2 + |y|^2| + |y|^2}{|a|^2 + |b|^2 + |c|^2}$

A. 9

B. 6

C. 3

D. 1

Answer: C

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12. $\begin{vmatrix} a & a^2 & a^3-1 \\ b & b^2 & b^3-1 \\ c & c^2 & c^3-1 \end{vmatrix} = 0$ prove that $abc = I$

A. 0

B. 1

C. -1

D. -2

Answer: B

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13. If the adjoint of a 3×3 matrix P is $\begin{bmatrix} 1 & 4 & 4 \\ 2 & 1 & 7 \\ 1 & 1 & 3 \end{bmatrix}$, then the possible value(s) of the determinant of P is (are)

A. ± 2

B. ± 3

C. ± 1

D. 0

Answer: A

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14. If $\begin{vmatrix} 1 & -3 & 4 \\ -5 & x+2 & 2 \\ 4 & 1 & x-6 \end{vmatrix} = 0$ then x equals

A. 17,21

B. 0,19

C. 0,35

D. 21,35

Answer: C

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15. Suppose $n \varepsilon N$ and for $1 \leq r \leq n$

Let $\Delta r = \begin{vmatrix} 3r-2 & 2020 & 3n-1 \\ 2r-1 & 2025 & 2n \\ r & 2029 & n+1 \end{vmatrix}$ then $\frac{1}{3n}\sum_{r=1}^{n}(\Delta_r + 6)$ is equal to

____

A. 0

B. 1

C. 2

D. 3

Answer: B

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Exercise Numerical Answer Type Questions

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

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2. If $\begin{vmatrix} 3 & 2 \\ 1 & x \end{vmatrix} - \begin{vmatrix} 2x & 3 \\ -2 & 1 \end{vmatrix} = \begin{vmatrix} 4.1 & 1 \\ 2 & 1 \end{vmatrix}^2$, then x=_____

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3. If $\begin{vmatrix} 1 & 2 & 3 \\ 2 & x & 3 \\ 3 & 4 & 5 \end{vmatrix} = 0$ then x=_______

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4. Let $\omega \neq 1$ be a cube root of unity, and $\Delta = \begin{vmatrix} 2 & 2\omega & -\omega^2 \\ 1 & 1 & 1 \\ 1 & -1 & 0 \end{vmatrix}$ then $2\cos(\Delta) =$ ___________

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5. If $\Delta_1 = \begin{vmatrix} b+c & c+a & a+b \\ c+a & a+b & b+c \\ a+b & b+c & c+a \end{vmatrix}$ and $\Delta_2 = \begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix}$ then $\dfrac{\Delta_1}{\Delta_2} =$

______

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6. Suppose $a, b, c \varepsilon R$ and

$$\Delta = \begin{vmatrix} a & a+b & a+b+c \\ 3a & 4a+3b & 5a+4b+3c \\ 6a & 9a+6b & 11a+9b+6c \end{vmatrix}$$ If $\Delta = 11.728$ then a=_____

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7. Suppose $a_1, a_2, a_3, b_1, b_2, b_3, c_1, c_2, c_3 \varepsilon R$. Let

$$\Delta = \begin{vmatrix} b_2c_3 - b_3c_2 & c_2a_3 - c_3a_2 & a_2b_3 - a_3 \_ (2) \\ b_3c_1 - b_1c_3 & c_3a_1 - c_1a_3 & a_3b_1 - a_1b_3 \\ b_1c_2 - b_2c_1 & c_1a_2 - c_2a_1 & a_1b_2 - a_2b_1 \end{vmatrix}$$

If $\Delta = 47.61$

then $1\begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_2 & c_3 \end{vmatrix} = 1$___________

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8. Let

$$f(x)=\begin{vmatrix}4x^2+2x & 2x+1 & 2x-2\\ 8x^2+6x-1 & 6x & 6x-3\\ (2x+1)^2+2 & 4x-1 & 4x-1\end{vmatrix}$$

If $f(x)=ax+b$, then $\frac{1}{24}(2a+3b)=$ ____________

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9. Let $f(x)=\begin{vmatrix}1 & 3 & 5\\ x-2 & 3x^2-12 & 5x^3-40\\ x-3 & 3x^2-27 & 2x^3-54\end{vmatrix}$ then $f(2)f(3)+f(2)f(7)+f(3)f(7)=$ _________

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10. Suppose $x+iy=\begin{vmatrix}7i & -5i & 1\\ 14 & 5i & -1\\ 28 & 5 & i\end{vmatrix}$ then $\sqrt{(x+1/4)^2+y^2}=$

____

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11. Suppose $a, b, c, > 0$ and

$$\begin{vmatrix} a^3-1 & a^2 & a \\ b^3-1 & b^2 & b \\ c^3-1 & c^2 & c \end{vmatrix} = 0$$ then least possible value of $a+b+c$ is __________

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12. Suppose $\omega \neq 1$ is a sube root of unity, and

$$\Delta = \begin{vmatrix} 1 & \omega^2 & 1-\omega^4 \\ \omega & 1 & 1+\omega^5 \\ 1 & \omega & \omega^2 \end{vmatrix}$$ then $|Re(\Delta)| =$ __________

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13. Suppose $a, b \varepsilon R$ and $\begin{vmatrix} x & a & b \\ a & x & b \\ b & b & x \end{vmatrix} - 4k(x-a)\left(x^2+ax-2b^2\right) = 0$

then a value of k is ______

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14. The value of k for which the system of linear equations

$(2k+2)x+10y=k$

$2kx+(2k+3)y=k-1$ ha sno solution is______________.

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15. $\begin{vmatrix} 1 & \cos(\pi/12) & \cos(\pi/3) \\ \cos(\pi/12) & 1 & \cos(\pi/4) \\ \cos(\pi/3) & \cos(\pi/4) & 1 \end{vmatrix} = 1$_______________

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Questions From Previous Years Aieee Jee Main Papers

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

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

A. positive

B. negative

C. 0

D. dependent on a.

Answer: C

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2. l, m,n are the p^{th}, q^{th} and r^{th} term of a G.P. all positive, then $\begin{vmatrix} \log l & p & 1 \\ \log m & q & 1 \\ \log n & r & 1 \end{vmatrix}$ equals :

A. 0

B. -1

C. $p+q+r$

D. None of these

Answer: A

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3. If $1, \omega, \omega^2$ are the cube 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. 1

B. 2

C. ω^2

D. 0

Answer: D

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4. If the system of linear equations $x + 2ay + az = 0, x + 3by + bz = 0$ and $x + 4cy + cz = 0$ has a non-zero solution, then a, b, c

A. are in G.P.

B. are in H.P.

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

D. are in A.P.

Answer: B

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5. If $a_1, a_2, a_3, \ldots\ldots\ldots a_n$ .... are in G.P and $a_i > 0$ then the value of the determinant

$$\begin{vmatrix} \log a_n, \log a_{n+1}, \log a_{n+2} \\ \log a_{n+1}, \log a_{n+2}, \log a_{n+3} \\ \log a_{n+2}, \log a_{n+3}, \log a_{n+4} \end{vmatrix}$$ is

A. 2

B. 1

C. 0

D. -2

Answer: C

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6. If $a^2 + b^2 + c^2$=-2 and

$\begin{vmatrix} 1+a^2x & (1+b^2)x & (1+c^2)x \\ (1+a^2)x & 1+b^2x & (1+c^2)x \\ (1+a^2)x & (1+b^2)x & (1+c^2)x \end{vmatrix}$ then f(x) is a polynomial of degree

A. 3

B. 2

C. 1

D. 0

Answer: B

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7. The value of $|\alpha|$ for which the system of equation

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

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

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

has no solution , is _____

A. not -2

B. 1

C. -2

D. either -2 or 1

Answer: C

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8. If $D=\begin{vmatrix}1&1&1\\1&1+x&1\\1&1&1+y\end{vmatrix}$ for $x\neq0, y\neq0$, then D is divisible by

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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9. Let a,b and c be such that (b+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 odd intetger

B. any integer

C. zero

D. any even integer

Answer: A

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10. If a, b, c are positive and unequal, show that value of the determinant

$$\Delta = \begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix}$$ is negative

A. non negative

B. negative

C. positive

D. non positive

Answer: B

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11. Statement 1: The system of linear equations

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

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

$x - (\sin\alpha)y - (\cos\alpha)z = 0$

has a non trivial solution for only one value of α lying in the interval $(0, \pi/2)$

Statement 2: The equation in α

$\Delta = \begin{vmatrix} \cos\alpha & \sin\alpha & \cos\alpha \\ \sin\alpha & \cos\alpha & \sin\alpha \\ \cos\alpha & -\sin\alpha & -\cos\alpha \end{vmatrix} = 0$ has only one solution lyining in the interval $(0, \pi/2)$

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12. If $\alpha, \beta \neq 0$, and $f(n) = \alpha^n + \beta^n$ and $|31 + f(1)1 + f(2)1 + f(1)1 + f(2)1 + f(3)1 + f(2)1 + f(3)1 + f(4)| =$, then K is equal to (1) $\alpha\beta$ (2) $\frac{1}{\alpha\beta}$ (3) 1 (4) -1

A. $\frac{1}{\alpha\beta}$

B. 1

C. -1

D. $\alpha\beta$

Answer: B

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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. -1

Answer: B

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14. Let fori $1, 2, 3, p_i(x)$ be a polynomial ofdegree 2 in $x_1 p_i(x)$ and $p_i(x)$ be the first and second order derivatives of $p_i(x)$ respectively.Let, $A(x) = \begin{bmatrix} p_1(x) & p'_1(x) & p''_1(x) \\ p_2(x) & p'_2(x) & p''_2(x) \\ p_3(x) & p'_3(x) & p''_3(x) \end{bmatrix}$ and $B(x) = [A(x)]^T A(x)$, then Determinant of $B(x)$: (A) Is a Polynomial of degree 6 (B) Is a Polynomial of degree 4 (C) Is a Polynomial of degree 2 (D) Does not depend on x

A. is a polynomial of degree 6 in x

B. is a polynomial of degree 3 in x

C. is a polynomial of degree 2 in x

D. does not depend on x

Answer: D

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15. If

$$\begin{vmatrix} a^2 & b^2 & c^2 \\ (a+\lambda)^2 & (b+\lambda)^2 & (c+\lambda)^2 \\ (a-\lambda)^2 & (b-\lambda)^2 & (c-\lambda)^2 \end{vmatrix} = k\lambda \begin{vmatrix} a^2 & b^2 & c^2 \\ a & b & c \\ 1 & 1 & 1 \end{vmatrix}$$

$\lambda \neq 0$ then k is equal to

A. $4\lambda abc$

B. $-4\lambda abc$

C. $4\lambda^2$

D. $-4\lambda^2$

Answer: C

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16. If $\Delta_r = \begin{vmatrix} r & 2r-1 & 3r+2 \\ \frac{n}{2} & n-1 & a \\ \frac{1}{2}n(n-1) & (n-1)^2 & \frac{1}{2}(n-1)(3n+4) \end{vmatrix}$ then the value of $\sum_{r=1}^{n-1} \Delta_r$ (1) depends only on n (2) is independent of both a and n (3) depends only on a (4) depends both on a and n

A. depends only on a

B. depends only on n

C. depends both on a and n

D. is independent of both a and n.

Answer: D

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17. 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. is an empty set

B. is a singleton

C. contains two elements

D. contains more than two elements

Answer: C

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18. If $\begin{vmatrix} x^2+x & x+1 & x-2 \\ 2x^2+3x-1 & 3x & 3x-3 \\ x^2+2x+3 & 2x-1 & 2x-1 \end{vmatrix} = ax - 12$ then 'a' is equal to (1) 12 (2) 24 (3) -12 (4) -24

A. 12

B. 24

C. -12

D. -24

Answer: B

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19. The least value of the product xyz for which the determinant $\begin{vmatrix} x & 1 & 1 \\ 1 & y & 1 \\ 1 & 1 & z \end{vmatrix}$ is non-negative, is: (A) $-16\sqrt{2}$ (B) $-2\sqrt{2}$ (C) -1 (D) -8

A. $-2\sqrt{2}$

B. $-16\sqrt{2}$

C. -8

D. 1

Answer:

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20. The system of linear equations

$x + \lambda y - z = 0, \lambda x - y - z = 0, x + y - \lambda z = 0$

has a non-trivial solution for

A. infinitely many values of λ

B. exactly one value of λ

C. exactly two values of λ

D. exactly three values of λ

Answer: D

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21. The number of distinct real roots of the equation, $\begin{vmatrix} \cos x & \sin x & \sin x \\ \sin x & \cos x & \sin x \\ \sin x & \sin x & \cos x \end{vmatrix} = 0$ in the interval $\left[-\frac{\pi}{4}, \frac{\pi}{4}\right]$ is :

A. 1

B. 4

C. 2

D. 3

Answer: C

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22. If S is the set of distinct values of $'b$ for which the following system of linear equations $x+y+z=1$ $x+ay+z=1$ $ax+by+z=0$ has no solution, then S is : a finite set containing two or more elements (2) a singleton an empty set (4) an infinite set

A. an empty set

B. an infinite set

C. a finite set containing two or more elements

D. a single ton

Answer: D

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23. Let ω be a complex number such that $2\omega+1=z$ where $z=\sqrt{-3}$. If $\left|(1, 1, 1), \left(1, -\omega^2-1, \omega^2\right), \left(1, \omega^2, \omega^7\right)\ \right| = 3k$, then k is equal to

A. $-z$

B. z

C. -1

D. 1

Answer: A

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24. The number of real values of λ for which the system of linear equations $2x+4y-\lambda z=0, 4x+\lambda y+2z=0, \lambda x+2y+2z=0$ has infinitely many solutions, is: (A) 0 (B) 1 (C) 2 (D) 3

A. 0

B. 1

C. 2

D. 3

Answer: B

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25. If $S = \left\{ x\varepsilon[0, 2\pi] : \begin{vmatrix} 0 & \cos x & -\sin x \\ \sin x & 0 & \cos x \\ \cos x & \sin x & 0 \end{vmatrix} = 0 \right\}$ then $\sum_{x\varepsilon S} \tan\left(\frac{\pi}{3} + x\right)$ is equal to

A. $4 + 2\sqrt{3}$

B. $-2 + \sqrt{3}$

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

D. $-4 - 2\sqrt{3}$

Answer: D

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26. If $\begin{vmatrix} x-4 & 2x & 2x \\ 2x & x-4 & 2x \\ 2x & 2x & x-4 \end{vmatrix} = (A+Bx)(x-A)^2$ then the ordered pair (A,B) is equal to

A. $(-4, 3)$

B. $(-4, 5)$

C. $(4, 5)$

D. $(-4, -5)$

Answer: B

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27. If the system of linear equations x+ky+3z=0 3x+ky-2z=0 2x+4y-3z=0 has a non-zero solution (x,y,z) then $\frac{xz}{y^2}$ is equal to

A. 10

B. -30

C. 30

D. -10

Answer: A

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28. The system of linear equations

$x + y + z = 2$

$2x + y - z = 3$

$3x + 2y + kz = 4$

has a unique solution, if

A. equal to $R - \{0\}$

B. an empty set

C. equal R

D. equal to {0}

Answer: A

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29. let $f(x) = \begin{vmatrix} \cos x & x & 1 \\ 2\sin x & x^2 & 2x \\ \tan x & x & 1 \end{vmatrix}$. then $\lim_{x \to 0} \frac{f'(x)}{x} =$

A. does not exist

B. exists and is equal to -2

C. exists and is equal to 0

D. exists and is equal to 2

Answer: D

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30. If the system of linear equations $x + ay + z = 3$ and $x + 2y + 2z = 6$ and $x + 5y + 3z = b$ has no solution, then (a) $a = -1, b = 9(2)a = -1, b \neq 9$ (3) $a \neq -1, b = 9$ (4) $a = 1, b \neq 9$

A. $a = -1, b = 9$

B. $a \neq -1, b = 9$

C. $a = 1, b \neq 9$

D. $a = -1, b \neq 9$

Answer: D

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31. Let $a_1, a_2, a_3 \ldots \ldots, a_{10}$ be in GP with $a_i > 1$ for $I = 2, 2, \ldots \ldots, 10$ and S be the set of pairs (r,k), $r, k \in N$ (the set of natural numbers) for which $\begin{bmatrix} \log_e a_1^r a_2^k & \log_e a_2^r a_3^k & \log_e a_3^r a_4^k \\ \log_e a_4^r a_5^k & \log_e a_5^r a_6^k & \log_e a_6^r a_7^k \\ \log_e a_7^r a_8^k & \log_e a_8^r a_9^k & \log_e a_9^r a_{10}^k \end{bmatrix} = 0$ Then the number of elements is S, is

A. 4

B. 2

C. 10

D. infinitely many

Answer: D

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32. Let $d \in R, \quad \text{and} \quad A = \begin{bmatrix} -2 & 4+d & (\sin\theta) - 2 \\ 2 & \sin\theta + 4 & 2d \\ 5 & 2\sin\theta - d & (-\sin\theta) + 2 + 2d \end{bmatrix}$. If the minimum value of det(A) is 16 for all $\theta \in [0, 2\pi]$, then a value of d is ,

A. -5

B. -7

C. $2(\sqrt{2}+1)$

D. $2(\sqrt{2}+2)$

Answer: A

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33. If $A = \begin{bmatrix} 1 & \sin\theta & 1 \\ -\sin\theta & 1 & \sin\theta \\ -1 & -\sin\theta & 1 \end{bmatrix}$, then for all $\theta \in \left(\frac{3\pi}{4}, \frac{5\pi}{4}\right)$ det (A) lies in the interval

A. $\left[\frac{5}{2}, 4\right)$

B. $\left(\frac{3}{2}, 3\right]$

C. $\left(0, \frac{3}{2}\right]$

D. $\left(1, \frac{5}{2}\right]$

Answer: B

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

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

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

C. abc

D. $-2(a+b+c)$

Answer: A

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35. Let the numbers 2, b, c be in an AP and $A=\begin{bmatrix}1 & 1 & 1\\ 2 & b & c\\ 4 & b^2 & c^2\end{bmatrix}$ If $\det(A)\in[2,16]$, then c lies in the interval.

A. [2,3)

B. $\left(2+2^{3/4},4\right)$

C. $[4,6]$

D. $\left[3,2+2^{3/4}\right]$

Answer: C

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36. The greatest value of $c \in R$ for which the system of linear equations

x-cy-cz = 0, cx -y + cz =0, cx + cy-z =0 has a non-trivial solution, is

A. -1

B. $1/2$

C. 2

D. 0

Answer: B

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37. Let α and β be the roots of the equation $x^2+x+1=0$. Then for $y \ne 0$ in R, $\begin{vmatrix} y+1 & \alpha & \beta \\ \alpha & y+\beta & 1 \\ \beta & 1 & y+\alpha \end{vmatrix}$ is equal to :

A. $y(y^2-1)$

B. $y(y^2-3)$

C. y^3

D. $y^3 - 1$

Answer: C

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38. If $\Delta_1 = \begin{vmatrix} x & \sin\theta & \cos\theta \\ -\sin\theta & -x & 1 \\ \cos\theta & 1 & x \end{vmatrix}$ and $\Delta_2 = \begin{vmatrix} x & \sin 2\theta & \cos 2\theta \\ -\sin 2\theta & -x & 1 \\ \cos 2\theta & 1 & x \end{vmatrix}, x \neq 0$, then for all $\theta \in \left(0, \frac{\pi}{2}\right)$, Then, $\Delta_1 + \Delta_2 = -2x^k$. The value of k is ______.

A. $\Delta_1 - \Delta_2 = -2x^3$

B. $\Delta_1 - \Delta_2 = x(\cos(2\theta) - \cos(4\theta))$

C. $\Delta_1 + \Delta_2 = -2(x^3 + x - 1)$

D. $\Delta_1 + \Delta_2 = -2x^3$

Answer: D

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39. The sum of the real roots of the equation

$$\begin{vmatrix} x & -6 & -1 \\ 2 & -3x & x-3 \\ -3 & 2x & x+2 \end{vmatrix} = 0, \text{ is equal to}$$

A. 6

B. 0

C. 1

D. -4

Answer: B

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40. If $B = \begin{bmatrix} 5 & 2\alpha & 1 \\ 0 & 2 & 1 \\ \alpha & 3 & -1 \end{bmatrix}$ is the inverse of a 3×3 matrix A, then the sum of all values of α

for which det (A) + 1 =0, is

A. 0

B. -1

C. 1

D. 2

Answer: C

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41. A value of $\theta \in (0, \pi/3)$, for which

$$\begin{vmatrix} 1+\cos^2\theta & \sin^2\theta & 4\cos 6\theta \\ \cos^2\theta & 1+\sin^2\theta & 4\cos 6\theta \\ \cos^2\theta & \sin^2\theta & 1+4\cos 6\theta \end{vmatrix} = 0,$$ is

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

B. $\frac{\pi}{18}$

C. $\frac{7\pi}{24}$

D. $\frac{7\pi}{36}$

Answer: A

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Questions From Previous Years B Architecture Entrance Examination Papers

1. If the system of equations

$x + y + z = 0$

$ax + by + z = 0$

$bx + y + z = 0$

has a non trivial solution then

A. $b^2 = 2b + 1$

B. $b^2 = 2b - 1$

C. $b - a = 0$

D. $b^2 = 2b$

Answer: B

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2. The system of linear equations

$(\lambda + 3)x + (\lambda + 2)y + z = 0$

$3x + (\lambda + 3)y + z = 0$

$2x + 3y + z = 0$

has a non trivial solution

A. if $\lambda = 1$

B. if $\lambda = -1$

C. for no real value of λ

D. if $\lambda = 0$

Answer: C

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3. If

$$\Delta_k = \begin{vmatrix} 2\left(3^{k-1}\right) & 3\left(4^{k-1}\right) & 4\left(5^k - 1\right) \\ \alpha & \beta & \gamma \\ 3^n - 1 & 4^n - 1 & 5^n - 1 \end{vmatrix}$$ then the value of $\sum_{k=1}^{n} \Delta_k$

depends

A. only on α and β not on γ

B. on all α, β and γ

C. onnone of α, β and γ

D. only on α, no on β and γ

Answer: C

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

A. 5

B. 10

C. 20

D. 40

Answer: A

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5. Let $\Delta_r = \begin{vmatrix} 2^{r-1} & 2(3^{r-1}) & 4(5^{r-1}) \\ \alpha & \beta & \gamma \\ 2^n - 1 & 3^n - 1 & 5^n - 1 \end{vmatrix}$ for $r = 1, 2, \ldots\ldots\ldots\ldots n$. The $\sum_{r=1} \Delta_r$ is

A. independent of α, β, γ and n

B. independent of n only

C. depends on α, β, γ and n

D. independent of α, β, γ only

Answer: A

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6. If $x_1, x_2, x_3, \ldots\ldots\ldots\ldots\ldots\ldots x_{13}$ are in A.P. then the value of

$$\begin{vmatrix} e^{x_1} & e^{x_4} & e^{x^7} \\ e^{x_4} & e^{x_7} & e^{x_{10}} \\ e^{x_7} & e^{x_{10}} & e^{x_{13}} \end{vmatrix}$$ is

A. 27

B. 0

C. 1

D. 9

Answer: B

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7. Find the value of determinat $\begin{vmatrix} \sqrt{13}+\sqrt{3} & 2\sqrt{5} & \sqrt{5} \\ \sqrt{15}+\sqrt{26} & 5 & \sqrt{10} \\ 3+\sqrt{65} & \sqrt{15} & 5 \end{vmatrix}$.

A. $5\sqrt{3}(\sqrt{6}-5)$

B. $5\sqrt{3}(\sqrt{6}-\sqrt{5})$

C. $5(\sqrt{6}-5)$

D. $\sqrt{3}(\sqrt{6}-\sqrt{5})$

Answer: C

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8. If the system of linear equations $x+2ay+az=0$, $x+3by+bz=0$ and $x+4cy+cz=0$ has a non-zero solution, then a, b, c

A. $2b=a+c$

B. $b^2=ac$

C. $2ac = ab + bc$

D. $2ab = ac + bc$

Answer: C

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

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

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

D. 2

Answer: B

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10. The system of lienar equations

$x-y+z=1$

$x+y-z=3$

$x-4y+4z=\alpha$ has

A. a unique solution when $\alpha=2$

B. a unique number when $\alpha\ne-2$

C. an infinite number of solutions when $\alpha=2$

D. an infinite number of solutions, when $\alpha=-2$

Answer: D

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11. 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. $[3, 5]$

B. $(4, 6)$

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

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

Answer: A

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12. Les S the set of all real values of a for which the following system of linear equations

$ax + 2y + 5z = 1$

$2x + y + 3z = 1$

$3y + 7z = 1$

is consistent. Then the set S is:

A. an empty set

B. equal to R

C. equal to R-{1}

D. equal to {1}

Answer: B

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13. $\begin{vmatrix} 2x & xy - xz & y \\ 2x + z + 1 & xy - xz + yz - z^2 & 1 + y \\ 3x + 1 & 2xy - 2xz & 1 + y \end{vmatrix}$ is equal to

A. $(y - xz)(z - x)$

B. zero

C. $(x - y)(y - z)(z - x)$

D. $(x - yz)(y - z)$

Answer: A

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14. Let S be the set of all real values of λ for which the system of linear equations

$\lambda x + y + z = 5\lambda$

$2\lambda x + 2y - z = 1$

$3y + z = 9$

has infinitely solutios. Then S

A. equal to R

B. is a singleton

C. contains exactly two elements

D. is an empty set

Answer: D

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15. Ifthe equations $a(y+z)=x, b(z+x)=y, c(x+y)=z$ have nontrivial solutions, then $\frac{1}{1+a}+\frac{1}{1+b}+\frac{1}{1+c}=$

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

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

C. 3

D. 2

Answer: D

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16. The value of a for whch the sytem of equations

$x + ay + z = 1$

$ax + y + z = 1$

$x + y + az = 1$

has no solution is

A. 1

B. -1

C. 2

D. -2

Answer: D

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17. If the system of linear equations

$x+4y-3z=2$

$2x+7y-4z=\alpha$

$-x-5y+5z=\beta$

has infinitely many solutions then the ordered pair (α, β) cannot take value

A. (4,-2)

B. (2,-4)

C. (3,-3)

D. (-3,3)

Answer: D

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18. The number of solutions of the equation

$3x - y - z = 0$

$-3x + 2y + z = 0$

$-3x + z = 0$

such that x,y,z are non negative integers and $x^2 + y^2 + z^2 \leq 81$ is

A. 3

B. 7

C. 1

D. 2

Answer: A

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