MATHS

BOOKS - CENGAGE

DETERMINANTS

Solved Examples And Exercises

1. If $f(\theta)=\begin{vmatrix}\sin^2 A & \cot A & 1\\ \sin^2 B & \cos B & 1\\ \sin^2 C & \cos C & 1\end{vmatrix}$, then (a) $tanA+tanB+c$ (b) $\cot A\cot B\cot C$ (c)$\sin^2 A+\sin^2 B+\sin^2 C$ (d)0

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2. Let $\Delta(x)=\begin{vmatrix}3 & 3x & 3x^2+2a^2\\ 3x & 3x^2+2a^2 & 3x^3+6a^2x\\ 3x^2+2a^2 & 3x^3+6a^2x & 3x^4+12a^2x^2+2a^4\end{vmatrix}$ then

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3. The determinant $\text{Delta} = \left|\left(a^2 + x\right)abacab\left(b^2 + x\right)bcacbc\left(c^2 + x\right)\right|$ is divisible by a.x b. x^2 c.x^3 d. none of these

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4. If $f(x) = \begin{vmatrix} a & -1 & 0 \\ ax & a & -1 \\ ax^2 & ax & a \end{vmatrix}, then f(2x) - f(x)$ is divisible by (a) a (b) b (c) c, d, e (d) none of these

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5. If (x)= |x^2+4x-3 2x+4 13 2x^2+5x-9 4x+5 26 8x^2-6x+1 16 x-6 104|=a x^3+b x^2+c x+d ,$then$a=3b. b=0c. c=0` d. none of these

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6. If $\left|x^n x^{n+2} x^{2n} 1 x^a a x^{n+5} x^{a+6} x^{2n+5}\right| = 0, \forall x \in R, where n \in N,$

then value of a is n b. $n-1$ c. $n+1$ d. none of these

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7. Let $x < 1,$ then value of $\begin{bmatrix} x^2+2 & 2x+1 & 1 \\ 2x+1 & x+2 & 1 \\ 3 & 3 & 1 \end{bmatrix}$ is a. none-negative b. none-positive c. negative d. positive

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8. If f (x) = $\begin{vmatrix} 0 & x-a & x-b \\ x+a & 0 & x-c \\ x+b & x+c & 0 \end{vmatrix}$ then

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9. Value of $\begin{bmatrix} x+y & z & z \\ x & y+z & x \\ y & y & z+x \end{bmatrix}$, where x ,y ,z are nonzero real number, is equal to xyz b. $2xyz$ c. $3xyz$ d. $4xyz$

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10. Which of the following is not the root of the equation $\begin{vmatrix} x & -6 & -1 \\ 2 & -3x & x-3 \\ -3 & 2x & x+2 \end{vmatrix} = 0?$ a.2 b. 0 c. 1 d. -3

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11. If A,B,C are the angles of a non right angled triangle ABC. Then find the value of: $\begin{vmatrix} \tan A & 1 & 1 \\ 1 & \tan B & 1 \\ 1 & 1 & \tan C \end{vmatrix}$

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12. If $f(x) = |xaaaxaaax| = 0$, then $f'(x) = 0 and f^x = 0$ has common root $f^x = 0 and f'(x) = 0$ has common root sum of roots of $f(x) = 0$ is $-3a$ none of these

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13. Evaluate $\begin{bmatrix} \cos\alpha\cos\beta & \cos\alpha\sin\beta & -\sin\alpha \\ -\sin\beta & \cos\beta & 0 \\ \sin\alpha\cos\beta & \sin\alpha\sin\beta & \cos\alpha \end{bmatrix} = 0$

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14. Roots of the equation $|xmn1axn1abx1abc1| = 0$ are independent of $m, and n$ independent of $a, b, and c$ depend on $m, n, and a, b, c$ independent of $m, n and a, b, c$

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15. Prove that the value of determinants is zero:

$|a-bb-cc-ax-yy-zz-xp-qq-rr-p|$

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16. If a, b, c are different, then the value of

$\left|0x^2-ax^3-bx^2+a0x^2+cx^4+bx-c0\right|=0$ is c b. c c. b d. 0

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17. Prove that the value of each the following determinants is zero:

$$\begin{vmatrix} a_1 & la_1+mb_1 & b_1 \\ a_2 & la_2+mb_2 & b_2 \\ a_3 & la_3+mb_3 & b_3 \end{vmatrix}$$

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18. If $|b++aa+ba+++ac+aa++c|=k|aba\mathbf{ca}|$, then value of k is 1 b. 2 c. 3 d. 4

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19. A triangle has vertices $A_i(x_i, y_i) f \text{ or } i = 1, 2, 3$ If the orthocentre of triangle is $(0, 0)$, then prove that

$|x_2 - x_3 y_2 - y_3 y_1 (y_2 - y_3) + x_1 (x_2 - x_3) x_3 - x_1 y_2 - y_3 y_2 (y_3 - y_1) + x_1($

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20. If α, β, γ are the roots of $ax^3 + bx^2 + cx + d = 0 and |\alpha\beta\gamma\beta\gamma\alpha\gamma\alpha\beta| = 0, \alpha \neq \beta \neq \gamma$ then find the equation whose roots are $\alpha + \beta - \gamma, \beta + \gamma - \alpha, and \gamma + \alpha - \beta.$

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21. 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 $\Delta_1 =$

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22. Prove that the value of each the following determinants is zero:

$$\begin{vmatrix} (a^x + a^{-x})^2 & (a^x - a^{-x})^2 & 1 \\ (b^y + b^{-y})^2 & (b^y - + b^{-y})^2 & 1 \\ (c^z + c^{-z})^2 & (c^z - c^{-z})^2 & 1 \end{vmatrix}$$

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23. The value of the determinant $\begin{bmatrix} 1^2 & 2^2 & 3^2 & 4^2 \\ 2^2 & 3^2 & 4^2 & 5^2 \\ 3^2 & 4^2 & 5^2 & 6^2 \\ 4^2 & 5^2 & 6^2 & 7^2 \end{bmatrix}$ is equal to 1 b. 0 c. 2

d. 3

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24. If f(x)=

$$|1xx + 12xx(x-1)(x+1)x3x(x-1)x(x-1)(x-2)(x+1)x(x-1)|$$

then f(500) is equal to 0 b. 1 c. 500 d. -500

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25. Show that $\begin{vmatrix} \log x & \log y & \log z \\ \log 2x & \log 2y & \log 2z \\ \log 3x & \log 3y & \log 3z \end{vmatrix} = 0$

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26. 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. $-1, 1$

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27. $\begin{bmatrix} 1 & 1+p & 1+p+q \\ 2 & 3+2p & 4+3p+2q \\ 3 & 6+3p & 10+6p+3q \end{bmatrix} = 1$

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28. If $\begin{vmatrix} a & b & a\alpha+b \\ b & c & b\alpha+c \\ a\alpha+b & b\alpha+c & 0 \end{vmatrix} = 0,$ prove that a,b,c, are in G.P. or α is a root of ax^2+ 2bx+c=0

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29. By using properties of determinants , show that : $\begin{bmatrix} 1+a^2-b^2 & 2ab & -2b \\ 2ab & 1-a^2+b^2 & 2a \\ 2b & -2a & 1-a^2-b^2 \end{bmatrix} = \left(1+a^2+b^2\right)^3$

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30. Which of the following values of α satisfy the equation

$$\begin{vmatrix} (1+\alpha)^2 & (1+2\alpha)^2 & (1+3\alpha)^2 \\ (2+\alpha)^2 & (2+2\alpha)^2 & (2+3\alpha)^2 \\ (3+alph)^2 & (2+2\alpha)^2 & (2+3\alpha)^2 \end{vmatrix} = 648\alpha?$$

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31. solve $\begin{bmatrix} 3a & -a+b & -a+c \\ -b+a & 3b & -b+c \\ -c+a & -c+b & 3c \end{bmatrix} = 3(a+b+c)(ab+bc+ca)$

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

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33.

$$\begin{bmatrix} 6i & -3i & 1 \\ 4 & 3i & -1 \\ 20 & 3 & i \end{bmatrix}$$

=x+i y ,$thena.$ x=3,y=1$b.$ x=1,y=3$c.$ x=0,y=3$d.$ x=0,y=0`

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34. The value of $\begin{vmatrix} yz & zx & xy \\ p & 2q & 3r \\ 1 & 1 & 1 \end{vmatrix}, wherex, y, z$ are respectively, pth, $(2q)$ th, and $(3r)$ th terms of an H.P. is a. -1 b. 0 c. 1 d. none of these

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35. Prove that

$$\begin{vmatrix} (\beta+\gamma-\alpha-\delta)^4 & (\beta+\gamma-\alpha-\delta)^2 & 1 \\ (\gamma+\alpha-\beta-\delta)^4 & (\gamma+\alpha-\beta-\delta)^2 & 1 \\ (\alpha+\beta-\gamma-\delta)^4 & (\alpha+\beta-\gamma-\delta)^2 & 1 \end{vmatrix} = -64(\alpha-\beta)(\alpha-\gamma)(\alpha-\delta)$$

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36. Prove that the value of each the following determinants is zero:

$$\left|\sin^2\left(x+\frac{3\pi}{2}\right)\sin^2\left(x+\frac{5\pi}{2}\right)\sin^2\left(x+\frac{7\pi}{2}\right)\sin^{x+\frac{3\pi}{2}}\sin^{x+\frac{5\pi}{2}}\sin^{x+\frac{7\pi}{2}}\sin^{x}\right.$$

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37. The number of values of k for which the lines $(k+1)x+8y=4kandkx+(k+3)y=3k-1$ are coincident is

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38. Prove that $|b+ca-bac+ab-cba+bc-ac|=3ab-a^3-b^3-c^3.$

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39. If $\left|a^2b^2c^2(a+1)^2(b+1)^2(c+1)^2(a-1)^2(b-1)^2(c-1)^2\right|=k(a-b)(b-c$

then find the value of $k.$

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40. Statement 1: $\text{Delta} = |my + nzmq + nrmb + nckz - mxkr - mpkc - ma - nx - ky$ is equal to 0. Statement 2: The value of skew symmetric matrix of order 3 is zero.

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41. Prove that $= \left|111abcbc + a^2ac + b^2ab + c^2\right| = 2(a-b)(b-c)(c-a)$

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42. If the determinant | cos(θ+ϕ) sinθ −cosθ −sin(θ+ϕ) cosθ sinθ cos2ϕ sinϕ cosϕ | is positive is independent of θ is independent of φ none of these

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43. The system of equations $-2x+y+z=a, \quad x-2y+z=b,$ $x+y-2z=c$, has: (a)no solution if $a+b+c\neq 0$ (b)unique solution if $a+b+c=0$ (c)infinite number of solutions if $a+b+c=0$ (d)none of these

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44. Show that if $x_1, x_2, x_3 \neq 0$ $|x_1+a_1b1a_1b_2a_1b_3a_2b_1x_2+a_2b_2a_2b_3a_3b_1a_3b_2x_3+a_3b_3| = x_1x_2x_3\left(1+\frac{a_1}{x}\right.$

.

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45. determinant `|"cos theta sin theta -sin theta cos theta

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46. If $\Delta_r = \begin{vmatrix} 2^{r-1} & 2.3^{r-1} & 4.5^{r-1} \\ \alpha & \beta & \gamma \\ 2^n - 1 & 3^n - 1 & 5^n - 1 \end{vmatrix}$, then find the value of Δ

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47. The values of $k \in R$ for which the system of equations $x + ky + 3z = 0, kx + 2y + 2z = 0, 2x + 3y + 4z = 0$ admits of nontrivial solution is 2 b. $5/2$ c. 3 d. $5/4$

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48. A determinant of second order is made with the elements 0 and 1. Find the number of determinants with non-negative values.

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49. If a, b, c are nonzero real numbers such that $|baabcaa\mathbf{c}aa| = 0, then$ $\frac{1}{a} + \frac{1}{b\omega} + \frac{1}{c\omega^2} = 0$ b. $\frac{1}{a} + \frac{1}{b\omega^2} + \frac{1}{c\omega^{\square}} = 0$ c. $\frac{1}{a\omega} + \frac{1}{b\omega^2} + \frac{1}{c} = 0$

d. none of these

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50. Prove that the determinant $\begin{bmatrix} x & \sin\theta & \cos\theta \\ -\sin\theta & -x & 1 \\ \cos\theta & 1 & x \end{bmatrix}$ is independent of ` theta.

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51. Consider the determinant $f(x) = \left|0x^2 - ax^3 - bx^2 + a0x^2 + cx^4 + bx - c0\right|$. Statement 1: $f(x) = 0$ has one root $x = 0$. Statement 2: The value of skew symmetric determinant of odd order is always zero.

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52. Find the value of $|124 - 130410|$

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53. Consider the system of the equation $kx + y + z = 1, x + ky + z = k, and x + y + kz = k^2$. Statement 1: System equations has infinite solutions when $k = 1$. Statement 2: If the determinant $\left|111kk1k^2 1k\right| = 0,$ t hen $k = -1$.

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54. If $a, b, c \in R,$ then find the number of real roots of the equation

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

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55. $\Delta = \begin{vmatrix} a & a^2 & 0 \\ 1 & 2a+b & (a+b) \\ 0 & 1 & 2a+3b \end{vmatrix}$ is divisible by $a+b$ b. $a+2b$ c. $2a+3b$ d. a^2

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56. Without expanding at any stage, prove that the value of each of the following determinants is zero. (1) $\begin{vmatrix} 0 & p-q & p-r \\ q-p & 0 & q-r \\ r-p & r-q & 0 \end{vmatrix}$ (2) $\begin{vmatrix} 41 & 1 & 5 \\ 79 & 7 & 9 \\ 29 & 5 & 3 \end{vmatrix}$

(3) $\begin{vmatrix} 1 & w & w^2 \\ w & w^2 & 1 \\ w^2 & 1 & w \end{vmatrix}$, where w is cube root of unity

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57. If a,b,c are all positive, and are p^{th}, q^{th} and r^{th} terms of a G.P., show that $\begin{vmatrix} \log a & p & 1 \\ \log b & q & 1 \\ \log c & r & 1 \end{vmatrix} = 0.$

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58. If the entries in a 3×3 determinant are either 0 or 1, then the greatest value of their determinants is

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59. The value of the determinant of n^{th} order, being given by $|x111x111x|$ is $(x-1)^{n-1}(x+n-1)$ b. $(x-1)^{n}(x+n-1)$ c. $(1-x)^{-1}(x+n-1)$ d. none of these

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60. Solve the equation $\begin{bmatrix} x+a & x & x \\ x & x+a & x \\ x & x & x+a \end{bmatrix} = 0, a \neq 0$

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61. If $a_1b_1, c_1, a_2b_2c_2anda_3b_3c_3$ are three digit even natural numbers and $= |c_1a_1b_1c_2a_2b_2c_3a_3b_3|, thenis$ divisible by 2 but not necessarily by 4 divisible by 4 but not necessarily by 8 divisible by 8 none of these

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62. If $= \begin{vmatrix} abc & b^2c & c^2b \\ abc & c^2a & ca^2 \\ abc & a^2b & b^2a \end{vmatrix} = 0, (a, b, c \in R)$ and are all different and nonzero), then prove that $a + b + c = 0$.

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63. The value of $\begin{vmatrix} yz & zx & xy \\ p & 2q & 3r \\ 1 & 1 & 1 \end{vmatrix}, where x, y, z$ are respectively, pth, $(2q)$ th, and $(3r)$ th terms of an H.P. is a.-1 b. 0 c. 1 d. none of these

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64. Show that the determinant $|a^2 + b^2 + c^2 bc + ca + a\mathbf{c} + ca + a\mathbf{c} + ca + aba^2 + b^c + c^2 bc + ca + a\mathbf{c} +$ is always non-negative.

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65. If $x \neq 0, y \neq 0, z \neq 0$ and $\begin{vmatrix} 1+x & 1 & 1 \\ 1+y & 1+2y & 1 \\ 1+z & 1+z & 1+3z \end{vmatrix} = 0,$ then $x^{-1} + y^{-1} + z^{-1}$ is equal to a.1 b.-1 c.-3 d. none of these

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66. If $x \neq y \neq z and \begin{vmatrix} x & x^2 & 1+x^3 \\ y & y^2 & 1+y^3 \\ z & z^2 & 1+z^3 \end{vmatrix} = 0,$ then the value of xyz is a.1 b. 2 c. -1 d. 2

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67. Prove that

$$\begin{vmatrix} 2 & \alpha+\beta+\gamma+\delta & \alpha\beta+\gamma\delta \\ \alpha+\beta+\gamma+\delta & 2(\alpha+\beta)(\gamma+\delta) & \alpha\beta(\gamma+\delta)+\gamma\delta(\alpha+\beta) \\ \alpha\beta+\gamma\delta & \alpha\beta(\gamma+\delta)+\gamma\delta(\alpha+\beta) & 2\alpha\beta\gamma\delta \end{vmatrix}$$

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68. Solve for x, $|x-6-12-3\times\ -3-32\times\ +2|=0.$

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69. The value of determinant $\left|111^{m}C_1^{m+1}C_1^{m+2}C_1^{m}C_2^{m+1}C_2^{m+2}C_2\right|$ is equal to 1 b. -1 c. 0 d. none of these

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70. Solve the equation $|a-xcbcb-xabac-x|=0wherea+b+c\neq 0.$

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71. If $a^2+b^2+c^2=-2andf(x)=$ $|a+a^2x(1+b^2)x(1+c^2)x(1+a^2)x1+b^2x(1+c^2)x(1+a^2)x(1+b^2)x$, then $f(x)$ is a polynomial of degree 0 b. 1 c. 2 d. 3

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72. 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. A) C his empty

B. null

C. null

D. null

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73. Solve:

$|x^2 - 1x^2 + 2x + 12x^2 + 3x + 12x^2 + x - 12x^2 + 5x - 32x^2 + 4x - 36x^2$

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74. If $|x3636x6x3| = |2x7x7272x| = |45x5x4x45| = 0,$ then x is equal to 0 b. -9 c. 3 d. none of these

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75. If $A_1B_1C_1$, $A_2B_2C_2$ and $A_3B_3C_3$ are three digit numbers, each of which is divisible by k, 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

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76. If

$f'(x) = |mxmx - pmx + p\cap + pn - pmx + 2nmx + 2n + pmx + 2n -$

, then $y = f(x)$ represents a straight line parallel to x-axis a straight line parallel to y-axis parabola a straight line with negative slope

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77. If $\sum_{n=1}^{n} \alpha_n = an^2 + bn, wherea, b$ are constants and $\alpha_1, \alpha_2, \alpha_3 \in \{1, 2, 3, \ldots\ldots, 9\} and 25\alpha_1, 37\alpha_2, 49\alpha_3$ be three digit number, then prove that $|\alpha_1\alpha_2\alpha_3 57925\alpha_1 37\alpha_2 49\alpha_3| = 0$

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78. The determinant $|xp + yxyyp + zyz0xp + yyp + z| = 0$ if x, y, z

A. a) if x,y,z are in AP

B. b) x,y,z are in GP

C. c) x,y,z are in HP

D. d) xy,zy,zx are in AP

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79. Using properties of determinant prove that

$|a+b+c-c-b-ca+b+c-a-b-aa+b+c| = 2(a+b)(b+c)($

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80. Show that

$\left| {}^{\wedge} xC_r^x C_{r+1}^x C_{r+2}^y C_r^y C_{r+1}^y C_{r+2}^z C_r^z C_{r+1}^z C_{r+1} \right| = \left| {}^{\wedge} xC_r^{x+1} C_{r+1}^{x+2} C_{r+2}^y C_r^{y+1}\right.$

.

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81. If $\omega \neq 1$ is a cube root of unity and $x+y+z \neq 0,$ then prove that

$$\left| \frac{x}{1+\omega} \frac{y}{\omega+\omega^2} \frac{z}{\omega^2+1} \frac{y}{\omega+\omega^2} \frac{z}{\omega^2+1} \frac{x}{1+\omega} \frac{zz}{\omega^2+1} \frac{x}{1+\omega} \frac{y}{\omega+\omega^2} \right| = 0$$

if $x=y=z$

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82. Statement 1: If the system of equation $\lambda x + (b-a)y + (c-a)z = 0, (a-b)x + \lambda y + (c-b)z = 0, and (a-c)x$

has a non trivial solution, then the value of λ is 0. Statement 2: the value of skew symmetric matrix of order 3 is order.

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83. If $A, BandC$ are the angels of a triangle, show that

$| -1 + \cos B \cos C + \cos B \cos B \cos C + \cos A - 1 + \cos A \cos A - 1 + \co$

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84. If α, β, γ are the angles of a triangle and system of equations

$\cos(\alpha - \beta)x + \cos(\beta - \gamma)y + \cos(\gamma - \alpha)z = 0$

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

$\sin(\alpha + \beta)x + \sin(\beta + \gamma)y + \sin(\gamma + \alpha)z = 0$ has non-trivial solutions, then triangle is necessarily a. equilateral b. isosceles c. right angled d. acute angled

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85. Without expanding the determinants, prove that

$|103115114111108106104113116| + |113116104108106111115114103| = 0$

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86. Given

$a = x/(y-z), b = y/(z-x), andc = z/(x-y), wherex, y, zandz$ are not all zero, then the value of $ab + bc + ca$ is 0 b. 1 c.-1 d. none of these

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87. Find the value of determinant

$\left|\left(\sqrt{(13)} + \sqrt{3}, 2\sqrt{5}, \sqrt{5}\right)\sqrt{(15)} + \sqrt{(26)}5\sqrt{(10)}3 + \sqrt{(65)}\sqrt{(15)}5\right|$

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88. a, b, c are distinct real numbers not equal to one. If $ax + y + z = 0, x + by + z = 0, and x + y + cz = 0$ have nontrivial solution, then the value of $\frac{1}{1-a} + \frac{1}{1-b} + \frac{1}{1-c}$ is equal to a.1 b. -1 c.$zero$ d. none of these

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89. Prove that the value of the determinant $\left| -75 + 3i\frac{2}{3} - 4i5 - 3i84 + 5i\frac{2}{3} + 4i4 - fi9 \right|$ is real.

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90. If the system of linear equation $x + y + z = 6, x + 2y + 3c = 14, and 2x + 5y + \lambda z = \mu(\lambda, \mu R)$ has a unique solution, then $\lambda = 8$ b. $\lambda = 8, \mu = 36$ c.$\lambda = 8, \mu \neq 36$ d. none of these

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91. If $a_r = (\cos 2r\pi + is \in 2r\pi)^{1/9}$, then prove that $|a_1 a_2 a_3 a_4 a_5 a_6 a_7 a_8 a_9| = 0.$

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92. Let $f(x) = |2\cos^2 x \sin 2x - \sin x \sin 2x 2\sin^2 x \cos x \sin x - \cos x 0|$. Then the value of $\int_0^{\pi/2} [f(x) + f'(x)]dx$ is a.π b. $\pi/2$ c.2π d. $3\pi/2$

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93. Using properties of determinants, prove that

$$\begin{vmatrix} -a^2 & ab & ac \\ ba & -b^2 & bc \\ ca & cb & -c^2 \end{vmatrix} = 4a^2b^2c^2$$

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94. The number of positive integral solutions of the equation

$$\begin{vmatrix} x^3+1 & x^2y & x^2z \\ xy^2 & y^3+1 & y^2z \\ xz^2 & z^2y & z^3+1 \end{vmatrix} = 11 \text{ is}$$

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95. `If the value of determinant |(a,1,1),(1,b,1)(1,1,c)| is positive , then

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96. By using properties of determinants. Show that: (i)

$$\begin{vmatrix} x+4 & 2x & 2x \\ 2x & x+4 & 2x \\ 2x & 2x & x+4 \end{vmatrix} = (5x-4)(4-x)^2$$ (ii)

$$\begin{vmatrix} y+k & y & y \\ y & y+k & y \\ y & y & y+k \end{vmatrix} = y^2(3y+k)$$

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97. Using properties of determinants, evaluate $|18408940891988919844 0|$.

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98. if $A_1, B_1, C_1 \ldots \ldots$ are respectively the cofactors of the elements $a_1, b_1, c_1 \ldots \ldots$ of the determinant

$\Delta = \begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix}$, $\Delta \neq 0$ then the value of $\begin{vmatrix} B_2 & C_2 \\ B_3 & C_3 \end{vmatrix}$ is equal to

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99. Solve for x

$|x - 22x - 33 \times -4x - 42x - 93x - 16x - 82x - 273x - 64| = 0.$

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100. If $\text{Delta}_1 = |x\mathbf{a}xbaax| and \text{Delta}_2 = |xbax|$ are the given determinants, then $\text{Delta}_1 = 3(\text{Delta}_2)^2$ b. $\frac{d}{dx}(\text{Delta}_1) = 3\text{Delta}_2$ c.

$$\frac{d}{dx}(\text{Delta}_1) = 3(\text{Delta}_2)^2 \text{ d. Delta}_1 = 3\text{Delta}23/2$$

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101. Without expanding evaluate the determinant

$$\begin{vmatrix} \sin\alpha & \cos\alpha & \sin(\alpha+\delta) \\ \sin\beta & \cos\beta & \sin(\beta+\delta) \\ \sin\gamma & \cos\gamma & \sin(\gamma+\delta) \end{vmatrix}$$

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102. if y= sin mx, them the value of the determinant

$$\begin{vmatrix} y & y_1 & y_2 \\ y_3 & y_4 & y_5 \\ y_6 & y_7 & y_8 \end{vmatrix} \text{ Where } y_n = \frac{d^n y}{dx^n} \text{ is}$$

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103. Find the value of the determinant $|111112341361014102 0|$

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104. The parameter on which the value of the determinant $\left|1aa^2\cos(p-d)x\cos px\cos(p+d)x\sin(p-d)x\sin px\sin(p+d)x\right|$ does not depend is a b. p c. d d. x

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105. If $x = cy + bz, y = az + cx, z = bx + ay, wherex, y, z$ are not all zeros, then find the value of $a^2 + b^2 + c^2 + 2abc.$

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106. If $\begin{vmatrix} b^2+c^2 & ab & ac \\ ab & c^2+a^2 & bc \\ ca & cb & a^2+b^2 \end{vmatrix} = ka^2b^2c^2,$ then the value of k is abc b. $a^2b^2c^2$ c. $bc + ca + ab$ d. none of these

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107. The value of $\left|-1213+2\sqrt{22}+2\sqrt{213}-2\sqrt{22}-2\sqrt{21}\right|$ is equal to

a. zero b. $-16\sqrt{2}$ c. $-8\sqrt{2}$ d. none of these

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108. Find the following system of equations is consistent, $(a+1)^3x+(a+2)^3y=(a+3)^3$ $(a+1)x+(a+2)y=a+3$ $x+y=1$, then find the value of a

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109. Prove the identities: $\begin{vmatrix} b^2+c^2 & ab & ac \\ ba & c^2+a^2 & bc \\ ca & cb & a^2+b^2 \end{vmatrix} = 4a^2b^2c^2$

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110. Prove that

$$\begin{bmatrix} 1+a^2+a^4 & 1+ab+a^2b^2 & 1+ac+a^2c^2 \\ 1+ab+a^2b^2 & 1+b^2+b^4 & 1+bc+b^2c^2 \\ 1+ac+a^2c^2 & 1+bc+b^2c^2 & 1+c^2+c^2 \end{bmatrix} = (a-b)^2(b-c)^2(c-a$$

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111. If x, y, z are in A.P. , then the value of the determinant are in A.P. , then the value of the determinant $|a+2a+3a+2xa+3a+4a+2ya+4a+5a+2z|$ is a. 1 b. 0 c. $2a$ d. a

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112. Prove that

$$\begin{vmatrix} (b+x)(c+x) & (c+x)(a+x) & (a+x)(b+x) \\ (b+y)(c+y) & (c+y)(a+y) & (a+y)(b+y) \\ (b+z)(c+z) & (c+z)(a+z) & (a+z)(b+z) \end{vmatrix} = (a-b)(b-c)(c-a$$

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113. If $a+b+c=0$, one root of $\begin{bmatrix} a-x & c & b \\ c & b-x & a \\ b & a & c-x \end{bmatrix}=0$ is a. $x=1$ b. $x=2$ c. $x=a^2+b^2+c^2$ d. $x=0$

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114. Factorize the following $\left|3a+b+ca^3+b^3+c^3a+b+ca^2+b^2+c^2a^4+b^4+c^4a^2+b^2+c^2a^3+\right.$

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

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116. If $g(x) - \frac{f(x)}{(x-a)(x-b)(x-c)}, where f(x)$ is a polynomial of degree $< 3,$ then prove that $\frac{dg(x)}{dx} = \left|1af(a)(x-a)^{-2}1bf(b)(x-b)^{-2}1cf(c)(x-c)^{-2}\right| + \left|a^2a1b^2b1c\right.$

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117. If the equation $2x+3y+1=0, 3x+y-2=0, and ax+2y-b=0$ are consistent, then prove that $a-b=2.$

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118. If w is a complex cube root of unity, then value of $=\left|a_1+b_1wa_1w^2+b_1c_1+b_1wa_2+b_2wa_2w^2+b_2c_2+b_2wa_3+b_3wa_3w^2+\right.$ is a. 0 b. -1 c. 2 d. none of these

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119. Let

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

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

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120. If $f(x), g(x) and h(x)$ are three polynomials of degree 2, then prove that

$\varphi(x) = |f(x)g(x)h(x)f'(x)g'(x)h'(x)f^x g^x h^x| isaconstantpolynomial$

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121. If a, b, c are in G.P. with common ratio $r_1 and \alpha, \beta, \gamma$ are in G.P. with common ratio r_2 and equations $ax + \alpha y + z = 0, bx + \beta y + z = 0, cx + \gamma y + z = 0$ have only zero solution, then which of the following is not true? a.$a + b + c$ b. abc c.1 d. none of these

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122. Show that: $|ab - \quad + ba + cbc - aa - \quad + ac| = (a+b+c)(a^2+b^2+c^2)\cdot$

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123. In triangle ABC, if $\left|111\frac{\cot A}{2}\frac{\cot B}{2}\frac{\cot C}{2}\frac{\tan B}{2}+\frac{\tan C}{2}\frac{\tan B}{2}+\frac{\tan A}{2}\frac{\tan A}{2}+\frac{\tan B}{2}\right|$ then the triangle must be a. equilateral b. isosceles c. obtuse angled d. none of these

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124. If $a, b, c, d, e,$ and $f$are in G.P. then the value of $\begin{vmatrix}(a^2) & (d^2) & x\\(b^2) & (e^2) & y\\(c^2) & (f^2) & z\end{vmatrix}$ depends on (A) x and y (B) x and z (C) y and z (D) independent of x ,y ,and z

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125. Prove that: $\begin{vmatrix} (b+c)^2 & a^2 & a^2 \\ b^2 & (c+a)^2 & b^2 \\ c^2 & c^2 & (a+b)^2 \end{vmatrix} = 2abc(a+b+c)^3$

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126. if $x_i = a_i b_i C_i i = 1, 2, 3$ are three- digit positive integer such that each x_i is a mulptiple of 19 then prove that $\begin{matrix} a_1 & a_2 & a_3 \\ b_1 & b_2 & b_3 \\ c_1 & c_2 & c_3 \end{matrix}$ is divisible by 19.

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127. 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 : (1) infinitely many values of λ . (2) exactly one value of λ . (3) exactly two values of λ . (4) exactly three values of λ .

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

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129. If $c<1$ and the system of equations $x+y-1=0, 2x-y-c=0, andbx+3by-c=0$ is consistent, then the possible real values of b are $b\left(-3\frac{3}{4}\right)$ b. $b\left(-\frac{3}{2},4\right)$ c. $b\left(-\frac{3}{4},3\right)$ d. none of these

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130. Prove that

$$\begin{vmatrix} x^2 & x^2-(y-z)^2 & yz \\ y^2 & y^2-(z-x)^2 & zx \\ z^2 & z^2-(x-y)^2 & xy \end{vmatrix} = (x-y)(y-z)(z-x)(x+y+z)\left(x^2+y^2+\right.$$

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131. If a,b and c are real numbers, and

$$\Delta = \begin{bmatrix} b+c & C+a & a+b \\ c+a & a+b & b+c \\ a+b & b+c & c+a \end{bmatrix} = 0$$

Show that either $a+b+c=0 \text{or} a=b=c.$

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

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133. Prove that

$$\left|ab+ca^2bc+ab^2ca+bc^2\right| = -(a+b+c)\times(a-b)(b-c)(c-a).$$

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134. If $a > 0$ and discriminant of $ax^2 + 2bx + c$ is negative, then $\begin{vmatrix} a & b & ax+b \\ b & c & bx+c \\ ax+b & bx+c & 0 \end{vmatrix}$ is $+ve$ b. $(ac-b)^2(ax^2+2bx+c)$ c. $-ve$ d. 0

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135. If $\begin{vmatrix} a-b-c & 2a & 2a \\ 2b & b-c-a & 2b \\ 2c & 2c & c-a-b \end{vmatrix} = (a+b+c)$ $\times (x+a+b+c)^2$, $x \neq 0$ and $a+b+c \neq 0$ then x is equal to

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136. If $a_1, a_2, a_3, \ldots\ldots\ldots, a_n$..... are in G.P., then the determinant $\Delta =$ $\begin{vmatrix} \log a_n & \log a_{n+1} & \log_{n+2} \\ \log a_{n+3} & \log a_{n+4} & \log_{n+5} \\ \log a_{n+6} & \log a_{n+7} & \log_{n+8} \end{vmatrix}$ is equal to

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137. By using properties of determinants , show that :

$$\begin{bmatrix} a^2+1 & ab & ac \\ ab & b^2+1 & bc \\ ca & cb & c^2+1 \end{bmatrix} = 1+a^2+b^2+c^2$$

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138. Let $\vec{a}_r = x_r\hat{i} + y_r\hat{j} + z_r\hat{k}, r = 1, 2, 3$ be three mutually perpendicular unit vectors, then the value of $\begin{vmatrix} x_1 & x_2 & x_3 \\ y_1 & y_2 & y_3 \\ z_1 & z_2 & z_3 \end{vmatrix}$ is equal to 0 b. ± 1 c. ± 2 d. none of these

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139. 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 $\pi/4 \leq x \leq \pi/4$ is 0 b. 2 c. 1 d. 3

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140. Let a, b, c be real numbers with $a^2 + b^2 + c^2 = 1$. Show that the equation

$|ax - by - cbx - aycx + abx + ay - ax + by - \text{y} + bcx + acy + b - ax -$

represents a straight line.

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141. If lines $px + qy + r = 0, qx + ry + p = 0 and rx + py + q = 0$ are concurrent, then prove that $p + q + r = 0 (where p, q, r$ are distinct$)\cdot$

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142. If $p\lambda^4 + q\lambda^3 + r\lambda^2 + s\lambda + t = \begin{vmatrix} \lambda^2 + 3\lambda & \lambda - 1 & \lambda + 3 \\ \lambda^2 + 1 & 2 - \lambda & \lambda - 3 \\ \lambda^2 - 3 & \lambda + 4 & 3\lambda \end{vmatrix}$ then $t =$

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143. Find the value of λ if $2x^2 + 7xy + 3y^2 + 8x + 14t + \lambda = 0$ represents a pair of straight lines

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144. If x, y, z are different from zero and $\text{Delta} = \begin{vmatrix} a & b-y & c-z \\ a-x & b & c-z \\ a-x & b-y & c \end{vmatrix} = 0,$ then the value of the expression $\frac{a}{x} + \frac{b}{y} + \frac{c}{z}$ is 0 b. -1 c. 1 d. 2

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145. If A, B, C are angles of a triangles, then the value of $\begin{vmatrix} e^{2iA} & e^{-iC} & e^{-iB} \\ e^{-iC} & e^{2iB} & e^{-iA} \\ e^{-iB} & e^{-iA} & e^{2iC} \end{vmatrix}$ is 1 b. -1 c. -2 d. -4

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146. For the equation $\begin{vmatrix} 1 & x & x^2 \\ x^2 & 1 & x \\ x & x^2 & 1 \end{vmatrix} = 0,$ There are exactly two distinct roots There is one pair of equation real roots. There are three pairs of equal roots Modulus of each root is 2

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147. Let $\text{Delta}_r = \left| r - 1n6(r-1)^2 2n^2 4n - 2(r-1)^2 3n^3 3n^2 - 3n \right|.$

Show that $\sum_{r=1}^{n} \text{Delta}_r$ is contant.

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148. Let m be a positive integer and Δr= $\begin{vmatrix} 2r-1 & .^m C_r & 1 \\ m^2 - 1 & 2^m & m+1 \\ \sin^2(m^2) & \sin^2 m & \sin(m^2) \end{vmatrix}.$

Then the value of $\sum_{r=0}^{m} \Delta r$

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149. Prove that

$|1 + a11111 + b11111 + c11111 + d| = abcd\left(a + \frac{1}{a} + \frac{1}{b} + \frac{1}{c} + \frac{1}{d}\right).$

Hence find the value of the determinant if a, b, c, d are the roots of the equation $px^4 + qx^3 + rx^2 + sx + t = 0.$

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150. Find the area of a triangle having vertices $A(3, 2), B(11, 8),$ and $C(8, 12).$

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151. If

$D_k = 1 \cap 2kn^2 + n + 1n^2 + n2k - 1n^2n^2 + n + 1and \sum_{k=1}^{n} D_k = 56.$

then n equals 4 b. 6 c. 8 d. none of these

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152. If $a \neq p, b \neq q, c \neq r and |pbcaqcabr| = 0$, then find the value of $\frac{p}{p-a} + \frac{q}{q-b} + \frac{r}{r-c}$.

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153. If x_1, x_2, x_3 as well as y_1, y_2, y_3 are in G.P. with same common ratio, then prove that the points $(x_1, y_1), (x_2, y_2), and (x_3, y_3)$ are collinear.

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154. If the lines $a_1x + b_1y + 1 = 0,\ a_2x + b_2y + 1 = 0\ and\ a_3x + b_3y + 1 = 0$ are concurrent, show that the points $(a_1, b_1),\ (a_2, b_2) and\ (a_3, b_3)$ are collinear.

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155. For a fixed positive integer n, if

$= |n!(n+1)!(n+2)!(n+1)!(n+2)!(n+3)!(n+2)!(n+3)!(n+4)!$

, then show that $\left[/\left((n!)^3\right)-4\right]$ is divisible by n.

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156. The number of values of a for which the lines $2x+y-1=0$, $ax+3y-3=0,$ and $3x+2y-2=0$ are concurrent is 0 (b) 1 (c) 2 (d) infinite

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157. If the lines $ax+y+1=0, x+by+1=0andx+y+c=0(a, b, c$ being distinct and different from $1)$ are concurrent, then prove that $\frac{1}{1-a}+\frac{1}{1-b}+\frac{1}{1-c}=1.$

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158. If $\left(1+ax+bx^2\right)^4 = a_0 + a_1x + a_2x^2 + \ldots + a_8x^8$ when $a, b, a_0, a_1, a_2 \ldots, a_8 \in R$ such that $a_0 + a_1 + a_2 \neq 0$ and $\begin{vmatrix} a_0 & a_1 & a_2 \\ a_1 & a_2 & a_0 \\ a_2 & a_0 & a_1 \end{vmatrix} = 0$ then the value of $5\frac{a}{b}$ (A) 6 (B) 8 (C) 10 (D) 12

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159. Find the value of λ for which the homogeneous system of equations: $2x + 3y - 2z = 0$ $2x - y + 3z = 0$ $7x + \lambda y - z = 0$ has non-trivial solutions. Find the solution.

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160. If $f, g, andh$ are differentiable functions of $xand(x) = \left|fgh(xf)'(xg)'(xh)'\left(x^{f2}f\right)''(x^2g)''(x^2h)\right|'prove$ $\Delta' = |$ (f g h f' g' h' (x^3f'' ')'(x^3g'' ')'(x^3h ' ')'|`

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

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

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162. if $= \begin{vmatrix} x^n & n! & 2 \\ \cos x & \cos.\frac{n\pi}{2} & 4 \\ \sin x & \sin.\frac{n\pi}{2} & 8 \end{vmatrix}$, then find the value of $\frac{d^n}{dx^n}[f(x)]_{x=0}.\ (n \in z)$.

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163. Without expanding a determinant at any stage, show that |

$|x^2+x, x+1, x+2|, |, 2x^2+3x-1, 3x, 3x-3|, |x^2+2x+3, 2x-1, 2$

are determinant of order 3 not involving $x \cdot$

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164. Show that $\begin{vmatrix} bc-a^2 & ca-b^2 & ab-c^2 \\ ca-b^2 & ab-c^2 & bc-a^2 \\ ab-c^2 & bc-a^2 & ca-b^2 \end{vmatrix}$ $\begin{vmatrix} a^2 & c^2 & 2ca-b^2 \\ 2ab-c^2 & b^2 & a^2 \\ b^2 & 2ac-a^2 & c^2 \end{vmatrix}$.

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165. Show that the system of equations $3x-y+4z=3,\ x+2y-3z=-2$ and $6x+5y+\lambda z=-3$ has at least one solution for any real number λ. Find the set of solutions of $\lambda=-5$

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166. Show that $\begin{vmatrix} 2bc-a^2 & c^2 & b^2 \\ c^2 & 2ca-b^2 & a^2 \\ b^2 & a^2 & 2ab-c^2 \end{vmatrix} = \begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix}^2$

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167. If $y = |\sin x \cos x \sin x \cos x - \sin x \cos \times 11| = f \in d\frac{dy}{dx}$.

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168. Consider the system of equation $x + y + z = 6, x + 2y + 3z = 10, andx + 2y + \lambda z = \mu$. Statement 1: if the system has infinite number of solutions, then $\mu = 10$. Statement 2: The determinant $|116121012\mu| = 0f \text{ or } \mu = 10.$

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169. Consider the system of linear equations in $x, yandz$: $(\sin 3\theta)x - y + z = 0(\cos 2\theta)x + 4y + 3z = 0\ 3x + 7y + 7z = 0$ Which of the following can be the value of θ for which the system has a non-trivial solution $n\pi + (-1)^n\frac{\pi}{6}, \forall n \in Z$ $n\pi + (-1)^n\frac{\pi}{3}, \forall n \in Z$ $n\pi + (-1)^n\frac{\pi}{9}, \forall n \in Z$ none of these

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170. Prove without expansion that

$|ah+bggab+chbf+bafhb+bcaf+bbg+fc| = a|ah+bgahbf+bahb$

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

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

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172. If 3 digit numbers $A28, 3B9 \text{ and } 62C$ are divisible by a fixed constant 'K' where A, B, C are integers lying between 0 and 9, then determinant $\begin{vmatrix} A & 3 & 6 \\ 8 & 9 & C \\ 2 & B & 2 \end{vmatrix}$ is always divisible by

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173. If $a = \cos\theta + i\sin\theta$, $b = \cos 2\theta - i\sin 2\theta$, $c = \cos 3\theta + i\sin 3\theta$ and if $\begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix} = 0$ then a.$\theta = 2k\pi, k \in Z$ b. $\theta = (2k+1)\pi, k \in Z$ c. $\theta = (4k+1)\pi, k \in Z$ d. none of these

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174. Prove that

$|a_1\alpha_1 + b_1\beta_1 a_1\alpha_2 + b_2\beta_2 a_1\alpha_3 + b_1\beta_3 a_2\alpha_1 + b_2\beta_1 a_2\alpha_2 + b_2\beta_2 a_2\alpha_3 + b_2\beta_3 a$

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175. If α, β, γ are the roots of $px^3 + qx^2 + r = 0$, then the value of the determinant $\begin{vmatrix} \alpha\beta & \beta\gamma & \gamma\alpha \\ \beta\gamma & \gamma\alpha & \alpha\beta \\ \gamma\alpha & \alpha\beta & \beta\gamma \end{vmatrix}$ is p b. q c. 0 d. r

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176. Prove that

$\left|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y)^2(c-z)^2\right.$

$\left|(1+ax)^2(1+bx)^2(1+cx)^2(1+ay)^2(1+by)^2(1+cy)^2(1+az)^2(1+bz)\right.$

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177. If $\left|1 \times^2 \times^2 1x^2 1x\right| =$, then find the value of

$\left|x^3-10x-x^4 0x-x^4 x^3-1x-x^4 x^3-10\right|$

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178. If

$\left|x^n x^{n+2} x^{n+3} y^n y^{n+2} y^{n+3} z^n z^{n+2} z^{n+3}\right| = (x-y)(y-z)(z-x)\left(\frac{1}{x}+\frac{1}{y}\right.$

then n equals 1 b. -1 c. 2 d. -2

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179. Solve the system of the equations: $ax+by+cz=d$ $a^2x+b^2y+c^2z=d^2$ $a^3x+b^3y+c^3z=d^3$ Will the solution always exist and be unique?

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180. if $\begin{vmatrix} a & b-c & c+b \\ a+c & b & c-a \\ a-b & a+b & c \end{vmatrix}=0$ then the line $ax+by+c=0$ passes through the fixed point which is

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181. If $2ax-2y+3z=0, x+ay+2z=0, and 2+az=0$ have a nontrivial solution, find the value of $a\cdot$

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182. If $\lfloor . \rfloor$ denotes the greatest integer less than or equal to the real number under consideration and $-1 \leq x < 0, 0 \leq y < 1, 1 \leq z < 2$, then the value of the determinant $\begin{vmatrix} \lfloor x \rfloor + 1 & \lfloor y \rfloor & \lfloor z \rfloor \\ \lfloor x \rfloor & \lfloor y \rfloor + 1 & \lfloor z \rfloor \\ \lfloor x \rfloor & \lfloor y \rfloor & \lfloor z \rfloor + 1 \end{vmatrix}$ is

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183. if $(x) = a + bx + cx^2$ and $\alpha, \beta\gamma$ are the roots of the equation $x^3 = 1$ then $\begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix}$ is equal to

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184. If $x, yandz$ are not all zero and connected by the equations $a_1x + b_1y + c_1z = 0, a_2x + b_2y + c_2z = 0, and(p_1 + \lambda q_1)x + (p_2 + \lambda q_2) +$, show that $\lambda = - |a_1b_1c_1a_2b_2c_2p_1p_2p_3| \div |a_1b_1c_1a_2b_2c_2q_1q_2q_3|$

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185. Find λ for which the system of equations $x + y - 2z = 0, 2x - 3y + z = 0, x - 5y + 4z = \lambda$ is consistent and find the solutions for all such values of $\lambda \cdot$

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186. If p, q, r are in A.P. then value of determinant $\left|a^2 + 2^{n+1} + 2pb^2 + 2^{n+2} + 3qc^2 + p2^n + p2^{n+1}2qa^2 + 2^n + pb^2 + 2^{n+1}c^2\right.$ is a) 0 (b) Independent from a, b, c c) $a^2b^2c^2 - 2^n$ (d) Independent from n

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187. For what values of $k,$ the following system of equations possesses a nontrival solution over the set of rationals: $c + ky + 3z = 0, 3c + ky - 2z = 02c + 3y - 4x = 0.$ Also find the solution for this value of $k \cdot$

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188. Let $a, b, c \in R$ such that no two of them are equal and satisfy $\begin{vmatrix} 2a & b & c \\ b & c & 2a \\ c & 2a & b \end{vmatrix} = 0$, then equation $24ax^2 + 8bx + 4c = 0$ has (a) at last one root in $[0, 1]$ (b) at last one root in $\left[-\frac{1}{2}, \frac{1}{2}\right]$ (c) at last one root in $[-1, 0]$ (d) at last two roots in $[0, 2]$

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189. Solve by Cramers rule $x + y + z = 6$ $x - y + z = 2$ $3x + 2y - 4z = -5$

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190. The value of the determinant $\begin{vmatrix} ka & k^2 + a^2 & 1 \\ kb & k^2 + b^2 & 1 \\ kc & k^2 + c^2 & 1 \end{vmatrix}$ is (A) $k(a+b)(b+c)(c+a)$ (B) $kabc(a^2 + b^2 + c^2)$ (C) $k(a-b)(b-c)(c-a)$ (D) $k(a+b-c)(b+c-a)(c+a-b)$

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191. Find the value of $a and b$ if the system of equation $a^2x - by = a^2 - band bx = b^2y = 2 + 4b$ (i) posses unique solution (ii) infinite solutions

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192. If $(x_1 - x_2)^2 + (y_1 - y_2)^2 = a^2$, $(x_2 - x_3)^2 + (y_2 - y_3)^2 = b^2$, $(x_3 - x_1)^2 + (y_3 - y_1)^2 = c^2$, and $k\begin{vmatrix} x_1 & y_1 & 1 \\ x_2 & y_2 & 1 \\ x_3 & y_3 & 1 \end{vmatrix} = (a + b + c)(b + c - b)(c + a - b) \times (a + b - c)$, then the value of k is 1 b. 2 c. 4 d. none of these

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193. $f(x) = \left|\cos \times 12\sin \times {}^2 2x \tan \times 1\right|$. Then value of $\left(\lim\right)_{x \overrightarrow{0}} \frac{f(x)}{x}$ is equal to 1 b. -1 c. zero d. none of these

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194. If the system of linear equation x + 2ay + az = 0, x + 3by + bz = 0, x + 4cy + cz = 0 has a non-trival solution then show that a, b, c are in H.P.

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195. Let α be a repeated root of a quadratic equation $f(x) = 0 and A(x), B(x), C(x)$ be polynomials of degrees 3, 4, and 5, respectively, then show that $|A(x)B(x)C(x)A(\alpha)B(\alpha)C(\alpha)A'(\alpha)B'(\alpha)C'(\alpha)|$ is divisible by $f(x)$, where prime $(')$ denotes the derivatives.

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196. If $|a^2 + \lambda^2 ab + c\lambda ca - b\lambda ab - c\lambda b^2 + \lambda^2 bc + aca + b\lambda bc - a\lambda c^2 + \lambda^2||\lambda c -$, then the value of λ is a) 8 b. 27 c. 1 d. -1

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197. Value of

$|1+x_1 1+x_1 x 1+x_1 x^2 1+x_2 1+x_2 x 1+x_2 x^2 1+x_3 1+x_3 x 1+x_3 x^2|$

depends upon $x \text{ o n l y}$ b. $x_1 \text{ o n l y}$ c. $x_2 only$ d. none of these

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198. If $(x)=|\alpha+x\theta+x\lambda+x\beta+x\varphi+x\mu+x\gamma+x\psi+xv+x|$ show that $\text{Delta}\hat{}(x)=0 and \text{Delta}(0)+Sx, where S$ denotes he sum of all the cofactors of all elements in $\text{Delta}(0) and$ dash denotes the derivative with respect of $x\cdot$

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199. The value of determinant $|bc-a^2 ac-b^2 ab-c^2 ac-b^2 ab-c^2 bc-a^2 ab-c^2 bc-a^2 ac-b^2|$ is a. always positive b. always negative c. always zero d. cannot say anything

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200. 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. 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

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201. Let $\begin{vmatrix} x & 2 & x \\ x^2 & x & 6 \\ x & x & 6 \end{vmatrix} = Ax^4 + Bx^3 + Cx^2 + Dx + E$.Then the value of 5A +4B +3C +2D +E is equal to

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202. 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

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203. The value of the determinant $\left|\left[\sin\theta, \cos\theta, \sin 2\theta\right], \left[\sin\left(\theta+\frac{2\pi}{3}\right), \cos\left(\theta+\frac{2\pi}{3}\right), \sin\left(2\theta+\frac{4\pi}{3}\right)\right], \left[\sin\right.\right.$

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204. Find the value of the determinant $|baabpqr111|, wherea, b, andc$ are respectively, the pth, qth, and rth terms of a harmonic progression.

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205. let $a > 0, d > 0$ find the value of the determinant

$$\begin{vmatrix} \frac{1}{a} & \frac{1}{a(a+d)} & \frac{1}{(a+d)(a+2d)} \\ \frac{1}{a+d} & \frac{1}{(a+d)(a+2d)} & \frac{1}{(a+2d)(a+3d)} \\ \frac{1}{a+2d} & \frac{1}{(a+2d)(a+3d)} & \frac{1}{(a+3d)(a+4d)} \end{vmatrix}$$

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206. For all values of A,B,C and P,Q,R show that

$$\begin{vmatrix} \cos(A-P) & \cos(A-Q) & \cos(A-R) \\ \cos(B-p) & \cos(B-Q) & \cos(B-R) \\ \cos(C-P) & \cos(C-Q) & \cos(C-R) \end{vmatrix} = 0$$

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207. Let $\lambda and \alpha$ be real. Find the set of all values of λ for which the system of linear equations $\lambda x + (\sin\alpha)y + (\cos\alpha)z = 0, x + (\cos\alpha)y + (\sin\alpha)z = 0, -x + (\sin\alpha)$ have trivial solution

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208. Prove that

$|ax - by - czay + bxcx + azay + bxby - cz - axbz + cycx + azbz + cycz$

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209. If $(x)=|\alpha+x\theta+x\lambda+x\beta+x\varphi+x\mu+x\gamma+x\psi+xv+x|$ show that $\mathrm{Delta}\hat{}(x)=0 and \mathrm{Delta}(0)+Sx, where S$ denotes he sum of all the cofactors of all elements in $\mathrm{Delta}(0) and$ dash denotes the derivative with respect of $x\cdot$

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210. 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 $\left|\frac{\alpha}{1-\alpha}\frac{\beta}{1-\beta}\frac{\gamma}{1-\gamma}\alpha\beta\gamma\alpha^2\beta^2\gamma^2\right|=\frac{25d}{2(a+b+c+d)}$

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

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212. Let

$= |2a_1b_1a_1b_2 + a_2b_1a_1b_3 + a_3b_1a_1b_2 + a_2b_1 2a_2b_2a_2b_3 + a_3b_2a_1b_3 + a_3b_1a_3b$

. Expressing as the product of two determinants, show that $= 0.$ Hence, show that if

$ax^2 + 2hxy + by^2 + 2gx + 2fy + c = (lx + my + n)\left(l'x + m'y + n\right), th$

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213. If $2s = a + b + c$ and $A = \begin{vmatrix} a^2 & (s-a)^2 & (s-a)^2 \\ (s-b)^2 & b^2 & (s-b)^2 \\ (s-c)^2 & (s-c)^2 & c^2 \end{vmatrix}$ then det A

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214. Evaluate $| \hat{} \; xC_1^x C_2^x C_3^y C_1^y C_2^y C_3^z C_1^z C_2^z C_3|$

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215. Using factor theorem, show that

$$\begin{vmatrix} -2a & a+b & c+a \\ a+b & -2a & b+c \\ c+a & c+b & -2c \end{vmatrix} = 4(a+b)(b+c)(c+a)$$

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216. If a determinant of order 3×3 is formed by using the numbers 1 or -1 then minimum value of determinant is :

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217. If $z = \left| -53 + 4i5 - 7i3 - 4i68 + 7i5 + 7i8 - 7i9 \right|, thenz$ is purely real purely imaginary $a + ib, wherea \neq 0, b \neq 0$ d. $a + ib, whereb = 4$

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218. If $\omega = cis\frac{2\pi}{3}$, then number of distinct roots of $\begin{vmatrix} z+1 & \omega & \omega^2 \\ \omega & z+\omega^2 & 1 \\ \omega^2 & 1 & z+\omega \end{vmatrix}$ = 0.

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

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220. If

$ax12 + by12 + cz12 = ax22 + by22 + cz22 = ax32 + by32 + cz32 = d, ax$

then prove that $|x_1 y_1 z_1 x_2 y_2 z_2 x_3 y_3 z_3| = (d-f)\left\{\frac{(d+2f)}{abc}\right\}^{1/2}$

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221. If $A, B, andC$ are the angles of triangle, show that the system of equations

$x \sin 2A + yisnC + z \sin B = 0, \sin C + y \sin 2B + z \sin A = 0, andx \sin B$

posses nontrivial solution. Hence, system has infinite solutions.

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222. Let α, β, γ are the real roots of the equation $x^3 + ax^2 + bx + c = 0(a, b, c \in Randa \neq 0)$. If the system of equations $(\in u, v, andw)$ given by $\alpha u + \beta v + \gamma w = 0$ $\beta u + \gamma v + \alpha w = 0$ $\gamma u + \alpha v + \beta w = 0$ has non-trivial solutions then the value of a^2 / b is _______.

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223. If $a_1, a_2, a_3, 54, a_6, a_7, a_8, a_9$ are in H.P., and $D = |a_1 a_2 a_3 45 a_6 a_7 a_8 a_9|$, then the value of $[D] iswhere [.]$ represents the greatest integer function

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224. If $f(x)$ is a polynomial of degree < 3, prove that $|1af(a)/(x-a)1bf(b)/(x-b)1cf(c)/(x-c)| \div |1aa^2 1 \hat{} 21 \hat{} 2| = \frac{}{(x}$

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225. Prove that $= |acc-a+bcbb-cb+ca-bb-c0a-cxyz1+x+y| = 0$ implies that a, b, c are in A.P. or a, c, b are in G.P.

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226. Solve for $x \in R$: $\begin{vmatrix} (x+a)(x-a) & (x+b)(x-b) & (x+c)(x-c) \\ (x-a)^3 & (x-b)^3 & (x-c)^3 \\ (x+a)^3 & (x+b)^3 & (x+c)^3 \end{vmatrix}$ =0, a,b and c being distinct real numbers.

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227. Absolute value of sum of roots of the equation $|x+22x+33x+42x+33x+44x+53x+55c+810x+17|=0$ is ______.

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228. Let α_1, α_2 and β_1, β_2 be the roots of the equation $ax^2+bx+c=0$ and $px^2+qx+r=0$ respectively. If the system of equations $\alpha_1 y+\alpha_2 z=0$ and $\beta_1 y_\beta \_ 2z=0$ has a non trivial solution then prove that $\frac{b^2}{q^2}=\frac{ac}{pr}$

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229. The product of all values of t, for which the system of equations $(a-t)x+by+cz=0, bx+(c-t)y+az=0, cx+ay+(b-t)z=0$

has non-trivial solution, is $|a - c - b - cb - a - b - ac|$ (b) $|abcbcacab|$

$|aca\mathrm{ba}|$ (d) $|aa + \ + c + \ + a + aa + b|$

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230. Let $\omega = -\frac{1}{2} + i\frac{\sqrt{3}}{2}$, then value of the determinant $\begin{bmatrix} 1 & 1 & 1 \\ 1 & -1 & -\omega^2 \\ \omega^2 & \omega^2 & \omega \end{bmatrix}$ is (a) 3ω (b) $3\omega(\omega - 1)$ (c) $3\omega^2$ (d) $3\omega(1 - \omega)$

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231. If $= |-xa - xaab - x|$, then a factor is $a + b + x$ $x^2 - (a - b) + x + a^2 + b^2 + ab$ $x^2 - (a + b) + x + a^2 + b^2 - ab$ $a + b - x$

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232. If $g(x) = \left|a^{-x}e^{x\log_e a}x^2a^{-3x}e^{3x\log_e a}x^4a^{-5x}e^{5x\log_e a}1\right|$, then graphs of $g(x)$ is symmetrical about the origin graph of $g(x)$ is symmetrical about the y-axis $\left(\frac{d^4g(x)}{dx^4}\mid\right)_{x=0} = 0$ $f(x) = g(x)\times\log\left(\frac{a-x}{a+x}\right)$ is an odd function

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233. the sum of values of p for which the equations x+y+z=1x+2y +4z=p and x+4y +10z =p^2 have a solution is _____

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234. 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 _____

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235. Let

$D_1 = |aba + bcdc + daba - b| and D_2 = |aca + cbdb + daca + b + c|$

then the value of $\left|\frac{D_1}{D_2}\right|, where b \neq 0 and ad \neq bc,$ is ____.

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236. If

$| \times + yx + y + z2x3x + 2y4x + 3y + 2z3x6x + 3y10x + 6y + 3z| = 64,$

then the real value of x is ________.

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237. If $= \left|13 \cos \theta 1s \int h\eta 13 \cos \theta 1s \int h\eta 1\right|$, then the value of $(\_ (max))/2$

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238. If $\left|x^n x^{n+2} x^{n+4} y^n y^{n+2} y^{n+4} z^n z^{n+2} z^{n+4}\right| = \left(\frac{1}{y^2} - \frac{1}{x^2}\right)\left(\frac{1}{z^2} - \frac{1}{y^2}\right)\left(\frac{1}{x^2} -\right.$

then n is ________.

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239. The value of

$|2x_1y_1x_1y_2 + x_2y_1x_1y_3 + x_3y_1x_1y_2 + x_2y_1 2x_2y_2x_2y_3 + x_3y_2x_1y_3 + x_3y_1x_2y$

is.

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240. Given $A = |ab2cde2flm2n|, B = |f2de2n4l2mc2ab|$, then the value of B/A is _________.

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Examples

1. find the value of $\begin{vmatrix} 1 & 2 & 4 \\ -1 & 3 & 0 \\ 4 & 1 & 0 \end{vmatrix}$

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2. Prove that the determinant $\Delta = \begin{vmatrix} x & \sin\theta & \cos\theta \\ -\sin\theta & -x & 1 \\ \cos\theta & 1 & x \end{vmatrix}$ is independent of θ.

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3. The parameter on which the value of the determinant $\left|1 a a^2 \cos(p-d)x \cos px \cos(p+d)x \sin(p-d)x \sin px \sin(p+d)x\right|$ does not depend is a b. p c. d d. x

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

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5. If $a, b, c \in R$, then find the number of real roots of the equation

$= |xc - b - cxab - ax| = 0$

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6. If $x + y + z = 0$, prove that $\begin{vmatrix} ax & by & cz \\ cy & az & bx \\ bz & cx & ay \end{vmatrix} = xyz \begin{vmatrix} a & b & c \\ c & a & b \\ b & c & a \end{vmatrix}$

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7. If $p\lambda^4 + q\lambda^3 + r\lambda^2 + s\lambda + t = \begin{vmatrix} \lambda^2 + 3\lambda & \lambda - 1 & \lambda + 3 \\ \lambda^2 + 1 & 2 - \lambda & \lambda - 3 \\ \lambda^2 - 3 & \lambda + 4 & 3\lambda \end{vmatrix}$ then $t =$

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8. The largest value of a third order determinant whose elements are equal to 1 or 0 is

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9. Prove that the value of the determinant

$$\begin{vmatrix} -7 & 5+3i & \frac{2}{3}-4i \\ 5-3i & 8 & 4+5i \\ \frac{2}{3}+4i & 4-5i & 9 \end{vmatrix} \text{ is real}$$

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10. Without expanding the determinants Prove that

$$\begin{vmatrix} 103 & 115 & 114 \\ 111 & 108 & 106 \\ 104 & 113 & 116 \end{vmatrix} + \begin{vmatrix} 113 & 116 & 104 \\ 108 & 106 & 111 \\ 115 & 114 & 103 \end{vmatrix} = 0$$

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

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

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13. witout expanding at any stage Prove that

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

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14. consider the fourth -degree polynomial equation

$$\begin{vmatrix} a_1 + b_1 x & a_1 x^2 + b_1 & c_1 \\ a_2 + b_2 x^2 & a_2 x^2 + b_2 & c_2 \\ a_3 + b_3 x^2 & a_3 x^2 + b_3 & c_3 \end{vmatrix} = 0$$

Without expanding the determinant find all the roots of the equation.

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15. Let $\text{Delta}_r = \left| r - 1n6(r-1)^2 2n^2 4n - 2(r-1)^2 3n^3 3n^2 - 3n \right|$. Show that $\sum_{r=1}^{n} \text{Delta}_r$ is contant.

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16. Find the value of $\begin{vmatrix} 41 & 1 & 5 \\ 79 & 7 & 9 \\ 29 & 5 & 3 \end{vmatrix}$

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17. Find the value of determinant

$$\left|\sqrt{(13)} + \sqrt{3}2\sqrt{5}\sqrt{5}\sqrt{(15)} + \sqrt{(26)}5\sqrt{(10)}3 + \sqrt{(65)}\sqrt{(15)}5\right|$$

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18. Find the value of the determinant $\begin{vmatrix} 1 & 1 & 1 & 1 \\ 1 & 2 & 3 & 4 \\ 1 & 3 & 6 & 10 \\ 1 & 4 & 10 & 20 \end{vmatrix}$

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19. Prove that $\begin{vmatrix} \sin\alpha & \cos\alpha & \sin(\alpha+\delta) \\ \sin\beta & \cos\beta & \sin(\beta+\delta) \\ \sin\gamma & \cos\gamma & \sin(\gamma+\delta) \end{vmatrix} = 0$

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20. Solve for x

$$|x - 22x - 33 \times \; - 4x - 42x - 93x - 16x - 82x - 273x - 64| = 0.$$

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21. By using properties of determinants, prove the following: $|x + 42x2x2 \times\ + 42x2x2 \times\ + 4| = (5x+4)(4-x)^2$

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22. prove that $\begin{bmatrix} a-b-c & 2a & 2a \\ 2b & b-c-a & 2b \\ 2c & 2c & c-a-b \end{bmatrix}$ = $(a+b+c)^3$

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23. if $x_i = a_i b_i C_i, i = 1, 2, 3$ are three- digit positive integer such that each x_i is a mulptiple of 19 then prove that det $\begin{Bmatrix} a_1 & a_2 & a_3 \\ b_1 & b_2 & b_3 \\ c_1 & c_2 & c_3 \end{Bmatrix}$ is divisible by 19.

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24. If a,b and c are real numbers, and

$$\Delta = \begin{bmatrix} b+c & C+a & a+b \\ c+a & a+b & b+c \\ a+b & b+c & c+a \end{bmatrix} = 0$$

Show that either $a+b+c=0 \text{or} a=b=c.$

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25. Find the value of the determinant $|baabpqr111|, where a, b, and c$ are respectively, the pth, qth, and rth terms of a harmonic progression.

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26.

if $a_a, a_2, a_3 \ldots$ are in A.P, then find the value of the following determ

$$\begin{vmatrix} a_p + a_{p+m} + a_{p+2m} & 2a_p + 3a_{p+m} + 4a_{p+2m} & 4a_p + 9a_{p+m} + 16a_{p+} \\ a_p + a_{q+m} + a_{q+2m} & 2a_q + 3a_{q+m} + 4a_{q+2m} & 4a_q + 9a_{q+m} + 16a_{q+} \\ a_r + a_{r+m} + a_{r+2m} & 2a_r + 3a_{r+m} + 4a_{r+2m} & 4a_r + 9a_{r+m} + 16a_{r+} \end{vmatrix}$$

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27. Prove that

$\left|\left(1, , \beta\gamma + \alpha\delta, , \beta^2\gamma^2 + \alpha^2, \delta^2\right), \left(1, , \gamma\alpha + \beta\delta, , \gamma^2\alpha^2 + \beta^2\delta^2\right), \left(1, , \alpha\beta + \gamma\right.\right.$

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28. Prove that

$\left|ab + ca^2bc + ab^2ca + bc^2\right| = -(a+b+c) \times (a-b)(b-c)(c-a) \cdot$

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

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

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30. If a,b,c are all distinct and $\begin{vmatrix} a & a^3 & a^4-1 \\ b & b^3 & b^4-1 \\ c & c^3 & c^4-1 \end{vmatrix}$ =0, show that abc(ab+bc+ac) = a+b+c

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31. Prove that $\begin{vmatrix} a^2+1 & ab & ac \\ ab & b^2+1 & bc \\ ac & bc & c^2+1 \end{vmatrix} = 1+a^2+b^2+c^2$

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32. prove that $\begin{vmatrix} (b+c)^2 & bc & ac \\ ba & (c+a)^2 & cb \\ ca & cb & (a+b)^2 \end{vmatrix}$
$\begin{vmatrix} (b+c)^2 & a^2 & a^2 \\ b^2 & (c+a)^2 & b^2 \\ c^2 & c^2 & (a+b)^2 \end{vmatrix} = 2abc(a+b+c)^3$

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33. Let a, b, c be real numbers with $a^2 + b^2 + c^2 = 1$. Show that the equation

$|ax - by - cbx - aycx + abx + ay - ax + by - \text{y} + bcx + acy + b - ax -$

represents a straight line.

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34. If $a^2 + b^2 + c^2 = 1$, then prove that

$|a^2 + (b^2 + c^2)\cos\varphi ab(1 - \cos\varphi)ac(1 - \cos\varphi)ba(1 - \cos\varphi)b^2 + (c^2 + a^2)$

is independent of $a, b, \cdot$

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35. Find the area of a triangle having vertices $A(3, 2), B(11, 8)$, and $C(8, 12)$.

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36. If the lines $a_1x + b_1y + 1 = 0,\ a_2x + b_2y + 1 = 0\ and\ a_3x + b_3y + 1 = 0$ are concurrent, show that the points $(a_1, b_1),\ (a_2, b_2) and\ (a_3, b_3)$ are collinear.

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37. The number of values of a for which the lines $2x + y - 1 = 0$, $ax + 3y - 3 = 0,$ and $3x + 2y - 2 = 0$ are concurrent is 0 (b) 1 (c) 2 (d) infinite

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38. If the lines $ax + y + 1 = 0, x + by + 1 = 0andx + y + c = 0(a, b, c$ being distinct and different from $1)$ are concurrent, then prove that $\frac{1}{1-a} + \frac{1}{1-b} + \frac{1}{1-c} = 1.$

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39. Find the value of λ if $2x^2 + 6xy + 3y^2 + 8x + 14y + \lambda = 0$ represent a pair of straight lines.

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40. show that the determinant

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

is always non- negative.

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41. Factorize the following

$|3a + b + ca^3 + b^3 + c^3a + b + ca^2 + b^2 + c^2a^4 + b^4 + c^4a^2 + b^2 + c^2a^3 +$

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42. prove that $\begin{vmatrix} (a-x)^2 & (a-y)^2 & (a-z)^2 \\ (b-x)^2 & (b-y)^2 & (b-z)^2 \\ (c-x)^2 & (c-y)^2 & (c-z)^2 \end{vmatrix}$
$\begin{vmatrix} (1+ax)^2 & (1+bx)^2 & (1+cx)^2 \\ (1+ay)^2 & (1+by)^2 & (1+cy)^2 \\ (1+az)^2 & (1+bx)^2 & (1+cz)^2 \end{vmatrix}$

$= 2(b-c)(c-a)(a-b) \times (y-z)(z-x)(x-y)$

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43. If α, β, γ are real numbers, then without expanding at any stage, show that

$|1 \cos(\beta-\alpha)\cos(\gamma-\alpha)\cos(\alpha-\beta)1\cos(\gamma-\beta)\cos(\alpha-\gamma)\cos(\beta-\gamma)1| = ($

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44. If $\begin{vmatrix} 1 & x & x^2 \\ x & x^2 & 1 \\ x^2 & 1 & x \end{vmatrix} = 3$ then find the value of

$\begin{vmatrix} x^3-1 & 0 & x-x^4 \\ 0 & x-x^4 & x^3-1 \\ x-x^4 & x^3-1 & 0 \end{vmatrix}$

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45. Show that

$\left|bc-a^2ca-b^2ab-c^2ca-b^2ab-c^2bc-a^2ab-c^2bc-a^2ca-b^2\right|=\left|a^2c^2\right.$

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46. Let $=\begin{vmatrix}\cos x & \sin x & \cos x \\ \cos 2x & \sin 2x & 2\cos 2x \\ \cos 3x & \sin 3x & 3\cos 3x\end{vmatrix}$ then find the values of f(0) and f'$(\pi/2)$.

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47. If $f(x)=\left|x^{\cap}!2\cos x\frac{\cos(n\pi)}{2}4\sin x\frac{\sin(n\pi)}{2}8\right|$ then find the value of $\frac{d^n}{dx^n}([f(x)])_{x=0}n\dot{\in}z.$

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48. If $f, g, andh$ are differentiable functions of $xand(x) = \left|fgh(xf)'(xg)'(xh)'\left(x^{f2}f\right)''(x^2g)''(x^2h)\right|'prove$

$\Delta' =$ | (f g h f' g' h' (x^3f'' ')'(x^3g'' ')'(x^3h ' ')'|`

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49. Let α be a repeated root of a quadratic equation $f(x) = 0andA(x), B(x), C(x)$ be polynomials of degrees 3, 4, and 5, respectively, then show that $|A(x)B(x)C(x)A(\alpha)B(\alpha)C(\alpha)A'(\alpha)B'(\alpha)C'(\alpha)|$ is divisible by $f(x)$, where prime $(\,')$ denotes the derivatives.

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50. if $\Delta(x) = \begin{vmatrix} a_1 + x & b_1 + x & c_1 + x \\ a_2 + x & b_2 + x & c_2 + x \\ a_3 + x & b_3 + x & c_3 + x \end{vmatrix}$ then show that $\Delta(x) = 0$ and that $\Delta(x) = \Delta(0) + sx.$ where s denotes the sum of all the cofactors of all the elements in $\Delta(0)$

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51. If $\Delta(x) = \begin{vmatrix} 1 & x^2 & x^2 \\ 6 & 4x & 3 \\ 9 & x & -7 \end{vmatrix}$ then find the value of $\int_0^1 \Delta(x)dx$ without expanding $\Delta(x)$.

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52. Find the value of $aandb$ if the system of equation $a^2x - by = a^2 - bandbx = b^2y = 2 + 4b$ (i) posses unique solution (ii) infinite solutions

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53. If a system of three linear equations $x + 4ay + a = 0, x + 3by + b = 0, andx + 2cy + c = 0$ is consistent, then prove that a, b, c are in H.P.

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54. Solve by Cramers rule $x+y+z=6$ $x-y+z=2$ $3x+2y-4z=-5$

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55. 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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56. If $2ax-2y+3z=0, x+ay+2z=0, and2+az=0$ have a nontrivial solution, find the value of $a \cdot$

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57. For what values of k, the following system of equations possesses a nontrival solution over the set of rationals: $c + ky + 3z = 0, 3c + ky - 2z = 02c + 3y - 4x = 0.$ Also find the solution for this value of k.

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58. Using factor theorem, show that
$$\begin{vmatrix} -2a & a+b & c+a \\ a+b & -2a & b+c \\ c+a & c+b & -2c \end{vmatrix} = 4(a+b)(b+c)(c+a)$$

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59. If a,b and c are non- zero real number then prove that
$$\begin{vmatrix} b^2c^2 & bc & b+c \\ c^2a^2 & ca & c+a \\ a^2b^2 & ab & a+b \end{vmatrix} = 0$$

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60. Prove that

$|ax - by - czay + bxcx + azay + bxby - cz - axbz + cycx + azbz + cycz$

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61. If $f(x)$ is a polynomial of degree < 3, prove that

$|1af(a)/(x-a)1bf(b)/(x-b)1cf(c)/(x-c)| \div |1aa^2 1 \,\hat{}\; 21 \,\hat{}\; 2| = \frac{}{(x}$

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

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63. Find the value of $\begin{vmatrix} \cos\left(\frac{2\pi}{63}\right) & \cos\left(\frac{3\pi}{70}\right) & \cos\left(\frac{4\pi}{77}\right) \\ \cos\left(\frac{\pi}{72}\right) & \cos\left(\frac{\pi}{40}\right) & \cos\left(\frac{3\pi}{88}\right) \\ 1 & \cos\left(\frac{\pi}{90}\right) & \cos\left(\frac{2\pi}{99}\right) \end{vmatrix}$

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64. $Let f(t) = \begin{vmatrix} \cos t & t & 1 \\ 2\sin t & t & 2t \\ \sin t & t & t \end{vmatrix}$ .Then find $\lim_{t \to 0} \frac{f(t)}{t^2}$

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65. it

$x_1^2 + 2y_1^2 + 3z_1^2 = x_2^2 + 2y_2^2 + 3z_2^2 = x_3^2 + 2y_3^2 + 3z_3^2 = 2$ and $x_2x_3 + 2y_2$

Then find the value of $\begin{vmatrix} x_1 & y_1 & z_1 \\ x_2 & y_2 & z_2 \\ x_3 & y_3 & z_3 \end{vmatrix}$

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66. about to only mathematics

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67. If $bc + qr = ca + rp = ab + pq = -1$ and $(abc, pqr \neq 0)$ then $\begin{vmatrix} ap & a & p \\ bq & b & q \\ cr & c & r \end{vmatrix}$ is (A) 1 (B) 2 (C) 0 (D) 3

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Exercise 12.1

1. Evaluate

$|\cos\alpha\cos\beta\cos\alpha\sin\beta - \sin\alpha - \sin\beta\cos\beta 0\sin\alpha\cos\beta\sin\alpha\sin\beta\cos\alpha|$

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2. If A,B,C are the angles of a non right angled triangle ABC. Then find the value of: $\begin{vmatrix} \tan A & 1 & 1 \\ 1 & \tan B & 1 \\ 1 & 1 & \tan C \end{vmatrix}$

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3. If $e^{i\theta} = \cos\theta + is\int h\eta,$ find the value of $\left|1e^{i\pi/3}e^{i\pi/4}e^{-i\pi/3}1e^{i2\pi/3}e^{-i\pi/4}e^{-i2\pi/3}1\right|$

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4. Find the number of real root of the equation $|0x - ax - bx + a0x - cx + bx + c0| = 0, a \ne b \ne candb(a + c) > ac$

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5. If α, β, γ are the roots of $ax^3 + bx^2 + cx + d = 0and|\alpha\beta\gamma\beta\gamma\alpha\gamma\alpha\beta| = 0, \alpha \ne \beta \ne \gamma$ then find the equation whose roots are $\alpha + \beta - \gamma, \beta + \gamma - \alpha, and\gamma + \alpha - \beta.$

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6. A triangle has vertices $A_i(x_i, y_i)$ for i= 1,2,3,. If the orthocenter of triangle is (0,0) then prove that

$$\begin{vmatrix} x_2 - x_3 & y_2 - y_3 & y_1(y_2 - y_3) + x_1(x_2 - x_3) \\ x_3 - x_1 & y_3 - y_1 & y_2(y_3 - y_1) + x_2(x_3 - x_1) \\ x_1 - x_2 & y_1 - y_2 & y_3(y_1 - y_2) + x_3(x_1 - x_2) \end{vmatrix} = 0$$

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7. if $\omega \neq 1$ is cube root of unity and x+y+z $\neq$ 0 then

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

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Exercise 12.2

1. Prove that the value of determinant $\begin{vmatrix} 1 & \omega & \omega^2 \\ \omega & \omega^2 & 1 \\ \omega^2 & 1 & \omega \end{vmatrix} = 0$

where ω is complex cube root of unity .

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2. Prove that $\begin{vmatrix} a & a^2 & bc \\ b & b^2 & ac \\ c & c^2 & ab \end{vmatrix} \begin{vmatrix} 1 & 1 & 1 \\ a^2 & b^2 & c^2 \\ a^3 & b^3 & c^3 \end{vmatrix}$

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3. if $\Delta = \begin{vmatrix} abc & a_2 & c^2b \\ abc & c^2a & ca^2 \\ abc & a^2b & b^2a \end{vmatrix} = 0, (a, b, c \in R \text{ and } \text{ are all}$ different and non- zero) the prove that $a + b + c = 0$

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4. if $a_r = (\cos 2r\pi + I\sin 2r\pi)^{1/9}$ then prove that

$$\begin{vmatrix} a_1 & a_2 & a_3 \\ a^4 & a^5 & a_6 \\ a_7 & a_8 & a_9 \end{vmatrix} = 0$$

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5. Given $A = |ab2cde2flm2n|, B = |f2de2n4l2mc2ab|$, then the value of B / A is _________.

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Exercise 12.3

1. Prove that the value of each the following determinants zero:

$$(a)\begin{vmatrix} a_1 & la_1 + mb_1 & b_1 \\ a_2 & la_2 + mb_2 & b_2 \\ a_3 & la_3 + mb_3 & b_3 \end{vmatrix}$$

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2. using properties of determinants evaluate

$$\begin{vmatrix} 18 & 40 & 89 \\ 40 & 89 & 198 \\ 89 & 198 & 440 \end{vmatrix}$$

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3. Prove that $\begin{vmatrix} 18 & 40 & 89 \\ 40 & 89 & 198 \\ 89 & 198 & 440 \end{vmatrix} = 3abc - a^3 - b^3 - c^3$

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4. $\begin{bmatrix} 1 & 1+p & 1+p+q \\ 2 & 3+2p & 4+3p+2q \\ 3 & 6+3p & 10+6p+3q \end{bmatrix} = 1$

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5. Show that $\begin{vmatrix} a-x & c & b \\ c & b-x & a \\ b & a & c-x \end{vmatrix} = 0$

where $a+b+c \neq 0$

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6. Show that:

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

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7. Using properties of determinants Prove that

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

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

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9. By using properties of determinants , show that :

$$\begin{bmatrix} 1+a^2-b^2 & 2ab & -2b \\ 2ab & 1-a^2+b^2 & 2a \\ 2b & -2a & 1-a^2-b^2 \end{bmatrix} = \left(1+a^2+b^2\right)^3$$

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

$$\begin{vmatrix} x_1 + a_1b_1 & a_1b_2 & a_1b_3 \\ a_2b_1 & x_2 + a_2b_2 & a_2b_3 \\ a_3b_1 & a_3b_2 & x_3 + a_3b_3 \end{vmatrix} = x_1x_2x_3\left(1 + \frac{a_1b_1}{x_1} + \frac{a_2b_2}{x_2} + \frac{a_3b_3}{x_3}\right)$$

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11. If $A, BandC$ are the angels of a triangle, show that

$$| -1 + \cos B \cos C + \cos B \cos B \cos C + \cos A - 1 + \cos A \cos A - 1 + \text{co}$$

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12. If $\begin{vmatrix} a^2 & b^2 & c^2 \\ (a+b)^2 & (b+1)^2 & (c+1)^2 \\ (a-1)^2 & (b-1)^2 & (c-1)^2 \end{vmatrix} = k(a-b)(b-c)(c-a)$ then the value of k is a. 4 b. -2 c.-4 d. 2

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13. Prove that $\Delta = \begin{vmatrix} 1 & 1 & 1 \\ a & b & c \\ bc+1^2 & ac+b^2 & ab+c^2 \end{vmatrix}$

$= 2(a-b)(b-c)(c-1)$

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14. Evaluate $\begin{vmatrix} .^x C_1 & .^x C_2 & .^x C_3 \\ .^y C_1 & .^y C_2 & .^y C_3 \\ .^x C_1 & .^z C_2 & .^z C_3 \end{vmatrix}$

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15. if $\Delta_r = \begin{vmatrix} 2^{r-1} & 2\times 3^{r-1} & 4\times 5^{r-1} \\ \alpha & \beta & \gamma \\ 2^n-1 & 3^n-1 & 5^n-1 \end{vmatrix}$

then find the value of $\Sigma_{r=1}^{n} \Delta r$.

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16. Prove that

$$|1+a11111+b11111+c11111+d| = abcd\left(a+\frac{1}{a}+\frac{1}{b}+\frac{1}{c}+\frac{1}{d}\right).$$

Hence find the value of the determinant if a, b, c, d are the roots of the equation $px^4+qx^3+rx^2+sx+t=0$.

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17. Prove that $\begin{vmatrix} 1 & ab & \frac{1}{a}+\frac{1}{b} \\ 1 & bc & \frac{1}{b}+\frac{1}{c} \\ 1 & ca & \frac{1}{c}+\frac{1}{a} \end{vmatrix} = 0$

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18. Prove the identities: $|b^2+c^2abacbac^2+a^2bacba^2+b^2| = 4a^2b^2c^2$

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19. Show that $\begin{vmatrix} a & b-c & c+b \\ a+c & b & c-a \\ a-b & b+a & c \end{vmatrix} = (a+b+c)\left(a^2+b^2+c^2\right)$

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Exercise 12.4

1. If x_1, x_2, x_3 as well as y_1, y_2, y_3 are in G.P. with same common ratio, then prove that the points $(x_1, y_1), (x_2, y_2), and(x_3, y_3)$ are collinear.

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2. If lines $px+qy+r=0, qx+ry+p=0andrx+py+q=0$ are concurrent, then prove that $p+q+r=0(wherep, q, r$ are distinct$)$.

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3. if

$(x_1, x_2)^2 + (y_1 - y_2)^2 = a^2, (x_2 - x_3)^2 + (y_2 - y_3)^2 = b^2(x_3 - x_1)^2 + (y_3$

where a,b,c are positive then prove that

$$4\begin{vmatrix} x_1 & y_1 & 1 \\ x_2 & y_2 & 1 \\ x_3 & y_3 & 1 \end{vmatrix} = (a+b+c)(b+c-a)(c+a-b)(a+b-c)$$

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4. it is known that the equation of hyperbola and that of its pair of asymptotes differ by constant . If equation of hyperbola is $x^2 + 4xy + 3y^2 - 4x + 2y + 1 = 0$ then find the equation of its pair of asymptoes.

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Exercise 12.5

1. Prove that

$|(b+x)(c+x)(v+x)(a+x)(a+x)(b+x)(b+y)(c+y)(c+x)(a+t)$

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2. $\Delta = \begin{vmatrix} 1+a^2+a^4 & 1+ab+a^2b^2 & 1+ac+a^2c^2 \\ 1+ab+a^2b^2 & 1+b^2+b^4 & 1+bc+b^2c^2 \\ 1+ac+a^2c^2 & 1+bc+b^2c^2 & 1+c^2c^4 \end{vmatrix}$ is equal to

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3. Prove that

$|2\alpha+\beta+\gamma+\delta\alpha\beta+\gamma\delta\alpha+\beta+\gamma+\delta 2(\alpha+\beta)(\gamma+\delta)\alpha\beta(\gamma+\delta)+\gamma\delta(\alpha$

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4. For all values of $A, B, CandP, Q, R$ show that

$|\cos(A-P)\cos(A-Q)\cos(A-R)\cos(B-P)\cos(B-Q)\cos(B-R)\cos$

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

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6. Express $=\left|2bc-a^2c^2b^2c^22ca-b^2a^2b62a^22ab-c^2\right|$ as square of a determinant of hence evaluate if.

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Exercise 12.6

1. Let $f(x)=\begin{vmatrix}\cos(x+x^2) & \sin(x+x^2) & -\cos(x+x^2)\\ \sin(x-x^2) & \cos(x-x^2) & \sin(x-x^2)\\ \sin 2x & 0 & \sin(2x^2)\end{vmatrix}$.

Find the value of f'(0).

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2. If $f(x), g(x) and h(x)$ are three polynomial of degree 2, then prove that $\varphi(x) = | f(x)g(x)h(x)f'(x)g'(xh'(x)f''(x)g''(xh''(x)|$ is a constant polynomial.

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3. If $g(x) - \frac{f(x)}{(x-a)(x-b)(x-c)}, where f(x)$ is a polynomial of degree $< 3,$ then prove that $\frac{dg(x)}{dx} = \left|1af(a)(x-a)^{-2}1bf(b)(x-b)^{-2}1cf(c)(x-c)^{-2}\right| + \left|a^2 a1b^2b1c$

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4. If $f(x) = \begin{vmatrix} \cos(x+\alpha) & \cos(x+\beta) & \cos(x+\gamma) \\ \sin(x+\alpha) & \sin(x+\beta) & \sin(x+\gamma) \\ \sin(\beta-\gamma) & \sin(\gamma-\alpha) & \sin(\alpha-\beta) \end{vmatrix}$ and $f(0) = 2$ theb find the value of $\Sigma_{r=1}^{30} |f(r)|$.

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5. $f(x) = \begin{vmatrix} \cos x & x & 1 \\ 2\sin x & x^2 & 2x \\ \tan x & x & 1 \end{vmatrix}$ then find the value of

$$\lim_{x \to 0} \frac{f(x)}{x}$$

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Exercise 12.7

1. Find the following system of equations is consistent, $(a+1)^3 x + (a+2)^3 y = (a+3)^3$ $(a+1)x + (a+2)y = a+3$ +=1, then find the value of $a\cdot$

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2. Solve the system of the equations: $ax + by + cz = d$ $a^2 x + b^2 y + c^2 z = d^2$ $a^3 x + b^3 y + c^3 z = d^3$ Will the solution always exist and be unique?

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3. consider the system of equations : ltbr. $3x - y + 4z = 3$

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

$6x + 5y + \lambda z = -3$

Prove that system of equation has at least one solution for all real values of λ.also prove that infinite solutions of the system of equations satisfy $\frac{7x-4}{-5} = \frac{7y+9}{13} = z$

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4. If the equation $2x + 3y + 1 = 0, 3x + y - 2 = 0, and ax + 2y - b = 0$ are consistent, then prove that $a - b = 2$.

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5. if x,y and z are not all zero and connected by the equations $a_1x + b_1y + c_1z = 0, a_zx + b_2y + c_2z = 0$ and

$(p_1+\lambda q_1)x+(p_2+\lambda q_2)y+(p_3+\lambda q_3)z=0$ show that

$$\lambda = -\begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ p_1 & p_2 & p_3 \end{vmatrix} \div \begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ q_1 & q_2 & q_3 \end{vmatrix}$$

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Exercise (Single)

1. if $\theta \in R$ then maximum value of $\Delta = \begin{vmatrix} 1 & 1 & 1 \\ 1 & 1+\sin\theta & 1 \\ 1 & 1 & 1+\cos\theta \end{vmatrix}$ is

A. $\sqrt{3}/2)$

B. $1/2$

C. $1/\sqrt{2}$

D. None of these

Answer: B

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2. 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. $pa + qb + rc$

C. 1

D. none of these

Answer: A

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3. If α, β, γ are the roots of $px^2 + qx^2 + r = 0$, then the value of the determinant $|\alpha\beta\beta\gamma\gamma\alpha\beta\gamma\gamma\alpha\alpha\beta\gamma\alpha\alpha\beta\beta\gamma|$ is p b. q c. 0 d. r

A. p

B. q

C. 0

D. r

Answer: C

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4. If $f(x) = a = bx + cx^2 and\alpha, \beta, \gamma$ are the roots of the equation $x^3 = 1, then|abcbcacab|$ is equal to $f(\alpha) + f(\beta) + f(\gamma)$ $f(\alpha)f(\beta) + f(\beta)f(\gamma) + f(\gamma)f(\alpha)$ $f(\alpha)f(\beta)f(\gamma) - f(\alpha)f(\beta)f(\gamma)$

A. $f(\alpha) + f(\beta) + f(\gamma)$

B. $f(\alpha)f(\beta) + f(\beta)f(\gamma) + f(\gamma)f(\alpha)$

C. $f(\alpha)f(\beta)f(\gamma)$

D. $-f(\alpha)f(\beta)f(\gamma)$

Answer: D

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5. If $[.]$ denotes the greatest integer less than or equal to the ral number under consideration, and $-1 \leq x < 0, 0 \leq y < 1, 1 \leq a < 2,$ then the value of the determinant $\begin{vmatrix} [x]+1 & [y] & [z] \\ [x] & [y]+1 & [z] \\ [x] & [y] & [z]+1 \end{vmatrix}$ is

a. $[x]$

b. $[y]$

c. $[z]$

d. none of these

A. $[x]$

B. $[y]$

C. $[z]$

D. none of these

Answer: C

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6. if $a = \cos\theta + i\sin\theta$, $b = \cos 2\theta - i\sin 2\theta$, $c = \cos 3\theta + i\sin 3\theta$ and if $\begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix} = 0$ then

A. $\theta = 2k\pi,\ k \in Z$

B. $\theta = (2k+1)\pi,\ k \in Z$

C. $\theta = (4k+1)\pi,\ k \in Z$

D. none of these

Answer: A

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7. If $\begin{vmatrix} x^n & x^{n+2} & x^{n+3} \\ y^n & y^{n+2} & y^{n+3} \\ z^n & z^{n+2} & z^{n+3} \end{vmatrix} = (x-y)(y-z)(z-x)\left(\frac{1}{x} + \frac{1}{y} + \frac{1}{z}\right)$, then n equals

A. 1

B. -1

C. 2

D. -2

Answer: B

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

A. 1

B. 0

C. -1

D. 2

Answer: C

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9. about to only mathematics

A. -2

B. -4

C. 0

D. -8

Answer: B

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10. If $A+B+C=\pi$ and $e^{i\theta}=\cos\theta+i\sin\theta$ and $z=\begin{vmatrix} e^{2iA} & e^{-iC} & e^{-iB} \\ e^{-iC} & e^{2iB} & e^{-iA} \\ e^{-iB} & e^{-iA} & e^{2iC} \end{vmatrix}$, then

A. 1

B. -1

C. -2

D. -4

Answer: D

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11. If a, b, c are different, then the value of x for which $\begin{vmatrix} 0 & x^2-a & x^3-b \\ x^2+a & 0 & x^2+c \\ x^4+b & x-c & 0 \end{vmatrix} = 0$ is

A. a

B. c

C. b

D. 0

Answer: D

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12. `If the value of determinant |(a,1,1),(1,b,1)(1,1,c)| is positive , then

A. $abc > 1$

B. $abc > -8$

C. $abc > -8$

D. $abc > -2$

Answer: B

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13. if $A_1, B_1, C_1 \ldots \ldots$ are respectively the cofactors of the elements $a_1, b_1, c_1 \ldots \ldots$ of the determinant

$\Delta = \begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix}, \Delta \neq 0$ then the value of $\begin{vmatrix} B_2 & C_2 \\ B_3 & C_3 \end{vmatrix}$ is equal to

A. $a_1^2 \Delta$

B. $a_1 \Delta$

C. $a_1\Delta^2$

D. $a_1^2\Delta^2$

Answer: B

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14. If $a, b, c, d, e, and f$ are in G.P. then the value of $\left|a^2 d^2 x b^2 e^2 y c^2 f^2 z\right|$ depends on $x and y$ b. $x and z$ c. $y and z$ d. independent of $x, y, and z$

A. x and y

B. x and z

C. y and z

D. independent of x,y and z

Answer: D

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15. Let $x < 1$, then value of $\left|x^2 + 22x + 112x + 1x + 21331\right|$ is a. none-negative b. none-positive c. negative d. positive

A. non-negative

B. non- positive

C. begative

D. positive

Answer: C

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16. The value of $\left| - 1213 + 2\sqrt{22} + 2\sqrt{213} - 2\sqrt{22} - 2\sqrt{21}\right|$ is equal to a. zero b. $-16\sqrt{2}$ c. $-8\sqrt{2}$ d. none of these

A. 0

B. $-16\sqrt{2}$

C. $-8\sqrt{2}$

D. none of these

Answer: B

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

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

B. $\sum_{i=1}^{n} D_i = 0$

C. $D_i D_j, \forall I, j$

D. None of these

Answer: B

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18. if w is a complex cube root to unity then value of

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

A. 0

B. -1

C. 2

D. none of these

Answer: A

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19. If $a + b + c = 0$, one root of $|a - xcbcb - xabac - x| = 0$ is $x = 1$

b. $x = 2$ c. $x = a^2 + b^2 + c^2$ d. $x = 0$

A. $x = 1$

B. $x = 2$

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

D. $x = 0$

Answer: D

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20. If x, y, z are in A.P. , then the value of the determinant are in A.P. , then the value of the determinant $|a + 2a + 3a + 2xa + 3a + 4a + 2ya + 4a + 5a + 2z|$ is a. 1 b. 0 c. $2a$ d. a

A. 1

B. 0

C. 2a

D. a

Answer: B

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21. If $a_1, a_2, a_3, \ldots\ldots\ldots, a_n$..... are in G.P., then the determinant $\Delta =$

$$\begin{vmatrix} \log a_n & \log a_{n+1} & \log_{n+2} \\ \log a_{n+3} & \log a_{n+4} & \log_{n+5} \\ \log a_{n+6} & \log a_{n+7} & \log_{n+8} \end{vmatrix}$$ is equal to

A. 1

B. 0

C. 2a

D. a

Answer: B

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22. Value of $|x + yzzxy + zxyyz + x|, wherex, y, z$ are nonzero real number, is equal to xyz b. $2xyz$ c. $3xyz$ d. $4xyz$

A. xyz

B. 2xyz

C. 3xyz

D. 4xyz

Answer: D

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23. Which of the following is not the root of the equation $|x-6-12-3\times \ -3-32\times \ +2|=0?$ 2 b. 0 c. 1 d. -3

A. 2

B. 0

C. 1

D. -3

Answer: B

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24. The value of the determinant $\left|kak^2+a^21kbk^2+b^21kck^2+c^21\right|$ is $k(a+b)(b+c)(c+a)$ $kabc\left(a^2+b^{f2}+c^2\right)$ $k(a-b)(b-c)(c-a)$ $k(a+b-c)(b+c-a)(c+a-b)$

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

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

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

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

Answer: C

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

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

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

A. $a + b + c = 0$

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

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

D. $x = a + b + c$

Answer: B

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26. If

$f'(x) = |mxmx - pmx + p \cap + pn - pmx + 2nmx + 2n + pmx + 2n -$

, then $y = f(x)$ represents a straight line parallel to x-axis a straight line parallel to y-axis parabola a straight line with negative slope

A. a straight line parallet to x-axis

B. a striaght line parallel to y-axis

C. parabola

D. a striaght line with negative slope

Answer: B

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27. If $|x3636x6x3| = |2x7x7272x| = |45x5x4x45| = 0,$ then x is equal to 0 b. -9 c. 3 d. none of these

A. 0

B. -9

C. 3

D. none of these

Answer: B

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28. If $\begin{vmatrix} x^n & x^{n+2} & x^{2n} \\ 1 & x^a & a \\ x^{n+5} & x^{a+6} & x^{2n+5} \end{vmatrix} = 0, \forall x \in R$,where $n \in N$, then value of a is

(a) n

(b) $n-1$

(c) $n+1$

(d) none of these

A. n

B. n-1

C. n+1

D. none of these

Answer: C

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29. for the equation $\begin{vmatrix} 1 & x & x^2 \\ x^2 & 1 & x \\ x & x^2 & 6 \end{vmatrix} = 0$

A. There are exactly two distinct roots

B. there is one pair of equation real roots

C. There are three pairs of equal roots

D. Modulus of each root is 2

Answer: C

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30. If $a^2 + b^2 + c^2 = -2 and f(x) =$

$|a + a^2 x (1 + b^2) x (1 + c^2) x (1 + a^2) x 1 + b^2 x (1 + c^2) x (1 + a^2) x (1 + b^2)$

, then $f(x)$ is a polynomial of degree 0 b. 1 c. 2 d. 3

A. 0

B. 1

C. 2

D. 3

Answer: C

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31. 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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32. The value of determinant

$\hat{}\ nC^n_{r-1}C_r(r+1)^{n+2}C^n_{r+1}C^n_r C_{r+1}(r+2)^{n+2}C^n_{r+2}C^n_{r+1}C_{r+2}(r+3)^{n+2}C$

is n^2+n-2 b. 0 c. $\hat{}\ n+3C_{r+3}$ d. $\hat{}\ nC_{r-1}+^n C_r +^n C_{r+1}$

A. $n^2+n-1)$

B. 0

C. $.^{n+3}\,C_{r+3}$

D. $.^n\,C_{r-1}+^n C_r +^n C_{r+1}$

Answer: B

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33. if $f(x)=\begin{vmatrix} x & a & a \\ a & x & a \\ a & a & x \end{vmatrix}=0$ then

A. $f(x)=0 \quad \text{and} \quad f(x)=0$ has one common root

B. $f(x)=0 \quad \text{and} \quad f(x)=0$ has one common root

C. sum of roots of f(x) =0 is -3a

D. none of these

Answer: B

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

A. 1

B. 2

C. -1

D. -2

Answer: C

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35. if $x \neq 0, y \neq 0, z \neq 0$ and $\begin{vmatrix} 1+x & 1 & 1 \\ 1+y & 1+2y & 1 \\ 1+z & 1+z & 1+3z \end{vmatrix} = 0$ then $x^{-1} + y^{-1} + z^{-1}$ is equal to

A. -1

B. -2

C. -3

D. none of these

Answer: C

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36. if $a_1b_1c_1, a_2b_2c_2$ and $a_3b_3c_3$ are three-digit even natural numbers and $\Delta = \begin{vmatrix} c_1 & a_1 & b_1 \\ c_2 & a_2 & b_2 \\ c_3 & a_3 & b_3 \end{vmatrix}$ then Δ is

A. divisible by 2 but not necessarily by 4

B. divisible by 4 but not necessarily by 8

C. divisible by 8

D. none of these

Answer: A

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

A. 1

B. 2

C. 3

D. 4

Answer: B

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38. 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

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

A. $D' = D$

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

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

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

Answer: D

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39. The value of the determinant $\begin{vmatrix} \log_a\left(\frac{x}{y}\right) & \log_a\left(\frac{y}{z}\right) & \log_a\left(\frac{z}{x}\right) \\ \log_b\left(\frac{y}{z}\right) & \log_b\left(\frac{z}{x}\right) & \log_b\left(\frac{x}{y}\right) \\ \log_c\left(\frac{z}{x}\right) & \log_c\left(\frac{x}{y}\right) & \log_c\left(\frac{y}{z}\right) \end{vmatrix}$

A. 1

B. -1

C. 0

D. $\frac{1}{6}\log_a xyz$

Answer: C

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40. If $a > 0, b > 0, c > 0$ are respectively the pth, qth, rth terms of a G.P., then the value of the determinant

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

A. 0

B. log (abc)

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

D. none of these

Answer: A

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41. If $a > 0$ and discriminant of $ax^2 + 2bx + c$ is negative, then $= abax + \mathbf{c}bx + cax + \mathbf{x} + c0$ is $+ve$ b. $(ac - b)^2\left(ax^2 + 2bx + c\right)$ c. $-ve$ d. 0

A. $+ve$

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

C. $-ve$

D. 0

Answer: C

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

A. 0

B. 2

C. 1

D. 3

Answer: C

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43. if

$$D_k = \begin{vmatrix} 1 & n & n \\ 2k & n^2+n+1 & n^2+n \\ 2k-1 & n^2 & n^2+n+1 \end{vmatrix} \text{ and } \Sigma_{k=1}^{n} D_k = 56$$

then n equals

A. 4

B. 6

C. 8

D. 7

Answer: D

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44. the value of $\Sigma_{r=2}^{n}(-2)^{r}\begin{vmatrix} {}^{n-2}C_{r-2} & {}^{n-2}C_{r-1} & {}^{n-2}C_{r} \\ -3 & 1 & 1 \\ 2 & -1 & 0 \end{vmatrix}(n > 2)$

A. $2n - 1 + (-1)^{n}$

B. $2n + 1 + (-1)^{n-1}$

C. $2n - 3 + (-1)^{n}$

D. none of these

Answer: A

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45. if $\Delta = \begin{vmatrix} 3 & 4 & 5 & x \\ 4 & 5 & 6 & y \\ 5 & 6 & 7 & z \\ x & y & z & 0 \end{vmatrix} = 0$ then

A. x, y, z are in A.P.

B. x, y, z are in G.P

C. x, y, z are in H.P

D. none of these

Answer: A

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46. Roots of the equations $\begin{vmatrix} x & m & n & 1 \\ a & x & n & 1 \\ a & b & x & 1 \\ a & b & c & 1 \end{vmatrix} = 0$ are

A. independent of m and n

B. independent of a,b and c

C. depend on m,n and a,b,c

D. inedependent of m,n and a,b,c

Answer: A

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47. 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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48. about to only mathematics

A. 0

B. 3

C. 6

D. 12

Answer: B

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49. In triangle ABC, if $\begin{vmatrix} 1 & 1 & 1 \\ \cot\left(\frac{A}{2}\right) & \cot\left(\frac{B}{2}\right) & \cot\left(\frac{C}{2}\right) \\ \tan\left(\frac{B}{2}\right) + \tan\left(\frac{C}{2}\right) & \tan\left(\frac{C}{2}\right) + \tan\left(\frac{A}{2}\right) & \tan\left(\frac{A}{2}\right) + \tan\left(\frac{B}{2}\right) \end{vmatrix}$ then the triangle must be (A) Equilateral (B) Isoceless (C) Right Angle (D) none of these

A. equilateral

B. isosceles

C. obtuse angled

D. none of these

Answer: B

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50. If $\begin{vmatrix} a & b-c & b+c \\ a+c & b & c-a \\ a-b & a+b & c \end{vmatrix} = 0$ then the line $ax+by+c=0$ passes through the fixed point which is

A. $(1, 2)$

B. $(1, 1)$

C. $(-2, 1)$

D. $(1, 0)$

Answer: B

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

Answer: D

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52. Let $\vec{a}_r = x_r\hat{i} + y_r\hat{j} + z_r\hat{k}, r = 1, 2, 3$ three mutually prependicular unit vectors then the value of $\begin{vmatrix} x_1 & -x_2 & x_3 \\ y_1 & y_2 & y_3 \\ z_1 & z_2 & z_3 \end{vmatrix}$ is equal to

A. zero

B. ± 1

C. ± 2

D. none of these

Answer: B

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53. Let

$$\begin{vmatrix} y^5z^6(z^3-y^3) & x^4z^6(x^3-z^3) & x^4y^5(y^3-x^3) \\ y^2z^3(y^6-z^6) & xz^3(z^6-x^6) & xy^2(x^6-y^6) \\ y^2 \hat{} (3)(z^3-y^3) & xz^3(x^3-z^3) & xy^2(y^3-x^3) \end{vmatrix} \text{ and } \Delta_2 = \begin{vmatrix} x \\ x^4 \\ x^7 \end{vmatrix}$$

.Then $\Delta_1\Delta_2$ is equal to

A. Δ_2^6

B. Δ_2^4

C. Δ_2^3

D. Δ_2^2

Answer: C

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54. the value of the determinant

$$\begin{vmatrix} (a_1-b_1)^2 & (a_1-b_2)^2 & (a_1-b_3)^2 & (a_1-b_4)^2 \\ (a_2-b_1)^2 & (a_2-b_2)^2 & (a_2-b_3)^2 & (a_3-b_4)^2 \\ (a_3-b_1)^2 & (a_3-b_2)^2 & (a_3-b_3)^2 & (a_3-b_4)^2 \\ (a_4-b_1)^2 & (a_4-b_2)^2 & (a_4-b_3)^2 & (a_4-b_4)^2 \end{vmatrix}$$ is

A. dependant on $a_i, i = 1, 2, 3, 4$

B. dependant on $b_i, i = 1, 2, 3, 4$

C. dependant on $a_{ij}, b_i i = 1, 2, 3, 4$

D. 0

Answer: D

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55. if $\Delta(x) = \begin{vmatrix} \tan x & \tan(x+h) & \tan(x+2h) \\ \tan(x+2h) & \tan x & \tan(x+h) \\ \tan(x+h) & \tan(x+2h) & \tan x \end{vmatrix}$, then

The value of $\lim_{h \to 0} \cdot \frac{\Delta(\pi/3)}{\sqrt{3}h^2}$ is

A. 144

B. 81

C. 64

D. 36

Answer: A

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56. Value of $\begin{vmatrix} 1+x_1 & 1+x_1x & 1+x_1x^2 \\ 1+x_2 & 1+x_2x & 1+x_2x^2 \\ 1+x_3 & 1+x_3x & 1+x_3x^2 \end{vmatrix}$ depends upon

A. x only

B. $x_1$only

C. $x_2$only

D. none of these

Answer: D

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57. If $\begin{vmatrix} a^2+\lambda^2 & ab+c\lambda & ca-b\lambda \\ ab-c\lambda & b^2+\lambda^2 & bc+a \\ ca+b\lambda & bc-a\lambda & c^2+\lambda^2 \end{vmatrix}$

$\begin{vmatrix} \lambda & c & -b \\ -c & \lambda & a \\ b & -a & \lambda \end{vmatrix} = \left(1+a^2+b^2+c^2\right)^3$, then he value of λ is

a. 8

b. 27

c. 1

d. -1

A. 8

B. 27

C. 1

D. -1

Answer: C

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

A. zero

B. -16

C. 16

D. -11

Answer: D

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59. $\Delta_1 = \begin{vmatrix} x & b & b \\ a & x & b \\ a & a & x \end{vmatrix}$ 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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60. if y= sin mx, them the value of the determinant

$$\begin{vmatrix} y & y_1 & y_2 \\ y_3 & y_4 & y_5 \\ y_6 & y_7 & y_8 \end{vmatrix} \text{ Where } \quad y_n = \frac{d^n y}{dx^n} \quad \text{is}$$

A. m^9

B. m^2

C. m^3

D. 0

Answer: D

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61. Let $f(x)=\begin{vmatrix} 2\cos^2 x & \sin 2x & -\sin x \\ \sin 2x & 2\sin^2 x & \cos x \\ \sin x & -\cos x & 0 \end{vmatrix}$, then the value of $\int_0^{\pi/2}\{f(x)+f'(x)\}dx$ is

A. π

B. $\pi/2$

C. 2π

D. $3\pi/2$

Answer: A

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62. a, b, c are distinct real numbers not equal to one. If $ax+y+z=0, x+by+z=0, and x+y+cz=0$ have nontrivial solution, then the value of $\frac{1}{1-a}+\frac{1}{1-b}+\frac{1}{1-c}$ is equal to a.1 b. -1 c.$zero$ d. none of these

A. -1

B. 1

C. zero

D. none of these

Answer: B

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63. If the system of linear equation $x+y+z=6, x+2y+3c=14, and 2x+5y+\lambda z=\mu(\lambda, \mu R)$ has a unique solution, then $\lambda=8$ b. $\lambda=8, \mu=36$ c.$\lambda=8, \mu \neq 36$ d. none of these

A. $\lambda \neq 8$

B. $\lambda=8, \mu \neq 36$

C. $\lambda=8, \mu=36$

D. none of these

Answer: A

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64. If α, β, γ are the angles of a triangle and system of equations

$\cos(\alpha - \beta)x + \cos(\beta - \gamma)y + \cos(\gamma - \alpha)z = 0$

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

$\sin(\alpha + \beta)x + \sin(\beta + \gamma)y + \sin(\gamma + \alpha)z = 0$ has non-trivial solutions, then triangle is necessarily a. equilateral b. isosceles c. right angled d. acute angled

A. equiliateral

B. isosoceles

C. right angled

D. acute angled

Answer: B

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65. Given

$a = x/(y - z), b = y/(z - x), and c = z/(x - y), where x, y, z and z$ are not all zero, then the value of $ab + bc + ca$ is 0 b. 1 c.-1 d. none of these

A. 0

B. 1

C. -1

D. none of these

Answer: C

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66. 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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67. 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. either -2 or 1

B. -2

C. 1

D. not-2

Answer: B

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68. the set of equations $\lambda x - y + (\cos\theta)z = 0, 3x + y + 2z = 0$, $(\cos\theta)$x+y+2z=0 ,$\theta \leq 0 < 2\pi$ has non-trivial solution (s)

A. for no value of λ and 0

B. for all values of λ and 0

C. for all values of λ and only tow values of 0

D. for only one value of λ and all values of 0

Answer: A

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69. If $c < 1$ and the system of equations $x + y - 1 = 0, 2x - y - c = 0, and bx + 3by - c = 0$ is consistent, then the possible real values of b are $b\left(-3\frac{3}{4}\right)$ b. $b\left(-\frac{3}{2}, 4\right)$ c. $b\left(-\frac{3}{4}, 3\right)$ d. none of these

A. $b \in \left(-3\frac{3}{4}\right)$

B. $b \in \left(-\frac{3}{2}, 4\right)$

C. $b \in \left(-\frac{3}{4}, 3\right)$

D. none of these

Answer: C

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70. If a, b, c are in G.P. with common ratio $r_1 and \alpha, \beta, \gamma$ are in G.P. with common ratio r_2 and equations $ax + \alpha y + z = 0, bx + \beta y + z = 0, cx + \gamma y + z = 0$ have only zero solution, then which of the following is not true? $a+b+c$ b. abc c.1 d. none of these

A. $r_1 \neq 1$

B. $r_2 \neq 1$

C. $r_1 \neq r_2$

D. none of these

Answer: D

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71. The product of all values of t, for which the system of equations $(a-t)x+by+cz=0, bx+(c-t)y+az=0, cx+ay+(b-t)z=0$ has non-trivial solution, is $|a-c-b-cb-a-b-ac|$ (b) $|abcbcacab|$ $|ac\mathrm{ab}\mathrm{a}|$ (d) $|aa+\ +c+\ +a+aa+b|$

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

B. $a+b+c$

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

D. 1

Answer: A

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72. 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. 0

B. 1

C. 2

D. 3

Answer: D

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Exercise (Multiple)

1. Which of the following has / have value equal to zero ?

A. $\begin{vmatrix} 8 & 2 & 7 \\ 12 & 3 & 5 \\ 16 & 4 & 3 \end{vmatrix}$

B. $\begin{vmatrix} 1/a & a^2 & bc \\ 1/b & b^2 & ac \\ 1/c & c^2 & ab \end{vmatrix}$

C. $\begin{vmatrix} a+b & 2a+b & 3a+b \\ 2a+b & 3a+b & 4a+b \\ 4a+b & 5a+b & 6a+b \end{vmatrix}$

D. $\begin{vmatrix} 2 & 43 & 6 \\ 7 & 35 & 4 \\ 3 & 17 & 2 \end{vmatrix}$

Answer: A::B::C

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

A. f(300,200=f(400,200)

B. f(200,400)=f(200,600)

C. f(100,200)=f(200,200)

D. none of these

Answer: A::C

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3. if $f(0) = \begin{vmatrix} \sin 0 & \cos 0 & \sin 0 \\ \cos 0 & \sin 0 & \cos 0 \\ \cos 0 & \sin 0 & \sin 0 \end{vmatrix}$ then

A. f(0)= 0 has exactly 2 real solutions in $[0, \pi]$

B. f(0) =0 has exactly 3 real solutions in $[0, \pi]$

C. range of function $\frac{f(0)}{1 - \sin 20}$ is $[-\sqrt{2}, \sqrt{2}]$

D. range of fucntion $.\frac{f(0)}{\sin 20 - 1}$ is $[-3, 3]$ is $[-3, 3]$

Answer: A::C

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4. If $f(x) = \left|a - 10axa - 1ax^2axa\right|, then f(2x) - f(x)$ is divisible by a

b. b c.c, d, e d. none of these

A. x

B. a

C. $2a + 3x$

D. x^2

Answer: A::B::C

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5. $\Delta = \begin{vmatrix} 1 & 1+ac & 1+bc \\ 1 & 1+ad & 1+bd \\ 1 & 1+ae & 1+be \end{vmatrix}$ is independent of

A. a

B. b

C. c,d,e

D. none of these

Answer: A::B::C

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6. if $\Delta = \begin{vmatrix} -x & a & b \\ b & -x & a \\ a & b & -x \end{vmatrix}$ then a factor of Δ is

A. $a+b+x$

B. $x^2-(a-b)x+a^2+b^2+ab$

C. $x^2+(a+b)x+a^2+b^2-ab$

D. $a+b-x$

Answer: C::D

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7. 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. x^3

D. none of these

Answer: A::B

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8. $= \left|aa^2 012a + b(a+b)012a + 3b\right|$ is divisible by $a+b$ b. $a+2b$ c. $2a+3b$ d. a^2

A. $a+b$

B. $a+2b$

C. $2a+3b$

D. a^2

Answer: A::B

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9. the roots of the equations $\begin{vmatrix} .^{x}C_r & .^{n-1}C_r & .^{n-1}C_{r-1} \\ .^{x+1}C_r & .^{n}C_r & .^{n}C_{r-1} \\ .^{x+2}C_r & .^{n+1}C_r & .^{n+1}C_{r-1} \end{vmatrix} = 0$

A. $x = n$

B. $x = n+1$

C. $x = n-1$

D. $x = n - 2$

Answer: A::C

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10. If $f(x) = \begin{vmatrix} 3 & 3x & 3x^2 + 2a^2 \\ 3x & 3x^2 + 2a^2 & 3x^3 + 6a^2x \\ 3x^2 + 2a^2 & 3x^3 + \quad + 6a^2x & 3x^4 + 12a^2x^2 + 2a^4 \end{vmatrix}$

then

A. f'(x)=0

B. y=f(x) is a straight line parallel to x-axis

C. $\int_0^2 f(x)dx = 32a^4$

D. none of these

Answer: A::B

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11. Let $f(n) = \begin{vmatrix} n & n+1 & n+1 \\ .^{n}P_{n} & .^{n+1}P_{n+1} & .^{n+2}P_{n+2} \\ .^{n}C_{n} & .^{n+1}C_{n+1} & .^{n+2}C_{n+2} \end{vmatrix}$ where the sysmbols have their usual neanings .then f(n) is divisible by

A. $n^2 + n + 1$

B. $(n+1)!$

C. $n!$

D. none of these

Answer: A::C

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12. If $\begin{vmatrix} a & b & a\alpha + b \\ b & c & b\alpha + c \\ a\alpha + b & b\alpha + c & 0 \end{vmatrix} = 0,$ prove that a,b,c, are in G.P. or α is a root of $ax^2 +$ 2bx+c=0

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 fo $ax^2 + 2bx + c$

Answer: B::D

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13. if $\begin{vmatrix} \sin x & \sin y & \sin z \\ \cos x & \cos y & \cos z \\ \cos^3 x & \cos^3 y & \cos^3 z \end{vmatrix} = 0$ then which of the following is / are possible ?

A. $x = y$

B. $y = z$

C. $x = z$

D. $x + y + z = \pi/2$

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

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14. 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. $\begin{vmatrix} 1 & 1 & 1 \\ -1 & -3 & 3 \\ 4 & 0 & 0 \end{vmatrix}$

B. $\begin{vmatrix} 0 & 1 & 2 \\ 1 & -2 & 3 \\ -4 & 0 & 0 \end{vmatrix}$

C. $\begin{vmatrix} 1 & 1 & -2 \\ -3 & -2 & 3 \\ 4 & 0 & 1 \end{vmatrix}$

D. $\begin{vmatrix} 0 & 1 & -2 \\ -1 & -3 & 3 \\ 4 & 0 & 0 \end{vmatrix}$

Answer: A::D

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15. if $\begin{vmatrix} 1 & 1 & 1 \\ a & b & c \\ bc & ca & ab \end{vmatrix} = \begin{vmatrix} 1 & 1 & 1 \\ a & b & c \\ a^3 & b^3 & c^3 \end{vmatrix}$ where a,b,c are distinct positive reals then the possible values of abc is / are

A. $\frac{1}{18}$

B. $\frac{1}{63}$

C. $\frac{1}{27}$

D. $\frac{1}{9}$

Answer: A::B

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16. $\begin{vmatrix} .^x C_r & .^x C_{r+1} & .^x C_{r+2} \\ .^y C_r & .^y C_{r+1} & .^y C_{r+2} \\ .^z C_r & .^z C_{r+1} & .^z C_{r+2} \end{vmatrix}$ is equal to

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17. If $\begin{vmatrix} \sin\theta\cos\phi & \sin\theta\sin\phi & \cos\theta \\ \cos\theta\cos\phi & \cos\theta\sin\phi & -\sin\theta \\ -\sin\theta\sin\phi & \sin\theta\cos\phi & \theta \end{vmatrix}$ then

A. Δ is independent of theta

B. Δ is independent of ϕ

C. $\Delta$is a constant

D. $\left[\frac{d\Delta}{d}(\theta)\right]_{\theta=\pi/2}=0$

Answer: B::D

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18. If $f(\theta)=\left|\sin^2 A\cot A1\sin^2 B\cos B1\sin^2 C\cos C1\right|$, then $tanA+tanB+c\cot A\cot B\cot C\sin^2 A+\sin^2 B+\sin^2 C$ 0

A. $\tan A+\tan B+C$

B. $\cot A\cot B\cot C$

C. $\sin^2 A+\sin^2 B+\sin^2 C$

D. 0

Answer: D

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19. if 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. non-negative

B. independent of theta

C. independent of ϕ

D. none of these

Answer: A::B

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20. If $g(x) = \begin{vmatrix} a^{-x} & e^{x \log_e a} & x^2 \\ a^{-3x} & e^{3x \log_e a} & x^4 \\ a^{-5x} & e^{5x \log_e a} & 1 \end{vmatrix}$ then

A. graphs of g(x) is symmetrical about the origin

B. gpaphs of g(x) is symmertical about the y-axis

C. $\frac{d^4 g(x)}{dx^4} \Big|_{x=0} = 0$

D. $f(x) = g(x) \times \log . \left(\frac{a-x}{a+x}\right)$ is an odd function

Answer: A::C

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21. If $\Delta(x) = \begin{vmatrix} x^2+4x-3 & 2x+4 & 13 \\ 2x^2+5x-9 & 4x+5 & 26 \\ 8x^2-6x+1 & 16x-6 & 104 \end{vmatrix} = ax^3+bx^2+cx+d,$

then

A. $a = 3$

B. $b = 0$

C. $c = 0$

D. None of these

Answer: B::C

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22. if $\begin{vmatrix} yz-x^2 & zx-y^2 & xy-z^2 \\ xz-y^2 & xy-z^2 & yz-x^2 \\ xy-z^2 & yz-x^2 & zx-y^2 \end{vmatrix} = \begin{vmatrix} r^2 & u^2 & u^2 \\ u^2 & r^2 & u^2 \\ u^2 & u^2 & r^2 \end{vmatrix}$ then

A. $r^2 = x + y + z$

B. $r^2 = x^2 = y^2 + z^2$

C. $u^2 = yz + zx + xy$

D. $u^2 = xyz$

Answer: B::C

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23. which of the following is / are true for

$\Delta = \begin{vmatrix} a^2 & 1 & a+c \\ 0 & b^2+1 & b+c \\ 0 & b+c & c^2+1 \end{vmatrix}$?

A. $\Delta \geq 0$ for real values of a,b,c

B. $\Delta \leq 0$ for real values of a,b,c

C. $\Delta = \begin{vmatrix} bc-1 & 0 & 0 \\ 1 & ac & -a \\ -b & -a & ab \end{vmatrix}$

D. $\Delta = 0$ if bc =1 where a,b,c are non-zero

Answer: A::C::D

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24. The values of $k \in R$ for which the system of equations $x + ky + 3z = 0, kx + 2y + 2z = 0, 2x + 3y + 4z = 0$ admits of nontrivial solution is 2 b. $5/2$ c. 3 d. $5/4$

A. 2

B. $5/2$

C. 3

D. $5/4$

Answer: A::B

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25. The system of equations $-2x + y + z = a \quad x - 2y + z = b$ $x + y - 2z = c$ has

A. no solution if $a + b + c \neq 0$

B. unique solution if $a + b + c = 0$

C. infinite number of solutions if $a + b + c = 0$

D. None of these

Answer: A::C

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26. Let α, β and γ be the roots of the equations $x^3 + ax^2 + bx + c = 0, (a \neq 0)$. If the system of equations $\alpha x + \beta y + \gamma z = 0$

$\beta x + \gamma y + \alpha z = 0$ and $\gamma x = \alpha y + \beta z = 0$ has non-trivial solution then

A. $a^2 = 3b$

B. $a^3 = 27c$

C. $b^3 = 27c^2$

D. $\alpha + \beta + \gamma = 0$

Answer: A::B::C

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Exercise (Comprehension)

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

Which of the following is true ?

A. f(x) =0 and f(x) =0 have one positive common root

B. f(x)=0 and f(x)=0 have one negative common root

C. f(x) =0 and f(x) =0 have no common root

D. None of these

Answer: D

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

which of the following is true ?

A. f(x) has one +ve point of maxima.

B. f(x) has one -ve point of minima

C. f(x)=0 has three distinct roots

D. Local minimum value of f(x) is zero

Answer: D

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

In which of the following interval f(x) is strictly increasing

A. $(-\infty, \infty)$

B. $(-\infty, 0)$

C. $(0, \infty)$

D. None of these

Answer: C

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4. Let $\Delta = \begin{vmatrix} -bc & b^2+bc & c^2+bc \\ a^2+ac & -ac & c^2+ac \\ a^2+ab & b^2+ab & -ab \end{vmatrix}$ and the equation $px^3 + qx^2 + rx + s = 0$ has roots a,b,c where $a, b, c \in R^+$

the value of Δ is

A. r^2 / p^2

B. r^3 / p^3

C. $- s / p$

D. none of these

Answer: B

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5. Let $\Delta = \begin{vmatrix} -bc & b^2+bc & c^2+bc \\ a^2+ac & -ac & c^2+ac \\ a^2+ab & b^2+ab & -ab \end{vmatrix}$ and the equation $px^3 + qx^2 + rx + s = 0$ has roots a,b,c where $a, b, c \in R^+$

The value of Δ is

A. $\leq 9r^2 / p^2$

B. $\geq 27s^2 / p^2$

C. $\leq 27s^3 / p^3$

D. none of these

Answer: B

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6. Let $\Delta = \begin{vmatrix} -bc & b^2+bc & c^2+bc \\ a^2+ac & -ac & c^2+ac \\ a^2+ab & b^2+ab & -ab \end{vmatrix}$ and the equation $px^3 + qx^2 + rx + s = 0$ has roots a,b,c where $a, b, c \in R^+$

$\text{if} \quad \Delta = 27 \quad \text{and} \quad a^2 + b^2 + c^2 = 3$then

A. $3p + 2q = 0$

B. $4p + 3q = 0$

C. $3p + q = 0$

D. none of these

Answer: C

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7. if $x > m, y > n, z > r(x, y, z > 0)$ such that $\begin{vmatrix} x & n & r \\ m & y & r \\ m & n & z \end{vmatrix} = 0$

The value of $\frac{x}{x-m} + \frac{y}{y-n} + \frac{z}{z-r}$ is

A. 1

B. -1

C. 2

D. -2

Answer: C

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8. if $x > m, y > n, z > r(x, y, z > 0)$ such that $\begin{vmatrix} x & n & r \\ m & y & r \\ m & n & z \end{vmatrix} = 0$

the value of $\frac{m}{x-m} + \frac{n}{y-n} + \frac{r}{z-r}$ is

A. -2

B. -4

C. 0

D. -1

Answer: D

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9. if $x > m, y > n, z > r(x, y, z > 0)$ such that $\begin{vmatrix} x & n & r \\ m & y & r \\ m & n & z \end{vmatrix} = 0$ the value $\dfrac{xyz}{(x-m)(y-n)(z-r)}$ is

A. 27

B. $\dfrac{8}{27}$

C. $\dfrac{64}{27}$

D. None of these

Answer: B

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10.

$$f(x)=\begin{vmatrix} x+c_1 & x+a & x+a \\ x+b & x+c_2 & x+a \\ x+b & x+b & x+c_3 \end{vmatrix} \quad \text{and} \quad g(x)=(C_1-x)(c_3-x)$$

Coefficient of x in f(x) is

A. $\dfrac{g(a)-f(b)}{b-a}$

B. $\dfrac{g(-a)-g(-b)}{b-a}$

C. $\dfrac{g(a)-g(b)}{b-a}$

D. none of these

Answer: C

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11.

$$f(x)=\begin{vmatrix} x+c_1 & x+a & x+a \\ x+b & x+c_2 & x+a \\ x+b & x+b & x+c_3 \end{vmatrix} \quad \text{and} \quad g(x)=(C_1-x)(c_3-x)$$

Which of the following is not a constant term in f(x) ?

A. $\dfrac{bg(a) - ag(b)}{(b - a)}$

B. $\dfrac{bf(a) - af(-b)}{(b - a)}$

C. $\dfrac{bf(-a) - ag(b)}{(b - a)}$

D. none of these

Answer: D

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12.

$$f(x) = \begin{vmatrix} x + c_1 & x + a & x + a \\ x + b & x + c_2 & x + a \\ x + b & x + b & x + c_3 \end{vmatrix} \text{ and } \quad g(x) = (C_1 - x)(c_3 - x)$$

`Which of the following is not true ?

A. $f(-a) = g(a)$

B. $f(-a) = g(-a)$

C. $f(-b) = g(b)$

D. none of these

Answer: B

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13. Suppose $f(x)$ is a function satisfying the following conditions: $f(0) = 2, f(1) = 1$ f has a minimum value at $x = \frac{5}{2}$ For all $x, f'(x) = |2ax2ax - 12ax + b + 1 + 1 - 12(ax + b)2ax + 2b + 12ax +$ where a, b are some constants. Determine the constants a, b , and the function $f(x)$

A. $1/4$

B. $1/2$

C. -1

D. 3

Answer: B

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14. Suppose f(x) is a function satisfying the following conditions :

(i) f(0)=2,f(1)=1

(ii) f has a minimum value at $x = 5/2$

(iii) for all x, $f(x) = \begin{vmatrix} 2ax & 2ax-1 & 2ax+b+1 \\ b & b+1 & -1 \\ 2(ax+b) & 2ax+2b+1 & 2ax+b \end{vmatrix}$

f(x)=0 has

A. both roots positive

B. both roots negative

C. roots of opposite sign

D. imaginary roots

Answer: D

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15. Suppose f(x) is a function satisfying the following conditions :

(i) f(0)=2,f(1)=1

(ii) f has a minimum value at $x = 5/2$

(iii) for all x, $f(x)=\begin{vmatrix} 2ax & 2ax-1 & 2ax+b+1 \\ b & b+1 & -1 \\ 2(ax+b) & 2ax+2b+1 & 2ax+b \end{vmatrix}$

Range of f(x) is

A. $[7/16, \infty)$

B. $(-\infty, 15/16]$

C. $[3/4, \infty)$

D. none of these

Answer: A

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16. Consider the polynomial fucntion $f(x)=\begin{vmatrix} (1+x)^a & (1+2x)^b & 1 \\ 1 & (1+x)^a & (1+2x)^b \\ (1+2x)^b & 1 & (1+x)^a \end{vmatrix}$ a,b being positive integers. The constant term in f(x) is

A. 2

B. 1

C. -1

D. 0

Answer: D

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17. Consider the polynomial fucntion

$$f(x)=\begin{vmatrix}(1+x)^2 & (1+2x)^b & 1 \\ 1 & (1+x)^a & (1+2x)^b \\ (1+2x)^b & 1 & (1+x)^a\end{vmatrix}$$

a,b being positive integers.

the coefficient of x in f(x) is

A. 2^a

B. $2^a-3\times 2^b+1$

C. 0

D. none of these

Answer: C

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18. Consider the polynomial fucntion

$$f(x) = \begin{vmatrix} (1+x)^2 & (1+2x)^b & 1 \\ 1 & (1+x)^a & (1+2x)^b \\ (1+2x)^b & 1 & (1+x)^a \end{vmatrix}$$

a,b being positive integers.

Which of the following is true ?

A. All the roots of the equation f(x)=0 are positive

B. All the roots of the equation f(x)=0 are negative

C. At least one of the equation f(x)=0 is repeating one .

D. None of these

Answer: C

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19. Given that the system of equations $x = cy + bz$, $y = az + cx$, $z = bx + ay$ has nonzero solutions and and at least one of the a,b,c is a proper fraction.

$a^2 + b^2 + c^2$ is

A. > 2

B. > 3

C. < 3

D. < 2

Answer: C

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20. Given that the system of equations $x = cy + bz$, $y = az + cx$, $z = bx + ay$ has nonzero solutions and and at least one of the a,b,c is a proper fraction.

abc is

A. $> \ -1$

B. > 1

C. < 2

D. < 3

Answer: A

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21. Given that the system of equations $x = cy + bz, y = az + cx, z = bx + ay$ has nonzero solutions and and at least one of the a,b,c is a proper fraction.

System has solution such that

A. $x, y, z \equiv (1 - 2a^2) : (1 - 2b^2) : (1 - 2c^2)$

B. $x.\ y.\ z \equiv \frac{1}{1 - 2a^2} : \frac{1}{1 - 2b^2} : \frac{1}{1 - 2c^2}$

C. $x.\ y.\ z \equiv \frac{a}{1 - a^2} : \frac{b}{1 - b^2} : \frac{c}{1 - c^2}$

D. $x.\ y.\ z \equiv \sqrt{1 - a^2} : \sqrt{1 - b^2} : \sqrt{1 - c^2}$

Answer: D

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22. Consider the system of equations

$x+y+z=6$

$x+2y+3z=10$

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

the system has unique solution if

A. $\lambda \neq 3$

B. $\lambda=3, \mu=10$

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

D. none of these

Answer: A

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23. Consider the system of equations

$x + y + z = 6$

$x + 2y + 3z = 10$

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

the system has infinite solutions if

A. $\lambda \neq 3$

B. $\lambda = 3, \mu = 10$

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

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

Answer: B

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24. Consider the system of equations

$x + y + z = 6$

$x + 2y + 3z = 10$

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

The system has no solution if

A. $\lambda \neq 3$

B. $\lambda = 3, \mu = 10$

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

D. none of these

Answer: C

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Matrix Match Type

1. Match the following lists :

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2. Match the following lists:

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3. If α, β, γ are the roots of $x^3 - 3x^2 + 3x - 1 = \begin{vmatrix} 1^2 & 2^2 & 3^2 \\ 2^2 & 3^2 & 4^2 \\ 3^2 & 4^2 & 5^2 \end{vmatrix}$

then match the list I with list II

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4. consider the system of equations

$\lambda x + y + z = 1$

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

$x + y + \lambda z = \lambda^2$

Now match the following lists:

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5. consider determinant $\Delta = |a_{ij}|$ of order 3. If $\Delta = 2$ the match the following lists.

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Exercise (Numerical)

1. If $a_1, a_2, a_3, 54, a_6, a_7, a_8, a_9$ are in H.P., and $D = |a_1 a_2 a_3 54 a_6 a_7 a_8 a_9|$, then the value of $[D] is where [.]$ represents the greatest integer function

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2. the sum of values of p for which the equations x+y+z=1x+2y +4z=p and x+4y +10z =p^2 have a solution is ____

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3. The sum of roots of the equations

$$\begin{vmatrix} x+2 & 2x+3 & 3x+4 \\ 2x+3 & 3x+4 & 4x+5 \\ 3x+5 & 5x+8 & 10x+17 \end{vmatrix} = 0 \text{ is } \_\_\_\_$$

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4. Prove that

$$\begin{vmatrix} (\beta+\gamma-\alpha-\delta)^4 & (\beta+\gamma-\alpha-\delta)^2 & 1 \\ (\gamma+\alpha-\beta-\delta)^4 & (\gamma+\alpha-\beta-\delta)^2 & 1 \\ (\alpha+\beta-\gamma-\delta)^4 & (\alpha+\beta-\gamma-\delta)^2 & 1 \end{vmatrix} = -64(\alpha-\beta)(\alpha-\gamma)(\alpha-\delta)$$

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5. 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 the value of f(500) ______

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6. If

$|(x, x+y, x+y+z), (2x+3x+2y, 4x+3y+2z), (3x+6x+3y, 10x$

then the real value of x is

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7. Let

$D_1 = |aba+bcdc+daba-b| and D_2 = |aca+cbdb+daca+b+c|$

then the value of $\left|\frac{D_1}{D_2}\right|$, $where b \neq 0 and ad \neq bc,$ is ____.

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8. if $a_1, a_2, a+_3 \ldots\ldots, a_{12}$ are in A.P and

$$\Delta_1 = \begin{vmatrix} a_1a_5 & a_1 & a_2 \\ a_2a_6 & a_2 & a_3 \\ a_3a_7 & a_3 & a_4 \end{vmatrix} \Delta_3 = \begin{vmatrix} a_2b_{10} & a_2 & a_3 \\ a_3a_{11} & a_3 & a_4 \\ a_3a_{12} & a_4 & a_5 \end{vmatrix}$$

then $\Delta_2 : \Delta_2 =$ ______

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9. if $\left(1+ax+bx^2\right)^4 = a_0 + a_1x + a_2x^2 + \ldots\ldots + a_8x^8$, where $a, b, a_0, a_1 \ldots\ldots, a_8 \in R$ such that $a_0 + a_1 + a_2 \neq 0$ and

$$\begin{vmatrix} a_0 & a_1 & a_2 \\ a_1 & a_2 & a_0 \\ a_2 & a_0 & a_1 \end{vmatrix} = 0 \text{ then the value of } 5.\frac{a}{b} \text{ is } \_\_\_\_$$

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10. $$\begin{vmatrix} 5\sqrt{\log_e 3} & 5\sqrt{\log_e 3} & 3\sqrt{\log_e 3} \\ 3^{-\log_{1/3} 4} & (0.1)^{\log_{0.01} 4} & 7^{\log_7 3} \\ 7 & 3 & 5 \end{vmatrix} \text{ is equal to } \_\_\_\_$$

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11. Let a+b+c =s and $\begin{vmatrix} s+c & a & b \\ c & s+a & b \\ c & a & s+b \end{vmatrix} = 532$ then the value of s is _____

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12. Let $a, b, c, \in R$ not all are equal and $\Delta_1 = \begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix}$

$\Delta_2 = \begin{vmatrix} a+2b & b+3c & c+4a \\ b+2c & c+3a & a+4b \\ c+2a & a+3b & b+4c \end{vmatrix}$ then $\frac{\Delta_2}{\Delta_1} = \_\_\_\_$

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13. Three distinct points $P(3u^2, 2u^3)$; $Q(3v^2, 2v^3)$ and $R(3w^2, 2w^3)$ are collinear then

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14. if $\Delta_r = \begin{vmatrix} r & 612 & 915 \\ 101r^2 & 2r & 3r \\ r & \frac{1}{r} & \frac{1}{r^2} \end{vmatrix}$ then the value of

$\lim_{n \to \infty} . \frac{1}{n^3} (\Sigma_{r=1}^{n} \Delta_r$ is $\_\_\_\_$

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15. if x=31,y=32 and z=33 then the value of

$$\begin{vmatrix}(x^2+1)^2 & (xy+1)^2 & (xz+1)^2 \\ (xy+1)^2 & (y^2+1)^2 & (yz+1)^2 \\ (xz+1)^2 & (yz+1)^2 & (z^2+1)^2\end{vmatrix} \text{ is } \_\_\_\_$$

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16. Let α, β, γ are the real roots of the equation $x^3 + ax^2 + bx + c = 0(a, b, c \in Randa \neq 0)$. If the system of equations $(\in u, v, andw)$ given by $\alpha u + \beta v + \gamma w = 0$ $\beta u + \gamma v + \alpha w = 0$ $\gamma u + \alpha v + \beta w = 0$ has non-trivial solutions then the value of a^2/b is _______.

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17. 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 _____

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18. Number of values of θ lying I $[0,100\pi]$ for which the system of equations (sin 3θ) x-y+z=0, (cos 2θ) x+4y +3z=0, 2x+ 7y+7z =0 has non-trivial solution is _____

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JEE Main Previous Year

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

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

Then the value of 'n' is:

A. zero

B. any even integer

C. any odd integer

D. any integer

Answer: 3

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2. Consider the system of linear equations:

$x_1 + 2x_2 + x_3 = 3$

$2x_1 + 3x_2 + x_3 = 3$

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

The system has

A. no solution

B. infinite number of solutions

C. exactly three solutions.

D. a unique solution

Answer: 1

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3. The number of values of k for which the linear equations $4x + ky + 2z = 0$ $kx + 4y + z = 0$ $2x + 2y + z = 0$ posses a non-zero solution is : (1) 3 (2) 2 (3) 1 (4) zero

A. zero

B. 3

C. 2

D. 1

Answer: 3

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4. The number of values of k for which the system of equations:

$kx + (3k+2)y = 4k$

$(3k-1)x + (9k+1)y = 4(k+1)$ has no solution, are

A. infinite

B. 1

C. 2

D. 3

Answer: 2

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5. 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. $\alpha\beta$

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

C. 1

D. -1

Answer: 3

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6. The set of all values of λ for which the system of linear equations

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

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

$-x - y = \lambda z$

has a non-trivial solution

A. is an empty set

B. is a singleton set

C. contains two elements

D. contains more than two elements

Answer: 3

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7. 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 : (1) infinitely many values of λ . (2) exactly one value of λ . (3) exactly two values of λ . (4) exactly three values of λ .

A. Exactly one value of λ

B. Exactly two values of λ

C. Exactly three values of λ

D. Infinitely many values of λ

Answer: 3

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8. 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. a singleton set

B. an empty set

C. an infinite set

D. a finite set containing two or more elements

Answer: 1

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9. Let ω be a complex number such that $2\omega+1=z$ where $z=\sqrt{-3.}$ $If\left|1111-\omega^2-1\omega^2 1\omega^2\omega^7\right|=3k,$ then$k$ is equal to : -1 (2) 1 (3) $-z$ (4) z

A. 1

B. $-z$

C. z

D. -1

Answer: 2

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10. 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. 30

B. -10

C. 10

D. -30

Answer: 3

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11. 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. $(4, 5)$

B. $(-4, -5)$

C. $(-4, 3)$

D. $(-4, 5)$

Answer: D

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JEE Advanced Previous Year

1. Which of the following values of α satisfying the equation

$\left|(1+\alpha)^2(1+2\alpha)^2(1+3\alpha)^2(2+\alpha)^2(2+2\alpha)^2(2+3\alpha)^2(3+\alpha)^2(3+2\alpha)\right.$

-4 b. 9 c. -9 d. 4

A. -4

B. 9

C. -9

D. 4

Answer: 2,3

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2. Let $a, \lambda, \mu \in R$, Consider the system of linear equations $ax+2y=\lambda 3x-2y=\mu$ Which of the flollowing statement (s) is (are) correct?

A. If $\alpha = -3$ then the system has infinitely many solutions for all values of λ and μ

B. If $\alpha \neq -3$ then the system has a unique solution for all values of λ and μ

C. If $\lambda + \mu = 0$ then the system has infiniely many solutions for $\alpha = -3$

D. if $\lambda + \mu \neq 0$ then the system has no solution for $\alpha = -3$

Answer: 2,3,4

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3. 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

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

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5. For a real number α, if the system $[1\alpha\alpha^2\alpha1\alpha\alpha^2\alpha1][xyz] = [1-11]$ of linear equations, has infinitely many solutions, then $1+\alpha+\alpha^2 =$

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6. Let P be a matrix of order 3×3 such that all the entries in P are from the set $\{-1, 0, 1\}$. Then, the maximum possible value of the determinant of P is _____.

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1. Number of real roots of the equation $[[1, x, x], [x, 1, x], [x, x, 1]| + |[1-x, 1, 1], [1, 1-x, 1], [1, 1, 1-x] \mid = ($

is

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2. If $\begin{vmatrix} \sqrt{3}x - x^2 & x-1 & x-\sqrt{3} \\ \sqrt{3}x & x & \sqrt{3}-1 \\ x-1 & \sqrt{3}-x & x-1 \end{vmatrix} = ax^4 + bx^3 + cx^2 + dx + e$ and $a + c = p + \sqrt{q}$, then $(p-q)$ is equal to

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3. If

$f(x) = \mid \cos(x+\alpha), \cos(x+\beta), \cos(x+\gamma)], [\sin(x+\alpha), \sin(x+\beta), \text{si}$

and

$f(0) = -2$ then $\sum_{r=1}^{30} |f(r)|$equals

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4. Let $f(x) = \begin{vmatrix} 1+\sin^2 x & \cos^2 x & 4\sin 2x \\ \sin^2 x & 1+\cos^2 x & 4\sin 2x \\ \sin^2 x & \cos^2 x & 1+4\sin 2x \end{vmatrix}$, the maximum value of $f(x)$ is

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5. Given $2x - y + 2z = 1, x - 2y + z = -4,$ and $x + y + \lambda z = 4.$ Then the. value of λ such that the given system of equation has no solution is

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6. If M and m are maximum and minimum value, respectively of $\begin{vmatrix} 1 & \cos\theta & 1 \\ \cos\theta & 1 & \cos\theta \\ -1 & \cos\theta & 1 \end{vmatrix}$, then value of $(M+m)$ is

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7. The value of $\begin{vmatrix} \log_3 512 & \log_4 3 \\ \log_3 8 & \log_4 9 \end{vmatrix} \begin{vmatrix} \log_2 3 & \log_8 3 \\ \log_3 4 & \log_3 4 \end{vmatrix}$ is

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8. If |[1 , x, x^2],[x , x^2 , 1],[x^2 , 1 , x]|=3, $thenthevalueof$|[x^(3)-1, 0 , x-x^4],[0, x-x^(4) , x^(3)-1],[x-x^(4) , x^(3)-1 , 0]|`

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9. If a, b, c are the sides of a scalene triangle such that |[a , a^2 , a^(3)-1],[b , b^2 , b^(3)-1],[c, c^2 , c^(3)-1]|=0, $thenthe \geq ometricmeanof$a, b c` is

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10. Let $a + b + c = s$ and |[s+c, a, b],[c ,s+a, b],[c, a , s+b]| $iscqual \to 54thenthevalueofs$` is

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