EXERCISE - O

SINGLE CORRECT TYPE QUESTIONS

1. If a, b, c are in AP, then $\begin{vmatrix} x+1 & x+2 & x+a \\ x+2 & x+3 & x+b \\ x+3 & x+4 & x+c \end{vmatrix}$ equals -

(A) $a+b+c$ (B) $x+a+b+c$ (C) 0 (D) none of these

MDT061

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

(A) 0 (B) $\log xyz$ (C) $\log(x+y+z)$ (D) $\log x \log y \log z$

MDT062

3. Let a determinant is given by $A = \begin{vmatrix} a & b & c \\ p & q & r \\ x & y & z \end{vmatrix}$ and suppose $A = 6$. If $B = \begin{vmatrix} p+x & q+y & r+z \\ a+x & b+y & c+z \\ a+p & b+q & c+r \end{vmatrix}$ then

(A) $B = 6$ (B) $B = -6$ (C) $B = 12$ (D) $B = -12$

MDT063

4. If $S_r = \begin{vmatrix} 2r & x & n(n+1) \\ 6r^2-1 & y & n^2(2n+3) \\ 4r^3-2nr & z & n^3(n+1) \end{vmatrix}$, then $\sum_{r=1}^{n} S_r$ does not depend on -

(A) x (B) y (C) n (D) all of these

MDT064

5. If $a, b, c > 0$ and $x, y, z \in R$, then the determinant $\begin{vmatrix} (a^x+a^{-x})^2 & (a^x-a^{-x})^2 & 1 \\ (b^y+b^{-y})^2 & (b^y-b^{-y})^2 & 1 \\ (c^z+c^{-z})^2 & (c^z-c^{-z})^2 & 1 \end{vmatrix}$ is equal to -

(A) $a^x b^y c^x$ (B) $a^{-x} b^{-y} c^{-z}$ (C) $a^{2x} b^{2y} c^{2z}$ (D) zero

MDT065

6. If a, b, c are sides of a scalene triangle, then the value of $\begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix}$ is :

(A) non-negative (B) negative (C) positive (D) non-positive

MDT066

7. If the system of linear equations

$x_1 + 2x_2 + 3x_3 = 6$

$x_1 + 3x_2 + 5x_3 = 9$

$2x_1 + 5x_2 + ax_3 = b$

is consistent and has infinite number of solutions, then :-

(A) $a \in R - \{8\}$ and $b \in R - \{15\}$
(B) $a = 8$, b can be any real number
(C) $a = 8$, $b = 15$
(D) $b = 15$, a can be any real number

MDT067

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

(A) 2 (B) 4 (C) 6 (D) 8

MDT068

9. Let $D_1 = \begin{vmatrix} a & b & a+b \\ c & d & c+d \\ a & b & a-b \end{vmatrix}$ and $D_2 = \begin{vmatrix} a & c & a+c \\ b & d & b+d \\ a & c & a+b+c \end{vmatrix}$ then the value of $\frac{D_1}{D_2}$ where $b \neq 0$ and $ad \neq bc$, is

(A) – 2 (B) 0 (C) – $2b$ (D) $2b$

MDT069

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

(A) 0 (B) 1 (C) 2 (D) 3

MDT070

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

(A) 0
(B) independent of θ
(C) independent of ϕ
(D) independent of θ & ϕ both

MDT071

12. If the system of equation, $a^2x - ay = 1 - a$ & $bx + (3-2b)y = 3 + a$ possess a unique solution $x = 1, y = 1$ then:

(A) $a = 1; b = -1$ (B) $a = -1, b = 1$ (C) $a = 0, b = 0$ (D) $a = 1, b = 0$

MDT072

13. $\begin{vmatrix} y+z & x & x \\ y & z+x & y \\ z & z & x+y \end{vmatrix}$ equals -

(A) $x^2y^2z^2$ (B) $4x^2y^2z^2$ (C) xyz (D) $4xyz$

MDT073

14. Consider the system of equations : $x + ay = 0, y + az = 0$ and $z + ax = 0$. Then the set of all real values of $'a'$ for which the system has a unique solution is :

(A) $\{1, -1\}$ (B) $R - \{-1\}$ (C) $\{1, 0, -1\}$ (D) $R - \{1\}$

MDT076

15. Let a, b, c be any real numbers. Suppose that there are real numbers x, y, z not all zero such that $x = cy + bz$, $y = az + cx$ and $z = bx + ay$, then $a^2 + b^2 + c^2 + 2abc$ is equal to

(A) 2 (B) -1 (C) 0 (D) 1

MDT077

MULTIPLE CORRECT TYPE QUESTIONS

16. The value of θ lying between $-\frac{\pi}{4}$ & $\frac{\pi}{2}$ and $0 \le A \le \frac{\pi}{2}$ and satisfying the equation

$$\begin{vmatrix} 1+\sin^2 A & \cos^2 A & 2\sin 4\theta \\ \sin^2 A & 1+\cos^2 A & 2\sin 4\theta \\ \sin^2 A & \cos^2 A & 1+2\sin 4\theta \end{vmatrix} = 0 \text{ are -}$$

(A) $A = \frac{\pi}{4}, \quad \theta = -\frac{\pi}{8}$ (B) $A = \frac{3\pi}{8} = \theta$

(C) $A = \frac{\pi}{5}, \quad \theta = -\frac{\pi}{8}$ (D) $A = \frac{\pi}{6}, \quad \theta = \frac{3\pi}{8}$

MDT080

17. The determinant $\begin{vmatrix} a & b & a\alpha+b \\ b & c & b\alpha+c \\ a\alpha+b & b\alpha+c & 0 \end{vmatrix}$ is equal to zero, if -

(A) a, b, c are in AP

(B) a, b, c are in GP

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

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

MDT081

18. System of linear equations in x, y, z

$2x + y + z = 1$

$x - 2y + z = 2$

$3x - y + 2z = 3$ have infinite solutions which

(A) can be written as $(-3\lambda - 1, \lambda, 5\lambda + 3) \forall \lambda \in R$

(B) can be written as $(3\lambda - 1, -\lambda, -5\lambda + 3) \forall \lambda \in R$

(C) are such that every solution satisfy $x - 3y + 1 = 0$

(D) are such that none of them satisfy $5x + 3z = 1$

MDT082

19. If $\begin{vmatrix} \frac{a}{b}+\frac{a}{c} & \frac{b}{c}+\frac{b}{a} & 1 \\ \frac{b}{a}+\frac{b}{c} & \frac{c}{a}+\frac{c}{b} & 1 \\ \frac{c}{a}+\frac{c}{b} & \frac{a}{b}+\frac{a}{c} & 1 \end{vmatrix}=0$, where $a, b, c \in R^+$, then which of the following is necessarily true -

(A) $\frac{1}{a}+\frac{1}{b}+\frac{1}{c}=0$ (B) $a^2+b^2+c^2=ab+bc+ac$

(C) $a = b = c$ (D) $\frac{1}{a}+\frac{1}{b}+\frac{1}{c}=1$

MDT083

20. The system of linear equations $x + y + z = 6$, $x + 2y + 3z = 14$ and $2x + 5y + pz = q$ have -

(A) infinitely many solution when $p = 8, q = 36$ (B) unique solution when $p \neq 8, q \neq 36$

(C) no solution when $p = 8, q \neq 36$ (D) atleast one solution for $q = 36, p \in R$

MDT084

21. If a, b, c are in A.P. and α, β, γ are positive real numbers in G.P., then the equation $\begin{vmatrix} x+a & x^2+\log\alpha & k \\ x+b & x^2+\log\beta & k \\ x+c & x^2+\log\gamma & k \end{vmatrix}=0$:-

(A) is an identity (B) has a root $x = 1$ (C) has a root $x = 0$ (D) has real & identical roots

MDT085

22. If system of equation $a_1x+b_1y=c_1$ & $a_2x+b_2y=c_2$ (where $a_1, b_1, c_1, a_2, b_2, c_2 \neq 0$) has infinite solutions, then-

(A) $\frac{a_1}{a_2}=\frac{b_1}{b_2}=\frac{c_1}{c_2}$

(B) $\frac{a_1+a_2}{a_1-a_2}=\frac{b_1+b_2}{b_1-b_2}=\frac{c_1+c_2}{c_1-c_2}$

(C) the quadratic equations $a_1x^2+b_1x+c_1=0$ & $a_2x^2+b_2x+c_2=0$ have no common root

(D) system of equation $a_1^2a_2x+b_1^2b_2y=c_1^2c_2$ & $a_1a_2^2x+b_1b_2^2y=c_1c_2^2$ will also have infinite number of solutions

MDT086

COMPREHENSION TYPE QUESTIONS

Paragraph for Question No. 23 to 25

Let $x, y, z \in R^+$ & $D = \begin{vmatrix} x & x^3 & x^4-1 \\ y & y^3 & y^4-1 \\ z & z^3 & z^4-1 \end{vmatrix}$

On the basis of above information, answer the following questions :

23. If $x \neq y \neq z$ & x, y, z are in GP and $D = 0$, then y is equal to -

(A) 1 (B) 2 (C) 4 (D) none of these

MDT087

24. If x, y, z are the roots of $t^3 - 21t^2 + bt - 343 = 0$, $b \in R$, then D is equal to-

(A) 1 (B) 0

(C) dependent on x, y, z (D) data inadequate

MDT088

25. If $x \neq y \neq z$ & x, y, z are in A.P. and $D = 0$, then $2xy^2z + x^2z^2$ is equal to-

(A) 1 (B) 2 (C) 3 (D) none of these

MDT089

Paragraph for Question No. 26 to 28

Let $\begin{vmatrix} 1 & 1 & 1 \\ 1 & 2 & 3 \\ \alpha & \beta & \gamma \end{vmatrix} = t$, where t is an even prime number & α, β, γ are the integral roots of the equation

$x^3 - 14x^2 + Px - 36 = 0$

On the basis of above information answer the following :

26. The value of P is-

(A) a rational number (B) a prime number

(C) an odd natural number (D) an even natural number

MDT090

27. The value of $\alpha(\beta^2 + \gamma^2) + \beta(\gamma^2 + \alpha^2) + \gamma(\alpha^2 + \beta^2)$ is divisible by -

(A) 17 (B) 34 (C) 51 (D) 68

MDT091

28. Which of following statement is/are false -

(A) t is divisible by $(\alpha - \beta)$ (B) t is divisible by $(\beta - \gamma)$

(C) t is divisible by $(\gamma - \alpha)$ (D) $(\gamma - \alpha)$ is divisible by t

MDT092

MATRIX MATCH/MATCHING LIST TYPE QUESTION

29. Consider a system of linear equations $a_ix + b_iy + c_iz = d_i$ (where $a_i, b_i, c_i \neq 0$ and $i = 1,2,3$) & (α,β,γ) is its unique solution, then match list-I with list-II

List-I	List-II
(I) If $a_i = k$, $d_i = k^2$, $(k \neq 0)$ and $\alpha + \beta + \gamma = 2$, then k is	(P) 1
(II) If $a_i = d_i = k \neq 0$, then $\alpha + \beta + \gamma$ is	(Q) 2
(III) If $a_i = k > 0$, $d_i = k + 1$, then $\alpha + \beta + \gamma$ can be	(R) 0
(IV) If $a_i = k < 0$, $d_i = k + 1$, then $\alpha + \beta + \gamma$ can be	(S) 3
	(T) –1

(A) I $\to$ P,Q; II $\to$ R; III $\to$ Q,S; IV $\to$ T (B) I $\to$ P; II $\to$ Q; III $\to$ R,S; IV $\to$ T

(C) I $\to$ Q; II $\to$ P,R; III $\to$ S; IV $\to$ T (D) I $\to$ Q; II $\to$ P; III $\to$ Q,S; IV $\to$ R,T

MDT093

30. Match the following for the system of linear equations

$\lambda x + y + z = 1, x + \lambda y + z = \lambda, x + y + \lambda z = \lambda^2$

	Column-I		Column-II
(A)	$\lambda = 1$	(P)	unique solution
(B)	$\lambda \neq 1$	(Q)	infinite solutions
(C)	$\lambda \neq 1, \lambda \neq -2$	(R)	no solution
(D)	$\lambda = -2$	(S)	finite many solutions

MDT094

EXERCISE - S

1. Let a, b, c are the solutions of the cubic $x^3 - 5x^2 + 3x - 1 = 0$, then find the value of the determinant $\begin{vmatrix} a & b & c \\ a-b & b-c & c-a \\ b+c & c+a & a+b \end{vmatrix}$.

MDT095

2. If $\Delta(x) = \begin{vmatrix} 0 & 2x-2 & 2x+8 \\ x-1 & 4 & x^2+7 \\ 0 & 0 & x+4 \end{vmatrix}$ and $f(x) = \sum_{j=1}^{3}\sum_{i=1}^{3} a_{ij}c_{ij}$, where a_{ij} is the element of i^{th} and j^{th} column in $\Delta(x)$ and c_{ij} is the cofactor a_{ij} $\forall$ i and j, then find the greatest value of $f(x)$, where $x \in [-3, 18]$

MDT096

3. If the equations $a(y+z) = x, b(z+x) = y, c(x+y) = z$ (where $a, b, c \neq -1$)have nontrivial solutions, then find the value of $\frac{1}{1+a} + \frac{1}{1+b} + \frac{1}{1+c}$.

MDT097

4. Find the sum of all positive integral values of a for which every solution to the system of equation $x + ay = 3$ and $ax + 4y = 6$ satisfy the inequalities $x > 1, y > 0$.

MDT098

5. For a determinant Δ of order 3, the element a_{ij} is defined as $a_{ij} = \tan^{-1}(\tan(i - j))$ $\forall$ i, j, then the value of Δ is equal to (where $'i'$ represents row and $'j'$ represents column)

MDT099

6. The number of triplets (α, β, γ) satisfying the following constraints

$2\alpha - \beta + 3\gamma = 4$

$\alpha + \beta - 3\gamma = -1$

$5\alpha - \beta + 3\gamma = 7$

$\alpha\beta\gamma \leq 0$

& $\alpha, \beta, \gamma \in I$

MDT100

7. Let $a, b, c, \ell, m, n \in R$ such that $a\ell + bm + cn = 0$, $b\ell + cm + an = 0$, $c\ell + am + bn = 0$. If a, b & c are distinct & $f(x) = ax^3 + bx^2 + cx + 5$, then the value of $f(1)$ is

MDT101

8. If $\begin{vmatrix} \sin^2 2x & \cos 2x & 4\sin^2 \frac{x}{2} \\ \tan^2 \frac{x}{2} & \cos^2 x & -\sin^2 x \\ -2\cos 4x & \tan^2 \frac{x}{2} & \sin 4x \end{vmatrix} = a_0 + a_1(\cos x) + a_2(\cos^2 x) + \dots\dots + a_n(\cos^n x)$, then a_0 is -

MDT102

9. If x, y, z are distinct digits $(0 \leq x,\ y,\ z \leq 9)$ & the minimum possible value of $\begin{vmatrix} z & 9y & x \\ z & y & 9x \\ 9z & y & x \end{vmatrix}$ is λ

then $\frac{\lambda}{83700}$ is

(where $9x, 9y$ & $9z$ are two digits number)

MDT103

10. $\begin{vmatrix} a & b-c & c+b \\ a+c & b & c-a \\ a-b & b+a & c \end{vmatrix} = \begin{vmatrix} b-c & b & b+a \\ a & -a-c & b-a \\ c+b & c-a & c \end{vmatrix}$ and $a > 0, b > 0, c > 0$, then the minimum value of $\frac{c^2}{ab}$ is

MDT104

EXERCISE - JEE (Main) PYQ

1. If $\Delta_1=\begin{vmatrix} x & \sin\theta & \cos\theta \\ -\sin\theta & -x & 1 \\ \cos\theta & 1 & x \end{vmatrix}$ and $\Delta_2=\begin{vmatrix} x & \sin 2\theta & \cos 2\theta \\ -\sin 2\theta & -x & 1 \\ \cos 2\theta & 1 & x \end{vmatrix}$, $x\neq 0$; then for all $\theta\in\left(0,\frac{\pi}{2}\right)$:

[JEE (Main) 2019]

(1) $\Delta_1-\Delta_2=x(\cos 2\theta-\cos 4\theta)$ (2) $\Delta_1+\Delta_2=-2x^3$

(3) $\Delta_1-\Delta_2=-2x^3$ (4) $\Delta_1+\Delta_2=-2(x^3+x-1)$

MDT105

2. If $a + x = b + y = c + z + 1$, where a, b, c, x, y, z are non-zero distinct real numbers, then $\begin{vmatrix} x & a+y & x+a \\ y & b+y & y+b \\ z & c+y & z+c \end{vmatrix}$ is equal to : **[JEE (Main) 2020]**

(1) 0 (2) $y(a - b)$ (3) $y (b - a)$ (4) $y(a - c)$

MDT106

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

$x + y + z = 2$

$x + 2y + 3z = 5$

$x + 3y + \lambda z = \mu$

has infinitely many solutions respectively **[JEE (Main) 2020]**

(1) 5 and 7 (2) 6 and 8 (3) 4 and 9 (4) 5 and 8

MDT107

4. If the following system of linear equations

$2x + y + z = 5$

$x - y + z = 3$

$x + y + az = b$

has no solution, then : **[JEE (Main) 2021]**

(1) $a = -\frac{1}{3}, b \neq \frac{7}{3}$ (2) $a \neq \frac{1}{3}, b = \frac{7}{3}$ (3) $a \neq -\frac{1}{3}, b = \frac{7}{3}$ (4) $a = \frac{1}{3}, b \neq \frac{7}{3}$

MDT021

5. Let $[\lambda]$ be the greatest integer less than or equal to λ. The set of all values of λ for which the system of linear equations $x + y + z = 4$, $3x + 2y + 5z = 3$, $9x + 4y + (28 + [\lambda])z = [\lambda]$ has a solution is:

[JEE (Main) 2021]

(1) $\mathbb{R}$ (2) $(-\infty,-9)\cup(-9,\infty)$ (3) $[-9,-8)$ (4) $(-\infty,-9)\cup[-8,\infty)$

MDT022

6. Let $A=\begin{pmatrix} [x+1] & [x+2] & [x+3] \\ [x] & [x+3] & [x+3] \\ [x] & [x+2] & [x+4] \end{pmatrix}$, where $[t]$ denotes the greatest integer less than or equal to t. If $det(A) = 192$, then the set of values of x is the interval: **[JEE (Main) 2021]**

(1) [68, 69) (2) [62, 63) (3) [65, 66) (4) [60, 61)

MDT023

7. Let $f(x)=\begin{vmatrix} \sin^2 x & -2+\cos^2 x & \cos 2x \\ 2+\sin^2 x & \cos^2 x & \cos 2x \\ \sin^2 x & \cos^2 x & 1+\cos 2x \end{vmatrix}, x\in[0,\pi]$

Then the maximum value of $f(x)$ is equal to ______. **[JEE (Main) 2021]**

MDT024

8. Let $\theta\in\left(0,\frac{\pi}{2}\right)$. If the system of linear equations

$(1+\cos^2\theta)x+\sin^2\theta\, y+4\sin 3\theta\, z=0$

$\cos^2\theta x+(1+\sin^2\theta)y+4\sin 3\theta\, z=0$

$\cos^2\theta x+\sin^2\theta\, y+(1+4\sin 3\theta)z=0$

has a non–trivial solution, then the value of θ is : **[JEE (Main) 2021]**

(1) $\frac{4\pi}{9}$ (2) $\frac{7\pi}{18}$ (3) $\frac{\pi}{18}$ (4) $\frac{5\pi}{18}$

MDT025

9. If the system of linear equations

$2x+y-z=7$

$x-3y+2z=1$

$x+4y+\delta z=k$, where $\delta, k\in R$

has infinitely many solutions, then $\delta+k$ is equal to: **[JEE (Main) 2022]**

(1) −3 (2) 3 (3) 6 (4) 9

MDT026

10. If the system of linear equations

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

$x+y+z=4$

$x-y+|\lambda|z=4\lambda-4$

where $\lambda\in\mathbb{R}$, has no solution, then **[JEE (Main) 2022]**

(1) $\lambda=7$ (2) $\lambda=-7$ (3) $\lambda=8$ (4) $\lambda^2=1$

MDT027

11. The ordered pair (a,b), for which the system of linear equations

$3x-2y+z=b$

$5x-8y+9z=3$

$2x+y+az=-1$

has no solution, is : **[JEE (Main) 2022]**

(1) $\left(3,\frac{1}{3}\right)$ (2) $\left(-3,\frac{1}{3}\right)$ (3) $\left(-3,-\frac{1}{3}\right)$ (4) $\left(3,-\frac{1}{3}\right)$

MDT029

12. The number of values of α for which the system of equations :

$x+y+z=\alpha$

$\alpha x+2\alpha y+3z=-1$

$x+3\alpha y+5z=4$

is inconsistent, is **[JEE (Main) 2022]**

(1) 0 (2) 1 (3) 2 (4) 3

MDT032

13. Let the system of linear equations

$x + y + \alpha z = 2$

$3x + y + z = 4$

$x + 2z = 1$

have a unique solution (x^*, y^*, z^*). If (α, x^*), (y^*, α) and $(x^*, -y^*)$ are collinear points, then the sum of absolute values of all possible values of α is : **[JEE (Main) 2022]**

(1) 4 (2) 3 (3) 2 (4) 1

MDT033

14. Let p and $p + 2$ be prime numbers and let $\Delta = \begin{vmatrix} p! & (p+1)! & (p+2)! \\ (p+1)! & (p+2)! & (p+3)! \\ (p+2)! & (p+3)! & (p+4)! \end{vmatrix}$

Then the sum of the maximum values of α and β, such that p^{α} and $(p + 2)^{\beta}$ divide Δ, is ________.

[JEE (Main) 2022]

MDT034

15. If the system of equations

$x + y + z = 6$

$2x + 5y + \alpha z = \beta$

$x + 2y + 3z = 14$

has infinitely many solutions, then $\alpha + \beta$ is equal to : **[JEE (Main) 2022]**

(1) 8 (2) 36 (3) 44 (4) 48

MDT035

16. Let $f(x) = \begin{vmatrix} 1+\sin^2 x & \cos^2 x & \sin 2x \\ \sin^2 x & 1+\cos^2 x & \sin 2x \\ \sin^2 x & \cos^2 x & 1+\sin 2x \end{vmatrix}$, $x \in \left[\frac{\pi}{6}, \frac{\pi}{3}\right]$. If α a β respectively are the maximum and the minimum values of f, then **[JEE (Main) 2023]**

(1) $\beta^2 - 2\sqrt{\alpha} = \frac{19}{4}$ (2) $\beta^2 + 2\sqrt{\alpha} = \frac{19}{4}$ (3) $\alpha^2 - \beta^2 = 4\sqrt{3}$ (4) $\alpha^2 + \beta^2 = \frac{9}{2}$

MDT108

17. Let $D_k = \begin{vmatrix} 1 & 2k & 2k-1 \\ n & n^2+n+2 & n^2 \\ n & n^2+n & n^2+n+2 \end{vmatrix}$. If $\sum_{k=1}^{n} D_k = 96$, then n is equal to **[JEE (Main) 2023]**

MDT109

18. For the system of linear equations

$2x + 4y + 2az = b$

$x + 2y + 3z = 4$

$2x - 5y + 2z = 8$

which of the following is **NOT** correct ? **[JEE (Main) 2023]**

(1) It has infinitely many solutions if $a = 3, b = 6$

(2) It has unique solution if $a = b = 6$

(3) It has unique solution if $a = b = 8$

(4) It has infinitely many solutions if $a = 3, b = 8$

MDT110

19. Let S_1 and S_2 be respectively the sets of all $a \in R-\{0\}$ for which the system of linear equations

$ax+2ay-3az=1$

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

$(3a+5)x+(a+5)y+(a+2)z=3$

has unique solution and infinitely many solutions. Then **[JEE (Main) 2023]**

(1) $n(S_1) = 2$ and S_2 is an infinite set (2) S_1 is an infinite set an $n(S_2) = 2$

(3) $S_1 = \phi$ and $S_2 = \mathbb{R} - \{0\}$ (4) $S_1 = \mathbb{R} - \{0\}$ and $S_2 = \phi$

MDT111

20. For the system of linear equations

$x + y + z = 6$

$\alpha x + \beta y + 7z = 3$

$x + 2y + 3z = 14,$

which of the following is NOT true ? **[JEE (Main) 2023]**

(1) If $\alpha = \beta = 7$, then the system has no solution

(2) If $\alpha = \beta$ and $\alpha \neq 7$ then the system has a unique solution.

(3) There is a unique point (α, β) on the line $x + 2y + 18 = 0$ for which the system has infinitely many solutions

(4) For every point $(\alpha, \beta) \neq (7, 7)$ on the line $x - 2y + 7 = 0$, the system has infinitely many solutions.

MDT112

EXERCISE - JEE (Advanced) PYQ

1. Which of the following values of α satisfy the equation $\begin{vmatrix}(1+\alpha)^2 & (1+2\alpha)^2 & (1+3\alpha)^2\\(2+\alpha)^2 & (2+2\alpha)^2 & (2+3\alpha)^2\\(3+\alpha)^2 & (3+2\alpha)^2 & (3+3\alpha)^2\end{vmatrix} = -648\alpha$?

[JEE (Advanced) 2015]

(A) – 4 (B) 9 (C) – 9 (D) 4

MDT054

2. 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

[JEE (Advanced) 2016]
MDT055

3. Let $a, \lambda, \mu \in$ R. Consider the system of linear equations

$$ax + 2y = \lambda$$
$$3x - 2y = \mu$$

Which of the following statement(s) is(are) correct ?

[JEE (Advanced) 2016]

(A) if $a = -3$, then the system has infinitely many solutions for all values of λ and μ
(B) If $a \neq -3$, then the system has a a unique solution for all values of λ and μ
(C) If λ + μ = 0, then the system has infinitely many solutions for $a = -3$
(D) If λ + μ ≠ 0, then the system has no solution for $a = -3$

MDT056

4. 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 ____ .

[JEE (Advanced) 2018]
MDT057

5. Let $|M|$ denote the determinant of a square matrix M. Let $g:\left[0,\frac{\pi}{2}\right] \to \mathbb{R}$ be the function defined by

$$g(\theta)=\sqrt{f(\theta)-1}+\sqrt{f\left(\frac{\pi}{2}-\theta\right)-1}$$

Where $f(\theta)=\frac{1}{2}\begin{vmatrix}1 & \sin\theta & 1\\-\sin\theta & 1 & \sin\theta\\-1 & -\sin\theta & 1\end{vmatrix}+\begin{vmatrix}\sin\pi & \cos\left(\theta+\frac{\pi}{4}\right) & \tan\left(\theta-\frac{\pi}{4}\right)\\\sin\left(\theta-\frac{\pi}{4}\right) & -\cos\frac{\pi}{2} & \log_e\left(\frac{4}{\pi}\right)\\\cot\left(\theta+\frac{\pi}{4}\right) & \log_e\left(\frac{\pi}{4}\right) & \tan\pi\end{vmatrix}$.

Let $p(x)$ be a quadratic polynomial whose roots are the maximum and minimum values of the function $g(\theta)$, and $p(2) = 2 - \sqrt{2}$. Then, which of the following is/are TRUE ?

[JEE (Advanced) 2022]

(A) $p\left(\frac{3+\sqrt{2}}{4}\right)<0$ (B) $p\left(\frac{1+3\sqrt{2}}{4}\right)>0$ (C) $p\left(\frac{5\sqrt{2}-1}{4}\right)>0$ (D) $p\left(\frac{5-\sqrt{2}}{4}\right)<0$

MDT058

6. Let p, q, r be nonzero real numbers that are, respectively, the 10^{th}, 100^{th} and 1000^{th} terms of a harmonic progression. Consider the system of linear equations

$x + y + z = 1$

$10x + 100y + 1000z = 0$

$qrx + pry + pqz = 0.$

List-I		List-II	
(I)	If $\frac{q}{r} = 10$, then the system of linear equations has	(P)	$x = 0, y = \frac{10}{9}, z = -\frac{1}{9}$ as a solution
(II)	If $\frac{p}{r} \neq 100$, then the system of linear equations has	(Q)	$x = \frac{10}{9}, y = -\frac{1}{9}, z = 0$ as a solution
(III)	If $\frac{p}{q} \neq 10$, then the system of linear equations has	(R)	infinitely many solutions
(IV)	If $\frac{p}{q} = 10$, then the system of linear equations has	(S)	no solution
		(T)	at least one solution

The correct option is:

(A) (I) → (T); (II) → (R); (III) → (S); (IV) → (T)

(B) (I) → (Q); (II) → (S); (III) → (S); (IV) → (R)

(C) (I) → (Q); (II) → (R); (III) → (P); (IV) → (R)

(D) (I) → (T); (II) → (S); (III) → (P); (IV) → (T) **[JEE (Advanced) 2022]**

MDT059

7. Let α, β and γ be real numbers. consider the following system of linear equations

$x + 2y + z = 7$

$x + \alpha z = 11$

$2x - 3y + \beta z = \gamma$

Match each entry in **List - I** to the correct entries in **List-II**

	List-I		List-II
(P)	If $\beta = \frac{1}{2}(7\alpha - 3)$ and $\gamma = 28$, then the system has	(1)	a unique solution
(Q)	If $\beta = \frac{1}{2}(7\alpha - 3)$ and $\gamma \neq 28$, then the system has	(2)	no solution
(R)	If $\beta \neq \frac{1}{2}(7\alpha - 3)$ where $\alpha = 1$ and $\gamma \neq 28$, then the system has	(3)	infinitely many solutions
(S)	If $\beta \neq \frac{1}{2}(7\alpha - 3)$ where $\alpha = 1$ and $\gamma = 28$, then the system has	(4)	$x = 11, y = -2$ and $z = 0$ as a solution
		(5)	$x = -15, y = 4$ and $z = 0$ as a solution

The correct option is : **[JEE (Advanced) 2023]**

(A) (P)→ (3); (Q)→ (2); (R)→ (1); (S → (4) (B) (P)→ (3); (Q)→ (2); (R)→ (5); (S)→ (4)

(C) (P)→ (2); (Q)→ (1); (R)→ (4); (S)→ (5) (D) (P)→ (2); (Q)→ (1); (R)→ (1); (S)→ (3)

MDT113

JEE (Main) Practice Paper

This paper is for yourself practice and assessment the discussion of this paper is optional though you can see PDF solutions or video solutions or solutions in hardcopy whichever is provided.

SECTION–A

- This section contains **TWENTY** questions.
- Each question has **FOUR** options (1), (2), (3) and (4). **ONLY ONE** of these four options is correct.
- For each question, darken the bubble corresponding to the correct option in the ORS.
- For each question, marks will be awarded in one of the following categories:

Full Marks : +4, if only the bubble corresponding to the correct option is darkened.
Zero Marks : 0, if none of the bubbles is darkened.
Negative Marks : –1 in all other cases.

1. The value of the determinant $\begin{vmatrix} a & b & 0 \\ 0 & a & b \\ b & 0 & a \end{vmatrix}$ is equal to -

(1) $a^3 - b^3$ (2) $a^3 + b^3$ (3) 0 (4) $a + b$

MDT012

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

(1) 0 (2) $2 \sin B \tan A \cos C$
(3) 1 (4) –1

MDT006

3. If $\begin{vmatrix} \sin 2x & \cos^2 x & \cos 4x \\ \cos^2 x & \cos 2x & \sin^2 x \\ \cos^4 x & \sin^2 x & \sin 2x \end{vmatrix} = a_0 + a_1(\sin x) + a_2(\sin^2 x) + \ldots\ldots + a_n(\sin^n x)$ then the value of a_0 is -

(1) –1 (2) 1 (3) 0 (4) 2

MDT002

4. An equilateral triangle has each of its sides of length 6 cm. If (x_1, y_1); (x_2, y_2) & (x_3, y_3) are its vertices then the value of the determinant, $\begin{vmatrix} x_1 & y_1 & 1 \\ x_2 & y_2 & 1 \\ x_3 & y_3 & 1 \end{vmatrix}^2$ is equal to -

(1) 192 (2) 243 (3) 486 (4) 972

MDT013

5. The value of determinant $\begin{vmatrix} a-b & b-c & c-a \\ b-c & c-a & a-b \\ c-a & a-b & b-c \end{vmatrix}$ is equal to -

(1) abc (2) $2abc$ (3) 0 (4) $4abc$

MDT001

6. The value of the determinant $\begin{vmatrix} -a & b & c \\ a & -b & c \\ a & b & -c \end{vmatrix}$ is equal to -

(1) 0
(2) $(a-b)(b-c)(c-a)$
(3) $(a+b)(b+c)(c+a)$
(4) $4abc$

MDT003

7. For any ΔABC, the value of determinant $\begin{vmatrix} \sin^2 A & \cot A & 1 \\ \sin^2 B & \cot B & 1 \\ \sin^2 C & \cot C & 1 \end{vmatrix}$ is equal to -

(1) 0
(2) 1
(3) $\sin A\ \sin B \sin C$
(4) $\sin A + \sin B + \sin C$

MDT004

8. If $D_p = \begin{vmatrix} p & 15 & 8 \\ p^2 & 35 & 9 \\ p^3 & 25 & 10 \end{vmatrix}$, then $D_1 + D_2 + D_3 + D_4 + D_5$ is equal to -

(1) 0 (2) 25 (3) 625 (4) –28000

MDT005

9. If $a, b, c > 0$ and $x, y, z \in R$, then the determinant $\begin{vmatrix} (a^x+a^{-x})^2 & (a^x-a^{-x})^2 & 1 \\ (b^y+b^{-y})^2 & (b^y-b^{-y})^2 & 1 \\ (c^z+c^{-z})^2 & (c^z-c^{-z})^2 & 1 \end{vmatrix}$ is equal to -

(1) $a^x b^y c^x$ (2) $a^{-x} b^{-y} c^{-z}$ (3) $a^{2x} b^{2y} c^{2z}$ (4) zero

MDT007

10. For a non-zero real a, b and c $\begin{vmatrix} \frac{a^2+b^2}{c} & c & c \\ a & \frac{b^2+c^2}{a} & a \\ b & b & \frac{c^2+a^2}{b} \end{vmatrix} = \alpha\ abc$, then the values of α is -

(1) –4 (2) 0 (3) 2 (4) 4

MDT008

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

(1) $a^2b^2c^2(a+b+c)$
(2) $abc(a+b+c)^2$
(3) zero
(4) 1

MDT010

12. 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 $f(100)$ is equal to -

(1) 0 (2) 1 (3) 100 (4) –100

MDT011

13. If the determinant $\begin{vmatrix} a+p & \ell+x & u+f \\ b+q & m+y & v+g \\ c+r & n+z & w+h \end{vmatrix}$ splits into exactly K determinants of order 3, each element of which contains only one term, then the values of K is

(1) 3 (2) 8 (3) 5 (4) None

MDT015

14. If the system of equations $x+2y+3z=4, x+py+2z=3, \mu x + 4y + z = 3$ has an infinite number of solutions, then -

(1) $p=2, \mu=3$ (2) $p=2, \mu=4$ (3) $p=3, \mu=4.5$ (4) $p=2, \mu=2$

MDT014

15. The equation $\begin{vmatrix} (1+x)^2 & (1-x)^2 & -(2+x^2) \\ 2x+1 & 3x & 1-5x \\ x+1 & 2x & 2-3x \end{vmatrix} + \begin{vmatrix} (1+x)^2 & 2x+1 & x+1 \\ (1-x)^2 & 3x & 2x \\ 1-2x & 3x-2 & 2x-3 \end{vmatrix} = 0$

(1) has no real solution

(2) has 4 real solutions

(3) has two real and two non-real solutions

(4) has infinite number of solutions, real or non-real

MDT009

16. If a, b, c are non-zero real numbers and if the system of equations

$(a-1)x = y + z,$

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

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

has a non-trivial solution, then $ab + bc + ca$ equals :

(1) 1 (2) $a+b+c$ (3) abc (4) – 1

MDT119

17. If $\Delta_r = \begin{vmatrix} r & 2r-1 & 3r-2 \\ \frac{n}{2} & n-1 & a \\ \frac{1}{2}n(n-1) & (n-1)^2 & \frac{1}{2}(n-1)(3n-4) \end{vmatrix}$

then the value of $\sum_{r=1}^{n-1} \Delta_r$:-

(1) depends only on n (2) is independent of both a and n

(3) depends only on a (4) depends both on a and n

MDT120

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

$2x_1 - 2x_2 + x_3 = \lambda x_1$

$2x_1 - 3x_2 + 2x_3 = \lambda x_2$

$-x_1 + 2x_2 = \lambda x_3$

has a non-trivial solution

(1) contains two elements (2) contains more than two elements

(3) is an empty set (4) is a singleton

MDT121

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

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

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

has no solution, is :

(1) infinite (2) 1

(3) 2 (4) 3

MDT122

20. 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:

(1) 10 (2) – 30

(3) 30 (4) –10

MDT123

SECTION-B

- This section will have **TEN** questions. Candidate can choose to attempt any 5 question out of these 10 questions. In case if candidate attempts more than 5 questions, first 5 attempted questions will be considered for marking.
- The answer to each question is a **NUMERICAL VALUE.**
- For each question, enter the correct numerical value (Answer should be rounded off to the nearest integer).
- Answer to each question will be evaluated according to the following marking scheme:

  Full Marks : +4, if only correct answer is given.

  Zero Marks : 0, if no answer is given.

  Negative Marks : -1 for incorrect answer

1. The absolute value of determinant $\begin{vmatrix} 18 & 40 & 89 \\ 40 & 89 & 198 \\ 89 & 198 & 440 \end{vmatrix}$ is **MDT016**

2. Product of the roots of $\begin{vmatrix} x+2 & 2x+3 & 3x+4 \\ 2x+3 & 3x+4 & 4x+5 \\ 3x+5 & 5x+8 & 10x+17 \end{vmatrix} = 0$ is

MDT018

3. If A, B, C are angles of an acute angle triangle. The minimum value of

$$\frac{1}{3^5}\begin{vmatrix} (\tan B + \tan C)^2 & \tan^2 A & \tan^2 A \\ \tan^2 B & (\tan C + \tan A)^2 & \tan^2 B \\ \tan^2 C & \tan^2 C & (\tan A + \tan B)^2 \end{vmatrix} \text{ is}$$

MDT019

4. If x, y & z are different even integers and minimum value of

$$\begin{vmatrix} 1+x^2+x^4 & 1+xy+x^2y^2 & 1+xz+x^2z^2 \\ 1+xy+x^2y^2 & 1+y^2+y^4 & 1+yz+y^2z^2 \\ 1+xz+x^2z^2 & 1+yz+y^2z^2 & 1+z^2+z^4 \end{vmatrix}$$ is N, then $\frac{N}{32}$ is

MDT020

5. The number of triplets (x, y, z) satisfying the following constraints

$2x - y + 3z = 4$

$x + y - 3z = -1$

$5x - y + 3z = 7$

$xyz \le 0$ & $x, y, z \in I$

MDT017

6. Find the value of $\begin{vmatrix} \log_x xyz & \log_x y & \log_x z \\ \log_y xyz & 1 & \log_y z \\ \log_z xyz & \log_z y & 1 \end{vmatrix}$

MDT114

7. If α, β, γ satisfy the equation $\begin{vmatrix} x & 1 & 1 \\ 1 & x & 1 \\ 1 & 1 & x \end{vmatrix} = 0$, then $\left|\frac{\alpha^3+\beta^3+\gamma^3}{\alpha^2+\beta^2+\gamma^2}\right|$

MDT115

8. 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 A_2, B_2, C_2 are respectively cofactors of a_2, b_2, c_2 then $a_1A_2 + b_1B_2 + c_1C_2$ is equal to-

MDT116

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

MDT117

10. Let $f(x) = \begin{vmatrix} 1 & x-1 & x \\ 2(x-1) & (x-1)(x-2) & x(x-1) \\ 3(x-1)(x-2) & (x-1)(x-2)(x-3) & x(x-1)(x-2) \end{vmatrix}$ & $D_r = \begin{vmatrix} 1 & 10 & 2r \\ 70 & 17 & 3r+1 \\ 1 & 1 & 1 \end{vmatrix}$. The value of $f(50) - D_5$ is -

MDT118

JEE (Advanced) Practice Paper

This paper is for yourself practice and assessment the discussion of this paper is optional though you can see PDF solutions or video solutions or solutions in hardcopy whichever is provided.

SECTION–I

- This section contains **SIX** questions.
- Each question has FOUR options (A), (B), (C) and (D). ONLY ONE of these four options is correct.
- For each question, darken the bubble corresponding to the correct option in the ORS.
- For each question, marks will be awarded in one of the following categories:

Full Marks : +3, if only the bubble corresponding to the correct option is darkened.
Zero Marks : 0, if none of the bubbles is darkened.
Negative Marks : –1, in all other cases

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

(A) 2 (B) 4 (C) 6 (D) 8

MDT041

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

$\begin{vmatrix} ax-by-c & bx+ay & cx+a \\ bx+ay & -ax+by-c & cy+b \\ cx+a & cy+b & -ax-by+c \end{vmatrix}=0$ represents.

(A) Straight Line (B) Circle
(C) Rectangular Hyperbola (D) None

MDT036

3. Given that $q^2-pr<0, p>0$, then the value of $\begin{vmatrix} p & q & px+qy \\ q & r & qx+ry \\ px+qy & qx+ry & 0 \end{vmatrix}$ is-

(A) zero (B) positive (C) negative (D) q^2+pr

MDT039

4. The set of equations $x-y+3z=2, 2x-y+z=4, x-2y+\alpha z=3$ has -

(A) unique solution only for $\alpha=0$ (B) unique solution for $\alpha=8$
(C) infinite number of solutions of $\alpha=8$ (D) no solution for $\alpha=8$

MDT038

5. If the system of equations $x+y-3=0$, $(1+K)x+(2+K)y-8=0$ and $x-(1+K)y+(2+K)=0$ is consistent then one of the value of K may be -

(A) 0 (B) $\frac{3}{5}$ (C) $-\frac{5}{3}$ (D) 2

MDT040

6. If $c<1$ and system of equations $x+y=1, 2x-y-c=0$ and $-bx+3by-c=0$ is consistent, then set of possible real values of b is

(A) $\left(-3, \frac{3}{4}\right)$ (B) $\left(-\frac{3}{2}, 4\right)$ (C) $\left(-\frac{3}{4}, 3\right)$ (D) $(3, 4)$

MDT037

SECTION-II

- This section contains **SIX** questions.
- Each question has **FOUR** options for correct answer(s). **ONE OR MORE THAN ONE** of these four option(s) is (are) correct option(s).
- For each question, choose the correct option(s) to answer the question.
- Answer to each question will be evaluated according to the following marking scheme:

Full Marks	: +4	If only (all) the correct option(s) is (are) chosen.
Partial Marks	: +3	If all the four options are correct but ONLY three options are chosen.
Partial Marks	: +2	If three or more options are correct but ONLY two options are chosen, both of which are correct options.
Partial Marks	: +1	If two or more options are correct but ONLY one option is chosen and it is a correct option.
Zero Marks	: 0	If none of the options is chosen (i.e. the question is unanswered).
Negative Marks	: –2	In all other cases.

For Example : If first, third and fourth are the **ONLY** three correct options for a question with second option being an incorrect option; selecting only all the three correct options will result in +4 marks. Selecting only two of the three correct options (e.g. the first and fourth options), without selecting any incorrect option (second option in this case), will result in +2 marks. Selecting only one of the three correct options (either first or third or fourth option), without selecting any incorrect option (second option in this case), will result in +1 marks. Selecting any incorrect option(s) (second option in this case), with or without selection of any correct option(s) will result in –2 marks.

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7. If α, β, γ are roots of the equation $x^2(px + q) = r(x + 1)$, then $\begin{vmatrix} 1+\alpha & 1 & 1 \\ 1 & 1+\beta & 1 \\ 1 & 1 & 1+\gamma \end{vmatrix}$.

(A) Greater than 2 (B) Less than 2 (C) Equal to 0 (D) Equal to 1

MDT047

8. The value of θ lying between $-\frac{\pi}{4}$ & $\frac{\pi}{2}$ and $0 \le A \le \frac{\pi}{2}$ and satisfying the equation

$$\begin{vmatrix} 1+\sin^2 A & \cos^2 A & 2\sin 4\theta \\ \sin^2 A & 1+\cos^2 A & 2\sin 4\theta \\ \sin^2 A & \cos^2 A & 1+2\sin 4\theta \end{vmatrix} = 0 \text{ are -}$$

(A) $A = \frac{\pi}{4}, \quad \theta = -\frac{\pi}{8}$

(B) $A = \frac{3\pi}{8}, \quad \theta = \frac{3\pi}{8}$

(C) $A = \frac{\pi}{5}, \quad \theta = -\frac{\pi}{8}$

(D) $A = \frac{\pi}{6}, \quad \theta = \frac{3\pi}{8}$

MDT042

9. The determinant $\begin{vmatrix} a & b & a\alpha+b \\ b & c & b\alpha+c \\ a\alpha+b & b\alpha+c & 0 \end{vmatrix}$ is equal to zero, if -

(A) a, b, c are in AP

(B) a, b, c are in GP

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

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

MDT044

10. If $P = \begin{vmatrix} 2 & \alpha+\beta+\gamma+\delta & \alpha\beta+\gamma\delta \\ \alpha+\beta+\gamma+\delta & 2(\alpha+\beta)(\gamma+\delta) & \alpha\beta(\gamma+\delta)+\gamma\delta(\alpha+\beta) \\ \alpha\beta+\gamma\delta & \alpha\beta(\gamma+\delta)+\gamma\delta(\alpha+\beta) & 2\alpha\beta\gamma\delta \end{vmatrix}$

Then

(A) $P < 0$ (B) $P < 5$ (C) $P < 7$ (D) $P = 0$

MDT046

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

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

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

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

has :

(A) no solution (B) unique solution

(C) infinitely many solutions (D) finitely many solutions

MDT045

12. If the system of linear equations $x + ay + az = 0, x + by + bz = 0, x + cy + cz = 0$ has a non-zero solution then

(A) System has always non-trivial solutions.

(B) System is consistent only when $a = b = c$

(C) If $a \neq b \neq c$, then $x = 0, y = t, z = -t \ \forall\, t \in R$

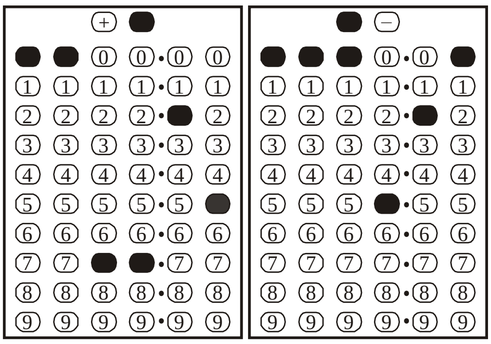
(D) If $a = b = c$, then $y = t_1, z = t_2, x = -a(t_1 + t_2) \ \forall\, t_1, t_2 \in R$

MDT043

SECTION-III

- This section contains **SIX** questions.
- The answer to each question is a **NUMERICAL VALUE**.
- For each question, enter the correct numerical value (in decimal notation, truncated/rounded-off to the **second decimal place**; e.g. 6.25, 7.00, –0.33, –.30, 30.27, –127.30, if answer is 11.36777..... then both 11.36 and 11.37 will be correct) by darken the corresponding bubbles in the ORS.

  For Example : If answer is –77.25, 5.2 then fill the bubbles as follows.



- Answer to each question will be evaluated according to the following marking scheme:

  Full Marks : + 4 If ONLY the correct numerical value is entered as answer.

  Zero Marks : 0 In all other cases.

13. Let the three-digit numbers $A28$, $3B9$ and $62C$, when A, B, C are integer between 0 and 9, be divisible by a fixed integer K, then the determinant $\begin{vmatrix} A & 3 & 6 \\ 8 & 9 & C \\ 2 & B & 2 \end{vmatrix}$ is divisible by $K^{\alpha_1}.A^{\alpha_2}.B^{\alpha_3}.C^{\alpha_4}$, then find the value of $\alpha_1 + \alpha_2 + \alpha_3 + \alpha_4$

MDT048

14. If $\begin{vmatrix} (\beta+\gamma-\alpha-\delta)^4 & (\beta+\gamma-\alpha-\delta)^2 & 1 \\ (\gamma+\alpha-\beta-\delta)^4 & (\gamma+\alpha-\beta-\delta)^2 & 1 \\ (\alpha+\beta-\gamma-\delta)^4 & (\alpha+\beta-\gamma-\delta)^2 & 1 \end{vmatrix} = -2^{\mu}(\alpha-\beta)(\alpha-\gamma)(\alpha-\delta)(\beta-\gamma)(\beta-\delta)(\gamma-\delta)$, then the value of μ is

MDT049

15. The value of $\begin{vmatrix} a_1 l_1 + b_1 m_1 & a_1 l_2 + b_1 m_2 & a_1 l_3 + b_1 m_3 \\ a_2 l_1 + b_2 m_1 & a_2 l_2 + b_2 m_2 & a_2 l_3 + b_2 m_3 \\ a_3 l_1 + b_3 m_1 & a_3 l_2 + b_3 m_2 & a_3 l_3 + b_3 m_3 \end{vmatrix}$ is equal to

MDT050

16. If (a, b, c) is a solution of following sets of equations

$$x + y + z - 6 = 0$$
$$2x + y - z - 1 = 0$$
$$x + y - 2z + 3 = 0$$

then the value of $\left[\frac{c}{ab}\right]$ is (Where [ ] represents GIF)

MDT051

17. 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 number of elements in S is :

MDT053

18. If the sum of values c for which the equations

$2x + 3y = 0$

$(c + 2)x + (c + 4)y = c + 6$

$(c + 2)^2 x + (c + 4)^2 y = (c + 6)^2$

are consistent, is λ. Then value of $|\lambda|$ is

MDT052

ANSWER KEY

EXERCISE - O

Que.	1	2	3	4	5	6	7	8	9	10
Ans.	C	A	C	D	D	B	C	C	A	C
Que.	11	12	13	14	15	16	17	18	19	20
Ans.	B	A	D	B	D	A,B,C,D	B,D	A,B,D	B,C	A,B,C,D
Que.	21	22	23	24	25	26	27	28	29	
Ans.	A,B,C	A,B,D	A	B	C	A,C	A,B	A,B,C	D	
Que.	30									
Ans.	$A \to Q$; $B \to P, R$; $C \to P$; $D \to R$									

EXERCISE - S

1. 80 **2.** 0 **3.** 2 **4.** 4 **5.** 0
6. 1 **7.** 5 **8.** 0 **9.** 9 **10.** 4

EXERCISE - JEE (Main) PYQ

Que.	1	2	3	4	5	6	7	8	9	10
Ans.	2	2	4	4	1	2	6	2	2	2
Que.	11	12	13	14	15	16	17	18	19	20
Ans.	3	2	3	4	3	1	6	1	4	4

EXERCISE - JEE (Advanced) PYQ

Que.	1	2	3	4	5	6	7
Ans.	B,C	2	B,C,D	4	A,C	B	A

JEE (Main) Practice Paper

Section-A	Q.	1	2	3	4	5	6	7	8	9	10
	A.	2	1	1	4	3	4	1	4	4	4
	Q.	11	12	13	14	15	16	17	18	19	20
	A.	3	1	2	4	4	3	2	1	2	1
Section-B	Q.	1	2	3	4	5	6	7	8	9	10
	A.	1	2	6	8	1	0	1	0	33	9

JEE (Advanced) Practice Paper

Section-I	**Q.**	**1**	**2**	**3**	**4**	**5**	**6**
	A.	C	A	C	D	C	C
Section-II	**Q.**	**7**	**8**	**9**	**10**	**11**	**12**
	A.	B,C	A,B,C,D	B,D	B,C,D	B	A,C,D
Section-III	**Q.**	**13**	**14**	**15**	**16**	**17**	**18**
	A.	1.00	6.00	0.00	1.00	1.00	7.00

Important Notes