PART # 01

ALGEBRA

EXERCISE # 01

SECTION-1 : (ONE OPTION CORRECT TYPE)

1. Number of solutions of $|z - 1| + |z + 1| = 4$ and $|2z - 1 + i| = \sqrt{14}$ is :

(A) 2 (B) 3 (C) 4 (D) none of these

2. Let X be the set of three digit numbers, which when divided by its sum of its digits give maximum value and Y be the set of all possible real values of a for which the $x^3 - 3ax^2 + 3(298a + 299)x - 2 = 0$ have a positive point of maxima, then the number of elements in $X \cap Y$, is :

(A) 0 (B) 6 (C) 7 (D) 9

3. Let $f(x) = x^2 - bx + c$, b is a odd positive integer, $f(x) = 0$ have two prime numbers as roots and $b + c = 35$. Then the global minimum value of f(x) is

(A) $-\frac{183}{4}$ (B) $\frac{173}{16}$

(C) $-\frac{81}{4}$ (D) data not sufficient

4. If z_1, z_2, z_3, z_4 are the reflections of the complex number z, with respect to the origin, real axis and imaginary axis respectively in an argand plane, then the value of $\arg(z_1^4 \cdot z_2^5 \cdot z_3^4 \cdot z_4^5 + 5)$ is

(A) $\frac{\pi}{3}$ (B) $\frac{\pi}{2}$ (C) $\frac{2\pi}{3}$ (D) none of these

5. If $a = e^{1/e}$ then the number of point of intersection of the curve $y = \log_a x$ and the line $y = x$, is

(A) three (B) zero (C) one (D) two

6. The coefficient of $a^8b^4c^9d^9$ in $(abc + abd + acd + bcd)^{10}$ is

(A) 10! (B) $\frac{10!}{8!4!9!9!}$

(C) 2520 (D) None of these.

7. Sum of all divisors of 5400 whose units digit is 0 is

(A) 5400 (B) 10800

(C) 16800 (D) None of these.

8. Sequence $\{t_n\}$ is a G.P. If t_6, 2, 5, t_{14} form another G.P in that order, then $t_1 . t_2 . t_3 ..... t_{19}$ is equal to

(A) 190 (B) 10^{10} (C) $10^{\frac{19}{2}}$ (D) 10^9

9. If $|\beta_k| < 3$, $1 \le k \le n$, then all the complex numbers z satisfying the equation
$1 + \beta_1 z + \beta_2 z^2 + \ldots + \beta_n z^n = 0$, $|z| < 1$

(A) lie inside the circle $|z| = \frac{1}{4}$
(B) lie in $\frac{1}{3} < |z| < \frac{1}{2}$
(C) lie on the circle $|z| = \frac{1}{4}$
(D) lie outside the circle $|z| = \frac{1}{4}$

10. The sum of the series ${}^{4n}C_0 + {}^{4n}C_4 + {}^{4n}C_8 + \ldots + {}^{4n}C_{4n}$ is
(A) $2^{4n-2} + (-1)^n 2^{2n-1}$
(B) $2^{4n-2} + (-1)^{n+1} 2^{2n-1}$
(C) $2^{4n-2} - 2^{2n-1}$
(D) $2^{4n-2} + 2^{2n-1}$

11. In a shooting competition, a man can score 5, 4, 3, 2 or 0 points for each shot. In how many ways he can achieve a score of 30 in just 7 shots
(A) 455 (B) 460 (C) 420 (D) 495

12. The product $\left(\frac{2^3-1}{2^3+1}\right)\left(\frac{3^3-1}{3^3+1}\right)\left(\frac{4^3-1}{4^3+1}\right)$ … (to infinity) is equal to
(A) $\frac{2}{3}$ (B) $\frac{1}{3}$ (C) $\frac{3}{4}$ (D) $\frac{1}{2}$

13. If $\alpha, \alpha^2, \ldots, \alpha^{n-1}$ be the n^{th} roots of unity, then $\left(\frac{3^n-1}{3^{n-1}}\right)\left(\sum_{r=1}^{n-1}\frac{1}{3-\alpha^r}+\frac{1}{2}\right) =$
(A) $-n$ (B) 0 (C) n (D) 1

14. If $\text{Re}\left(\frac{z-8i}{z+6}\right) = 0$, then $z = x + iy$ lies on the curve
(A) $x^2 + y^2 + 6x - 8y = 0$
(B) $4x - 3y + 24 = 0$
(C) $x^2 + y^2 - 8 = 0$
(D) none of these

15. The set of values of 'a' for which $x^3 + ax^2 + \sin^{-1}(x^2 - 4x + 5) + \cos^{-1}(x^2 - 4x + 5) = 0$ has atleast one solution is
(A) $\frac{\pi}{8}+2$ (B) $\frac{\pi}{8}+1$ (C) $-\left(\frac{\pi}{8}+1\right)$ (D) $-\left(\frac{\pi}{8}+2\right)$

16. Let $a_1 = 1$, $a_n = n(a_{n-1} + 1)$ for $n = 2, 3, \ldots$
define $P_n = \left(1+\frac{1}{a_1}\right)\left(1+\frac{1}{a_2}\right)\ldots\left(1+\frac{1}{a_n}\right)$. Then $\lim_{n\to\infty} P_n$ must be
(A) $1 + e$ (B) e (C) 1 (D) ∞

17. If n is a positive integer then $\sum_{k=1}^{n} k^3\left(\frac{{}^nC_k}{{}^nC_k - 1}\right)^2$ equals
(A) $\frac{n}{12}(n+1)^2(n+2)$
(B) $\frac{n}{12}(n+1)(n+2)^2$
(C) $\frac{n}{12}(n+1)(n+2)$
(D) none of these

18. If $|z - 25i| \le 15$, then maximum of arg(z) – minimum of arg(z) equals
(A) $2\cos^{-1}\left(\frac{3}{5}\right)$ (B) $2\cos^{-1}\left(\frac{4}{5}\right)$ (C) $\frac{\pi}{2}+\cos^{-1}\left(\frac{3}{5}\right)$ (D) $\sin^{-1}\left(\frac{3}{5}\right)-\cos^{-1}\left(\frac{3}{5}\right)$

19. The least value of the expression $x^2 + 4y^2 + 3z^2 - 2x - 12y - 6z + 14$ is

(A) 0 (B) 1

(C) no least value (D) none of these

20. The largest term of the sequence $a_n = \frac{n}{n^2+10}$ is

(A) $\frac{3}{19}$ (B) $\frac{2}{13}$ (C) 1 (D) $\frac{1}{7}$

21. The number of positive integral solution of $x^2 + 9 < (x + 3)^2 < 8x + 25$ is

(A) 2 (B) 3 (C) 4 (D) 5

22. $n.{}^{n-2}C_{r-1} = r(k^2 - 3)\,{}^{n}C_{r-1} + {}^{n-2}C_{r-1}$, then the value of k is

(A) $(-\infty, -2]$ (B) $\left(-\infty, -\sqrt{3}\right) \cup \left(\sqrt{3}, 2\right]$

(C) $\left[-2, -\sqrt{3}\right) \cup \left(\sqrt{3}, 2\right]$ (D) $\left[-2, -\sqrt{3}\right) \cup \left(\sqrt{3}, \infty\right]$

23. If the ratio of the squares of the roots of the equation $x^2 + px + q = 0$ be equal to the ratio of the roots of the equation $x^2 + lx + m = 0$, then

(A) $q^2m^2 = (p^2 - 2q)^2 l$ (B) $(p^2 - 2q)^2 m = q^2l^2$

(C) $q^2p^2 = (l^2 - 2q)^2 q$ (D) none of these

24. The equation $|z - 2i| + |z + 2i| = k$, $k > 0$, can represent on ellipse if k is

(A) 2 (B) 3

(C) 4 (D) 5

25. If n boys and n girls sit along a line alternately in x ways and along a circle in y ways such that x = 12 y then the number of ways in which n boys can sit at a round table so that all shall not have same neighbors is

(A) 6 (B) 120

(C) 60 (D) 12

26. If [.] denotes the greatest integer function, then the domain of the real valued function $\log_{[x+1/2]}|x^2 = x - 6|$ is

(A) $\left(\frac{1}{2}, 1\right] \cup (1, \infty)$ (B) $\left[\frac{3}{2}, 2\right) \cup (2, +\infty)$

(C) $\left(0, \frac{3}{2}\right] \cup (2, +\infty)$ (D) $(0, 1] \cup \left(\frac{3}{2}, +\infty\right)$

27. Equation $\frac{a^2}{x-\alpha} + \frac{b^2}{x-\beta} + \frac{c^2}{x-\gamma} = m - n^2x$ (a, b, c, m, n $\in$ R) has necessarily

(A) all the roots real (B) all the roots imaginary

(C) 2 real and 2 imaginary (D) 2 rational and 2 irrational

28. The number of non-integral solutions of $\left||4x - x^2| - 1\right| = 3$ is

(A) four (B) two (C) three (D) none of these

29. The coefficient of x^n in the polynomial $\left(x + {}^{2n+1}C_0\right)\left(x + {}^{2n+1}C_1\right)\left(x + {}^{2n+1}C_2\right)....\left(x + {}^{2n+1}C_n\right)$ is

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

(C) 2^{2n} (D) None of these

30. The inequality $(x - 3m)(x - m - 3) < 0$ is satisfied for x in [1, 3]. Determine the value of m for which this holds

(A) (1, 2) (B) (0, 1/3) (C) (1, 3) (D) none of these

31. If the equation $a(b - c)x^2 + b(c - a)x + c(a - b) = 0$ has equal roots where a, b, c are distinct positive numbers and $n \in N$, then

(A) $a^n + c^n \geq 2b^n$ (B) $a^n + c^n > 2b^n$ (C) $a^n + c^n \leq 2b^n$ (D) $a^n + c^n < 2b^n$

32. If z_1 and z_2 are two complex numbers such that $|z_1| = |z_2| + |z_1 - z_2|$, then

(A) $\text{Im}\left(\frac{z_1}{z_2}\right) = 0$ (B) $\text{Re}\left(\frac{z_1}{z_2}\right) = 0$

(C) $\text{Re}\left(\frac{z_1}{z_2}\right) = \text{Im}\left(\frac{z_1}{z_2}\right)$ (D) none of these

33. If α, β are roots of $2x + \frac{1}{x} = 2$ and $f(x) = \frac{8x^6 + 1}{x^3}$, then

(A) $f(\alpha) - f(\beta) = 0$ (B) $f(\alpha) + f(\beta) = 8$ (C) $f(\alpha) - f(\beta) = 2$ (D) $f(\alpha) + f(\beta) = 12$

34. If $f(x) = 0$ is a cubic equation with positive and distinct roots α, β, γ such that β is the H.M of the roots of $f'(x) = 0$. Then α, β, γ are in

(A) A.P. (B) G.P.

(C) H.P. (D) none of these

35. The number of ways in which the squares of a 8 × 8 chess board can be painted red or blue so that each 2 × 2 square has two red and two blue squares is

(A) 2^9 (B) $2^9 - 1$

(C) $2^9 - 2$ (D) none of these

36. All the roots of the equation $11z^{10} + 10iz^9 + 10iz - 11 = 0$ lie

(A) inside $|z| = 1$ (B) on $|z| = 1$

(C) outside $|z| = 1$ (D) can't say

37. Let f(x), g(x) and h(x) be quadratic polynomials having positive leading co-efficients and real and distinct roots. If each pair of them has a common root, then the roots of $f(x) + g(x) + h(x) = 0$ are

(A) always real and distinct (B) always real and may be equal

(C) may be imaginary (D) always imaginary

38. If x is positive and $x - [x]$, $[x]$ and x are in G.P., then $\{x\}$ is equal to, (where [.] denotes the greatest integer function and {.} denotes the fractional part of x)

(A) $\frac{\sqrt{5} - 1}{2}$ (B) $\frac{\sqrt{5} + 1}{4}$ (C) $\frac{\sqrt{5} - 1}{4}$ (D) none of these

39. The value of $\sum_{r=0}^{n-1}\left(\frac{n+1}{n}\right)\left(\frac{r \cdot {}^nC_r \, {}^nC_{r+1}}{r+2}\right)$ is

(A) ${}^{2n-1}C_{n+1}$ (B) ${}^{2n}C_{n-1}$ (C) ${}^{2n-1}C_{n-1}$ (D) ${}^{2n-1}C_{n-2}$

40. The number of points in the cartesian plane with integral co-ordinates satisfying the inequation $|x| \leq 10$, $|y| \leq 10$, $|x - y| \leq 10$ is

(A) 321 (B) 331 (C) 341 (D) none of these

41. The value of $\sum_{r=1}^{n} r^4 - \sum_{r=-1}^{n+2} (n + 1 - r)^4$ is equal to

(A) $-[1 + n^4 + (n + 1)^4]$ (B) $-[1 + (n + 1)^4 + (n + 2)^4]$

(C) $-[1 + (n - 1)^4 + n^4]$ (D) none of these

42. The value of a (a < 0) for which least value of quadratic expression $4x^2 - 4ax + a^2 - 2a + 2$ on the interval $0 \le x \le 2$ is equal to 3 is

(A) $-\sqrt{2}$ (B) $\sqrt{2} - 2$

(C) $1 - \sqrt{2}$ (D) none of these

43. The perpendicular distance of line $(1 - i) z + (1 + i)\bar{z} + 3 = 0$, from $(3 + 2i)$ will be

(A) 13 (B) $\frac{13}{2}$ (C) 26 (D) none of these

44. If the complex numbers z_1, z_2 satisfying $|z_1| = 16$ and $|z_2 - 2 - 3i| = 7$ the minimum value of $|z_1 - z_2|$

(A) 0 (B) 1

(C) 7 (D) 2

45. Find the value of $\frac{1}{3.5} + \frac{1}{7.9} + \frac{1}{11.13} + ... \infty$ terms :

(A) $\frac{1}{4} - \frac{\pi}{2}$ (B) $\frac{\pi}{8} - \frac{1}{9}$

(C) $\frac{1}{2} - \frac{\pi}{8}$ (D) none of these

46. If a, b > 0, a + b = 1, then the minimum value of $\left(a + \frac{1}{a}\right)^2 + \left(b + \frac{1}{b}\right)^2$ is

(A) 8 (B) 16

(C) 18 (D) $\frac{25}{2}$

47. The results of 10 cricket matches (win, lose or draw) have to be predicted. How many different forecasting can contain exactly 7 correct results?

(A) 100 (B) 120

(C) 960 (D) None of these

48. Let z_1, z_2 be two distinct complex numbers with non-zero real and imaginary parts such that $\arg(z_1 + z_2) = \pi/2$, then $\arg(z_1 - \bar{z}_1) - \arg(z_2 + \bar{z}_2)$ is equal to

(A) $\frac{\pi}{2}$ (B) π

(C) $-\frac{\pi}{2}$ (D) None of these.

49. The number of ways in which 4 persons P_1, P_2, P_3, P_4 can be arranged in a row such that P_2 does not follow P_1, P_3 does not follow P_2 and P_4 does not follow P_3 is

(A) 24 (B) 12

(C) 11 (D) 10

50. Let $z \in C$ and if $A = \left\{z : \arg(z) = \frac{\pi}{4}\right\}$ and $B = \left\{z : \arg(z - 3 - 3i) = \frac{2\pi}{3}\right\}$ then $n(A \cap B)$ is equal to

(A) 1 (B) 2

(C) 3 (D) 0

SECTION–2 : (MORE THAN ONE OPTION CORRECT TYPE)

51. If α, β are roots of $2x + \frac{1}{x} = 2$ and $f(x) = \frac{8x^6 + 1}{x^3}$, then

(A) $f(\alpha) - f(\beta) = 0$ (B) $f(\alpha) + f(\beta) = -8$

(C) $f(\alpha) - f(\beta) = 2$ (D) $f(\alpha) + f(\beta) = 8$

52. If z_1, z_2, z_3, z_4 be the vertices of a parallelogram taken in anticlockwise direction and $|z_1 - z_2| = |z_1 - z_4|$, then

(A) $\sum_{r=1}^{4} (-1)^r z_r = 0$ (B) $z_1 + z_2 - z_3 - z_4 = 0$

(C) $\arg\left(\frac{z_4 - z_2}{z_3 - z_1}\right) = \frac{\pi}{2}$ (D) $\arg\left(\frac{z_4 - z_1}{z_2 - z_1}\right) = \frac{\pi}{2}$

53. The coefficient of 3 consecutive terms in the expansion of $(1 + x)^n$ are in the ratio 1 : 7 : 35 the

(A) n is divisible by 5

(B) n is not divisible by any number other than 1 and itself

(C) n is divisible by 35 (D) n is divisible by 23

54. Let $f(n) = 2^n + 7^n$ where n is a positive integer, then

(A) if f(n) is divisible by 5, then f(n + 1) is also divisible by 5

(B) if f(n) is not divisible by 5, then f(n + 1) is not divisible by 5

(C) f(3) is not divisible by 5 (D) f(n) is not divisible by 5 for all n

55. The number of non negative integral solutions of $x_1 + x_2 + x_3 \le n$ is

(A) ${}^{n+2}C_2$ (B) ${}^{n+3}C_3$ (C) ${}^{n+2}C_n$ (D) ${}^{n+3}C_n$

56. If $a, b, c \in R$ such that $a^2 + b^2 + c^2 < 2(ab + bc + ca)$, then

(A) either a, b, c are all positive or all negative (B) atleast two of a, b, c are equal

(C) none of a, b, c can be zero (D) a, b, c are all distinct

57. If $\dfrac{\tan\alpha - i\left(\sin\frac{\alpha}{2} + \cos\frac{\alpha}{2}\right)}{1 + 2i\sin\frac{\alpha}{2}}$ is purely imaginary, then α is given by

(A) $2n\pi + \frac{\pi}{4}$ (B) $2n\pi$ (C) $n\pi + \frac{\pi}{4}$ (D) $n\pi - \frac{\pi}{4}$

58. Values of x for which the sixth term of the expansion of $E = \left(3^{\log_3 \sqrt{9^{|x-2|}}} + 7^{1/5 \log_7 [4 \cdot 3^{|x-2|} - 9]}\right)^7$ is 567 are

(A) 3 (B) 1 (C) 2 (D) 4

59. For a positive integer n, let $a(n) = 1 + \frac{1}{2} + \frac{1}{3} + ... + \frac{1}{2^n - 1}$, then

(A) $a(n) < n$ (B) $a(n) > \frac{n}{2}$

(C) $a(2n) > n$ (D) $a(2n) < 2n$

60. The value of x, for which the 6^{th} term in the expansion of $\left[10^{\log_{10}\sqrt{9^{x-1}+7}} + \frac{1}{10^{1/5\log_{10} 3^{x-1}+1}}\right]^7$ is 84 is equal to

(A) 1 (B) 2

(C) 3 (D) 4

61. If a + ib $\geq$ 8 – 6i, then

(A) a = 8, b = 6
(B) a = 8, b = – 6
(C) a = – 6, b = 8
(D) inequality is not defined in case of complex number

62. $\frac{1}{\sqrt{2}+\sqrt{5}}+\frac{1}{\sqrt{5}+\sqrt{8}}+\frac{1}{\sqrt{8}+\sqrt{11}}+\cdots$ n terms value of the above expression is

(A) $\frac{\sqrt{3n+2}-\sqrt{2}}{3}$ (B) $\frac{n}{\sqrt{2+3n}+\sqrt{2}}$ (C) less than n (D) less than $\sqrt{\frac{n}{3}}$

63. If $|z_1 + z_2| = |z_1 - z_2|$ and $|z_1| = |z_2|$, then

(A) $z_1 = z_2$ (B) $z_1 = -z_2$ (C) $z_1 = \pm iz_2$ (D) $z_2 = \pm iz_1$

64. For a positive integers n, if the expansion of $\left(\frac{5}{x^2}+x^4\right)^n$ has term independent of x, then 'n' can be

(A) 18 (B) 21 (C) 27 (D) 99

65. If $x^2 + mx + 1 = 0$ and $(b - c)x^2 + (c - a)x + (a - b) = 0$ have both roots common then

(A) m = – 2
(B) m = – 1
(C) a, b, c are in A.P.
(D) a, b, c are in H.P.

66. The modulus equation $||x - 3| + a| = 25$ ($a \in R$) can have real solutions for x if a lies on the interval

(A) $(-\infty, 25]$ (B) $[-25, 25]$ (C) $(-\infty, -25]$ (D) $(25, \infty)$

67. If x, y, a, b are real numbers such that $(x + iy)^{1/5} = a + ib$ and $P = \frac{x}{a} - \frac{y}{b}$, then

(A) (a – b) is a factor of P
(B) (a + b) is a factor of P
(C) (a + ib) is a factor of P
(D) (a – ib) is a factor of P

68. The complex numbers z_1, z_2, z_3 are the vertices of a triangle, find all the complex numbers z which make the triangle into parallelogram

(A) $z = z_1 + z_2 - z_3$ (B) $z = z_1 + z_3 - z_2$ (C) $z = z_2 + z_3 - z_1$ (D) $z = z_1 + z_2 + z_3$

69. $z_0 = \left(\frac{1-i}{2}\right)$ then the value of the product $(1 + z_0)(1 + z_0^2)\left(1+z_0^{2^2}\right)\cdots\left(1+z_0^{2^n}\right)$ must be

(A) $2^{2^{n-1}}$ (B) $(1-i)\left(1-\frac{1}{2^{2^n}}\right)$ (C) $\frac{5}{4}(1-i)$ if n = 1 (D) 0

70. If α, β are the roots of $8x^2 - 10x + 3 = 0$ then the equation whose roots are $(\alpha + i\beta)^{100} + (\alpha - i\beta)^{100}$ is

(A) $x^2 + x + 1 = 0$ (B) $x^2 - x + 1 = 0$ (C) $\frac{x^3-1}{x-1} = 0$ (D) none of these

71. All the three roots of $az^3 + bz^2 + cz + d = 0$ have negative real parts ($a, b, c \in R$), then

(A) ab > 0 (B) bc > 0 (C) ad > 0 (D) bc – ad > 0

72. If $a, b, c \in R$ such that $a^2 + b^2 + c^2 < 2(ab + bc + ca)$, then

(A) either a, b, c are all positive or all negative
(B) atleast two of a, b, c are equal
(C) none of a, b, c can be zero
(D) a, b, c are all distinct

73. If z_1, z_2 be two complex numbers ($z_1 \neq z_2$) satisfying $\left|z_1^2 - z_2^2\right| = \left|\bar{z}_1^2 + \bar{z}_2^2 - 2\bar{z}_1\bar{z}_2\right|$, then

(A) $|\arg z_1 - \arg z_2| = \pi$ (B) $|\arg z_1 - \arg z_2| = \frac{\pi}{2}$

(C) $\frac{z_1}{z_2}$ is purely imaginary (D) $\frac{z_1}{z_2}$ is purely real

74. a, b $\in$ I satisfies equation $a(b-1) = 3 + b - b^2$, then a + b is equal to

(A) 2 (B) 3

(C) 1 (D) – 1

75. Let $f(x) = ax^2 + bx + 2$, such that $a + b + 2 < 0$ and $a - 2b + 8 < 0$, then

(A) a < 0, f(x) has one real root in (0, 2) (B) f(x) has one real root in the interval (0, 1)

(C) f(x) has one real root in the interval (1, 2) (D) f(x) has one real root in the interval $\left(-\frac{1}{2}, 0\right)$

76. A woman has 11 close friend. Number of ways in which she can invite 5 of them to dinner, if two particular of them are not on speaking terms & will not attend together is -

(A) ${}^{11}C_5 - {}^{9}C_3$ (B) ${}^{9}C_5 + 2\,{}^{9}C_4$

(C) $3\,{}^{9}C_4$ (D) None of these

77. If f(x) = 0 is a polynomial whose coefficients all $\pm$ 1 and whose roots are all real, then the degree of f(x) can be equal to

(A) 1 (B) 2

(C) 3 (D) 4

78. The diagonals of a square are along the pair represented by $2x^2 - 3xy - 2y^2 = 0$. If (2, 1) is the vertex of the square, then the other vertices are

(A) (–1, 2) (B) (1, –2)

(C) (–2,–1) (D) (1,2)

79. If p, q, r are in H.P and p, q, – 2r are in G.P; (p, q, r > 0) then

(A) p^2, q^2, r^2 are in G.P.

(B) p^2, q^2, r^2 are in A.P.

(C) 2p, q, 2r are in A.P.

(D) p + q + r = 0

80. If the equations $\bar{a}z + a\bar{z} + b = 0$ and $\bar{a}z - a\bar{z} + b_1 = 0$ represent two lines C_1 and C_2 in the complex plane then

(A) L_1 and L_2 are perpendicular (B) b is purely real

(C) b_1 is purely imaginary (D) b_1 is purely real

81. If α is a real root of $x^3 + 2x^2 + 10x - 20 = 0$, then

(A) α is rational (B) α^2 is rational

(C) α is irrational (D) α^2 is irrational

82. If z_1 lies on $|z| = 1$ and z_2 lies on $|z| = 2$, then

(A) $3 \le |z_1 - 2z_2| \le 5$ (B) $1 \le |z_1 + z_2| \le 3$

(C) $|z_1 - 3z_2| \ge 5$ (D) $|z_1 - z_2| \ge 1$

83. If z_1, z_2, z_3, z_4 are root of the equation $a_0z^4 + z_1z^3 + z_2z^2 + z_3z + z_4 = 0$, where a_0, a_1, a_2, a_3 and a_4 are real, then

(A) $\bar{z}_1, \bar{z}_2, \bar{z}_3, \bar{z}_4$ are also roots of the equation

(B) z_1 is equal to at least one of $\bar{z}_1, \bar{z}_2, \bar{z}_3, \bar{z}_4$

(C) $-\bar{z}_1, -\bar{z}_2, -\bar{z}_3, -\bar{z}_4$ are also roots of the equation (D) none of these

84. If $a^3 + b^3 + 6\,abc = 8\,c^3$ & ω is a cube root of unity then :

(A) a, c, b are in A.P. (B) a, c, b are in H.P.

(C) $a + b\omega - 2\,c\omega^2 = 0$ (D) $a + b\omega^2 - 2\,c\omega = 0$

85. The points z_1, z_2, z_3 on the complex plane are the vertices of an equilateral triangle if and only if :

(A) $\Sigma\,(z_1 - z_2)\,(z_2 - z_3) = 0$ (B) $z_1^2 + z_2^2 + z_3^2 = 2\,(z_1 z_2 + z_2 z_3 + z_3 z_1)$

(C) $z_1^2 + z_2^2 + z_3^2 = z_1 z_2 + z_2 z_3 + z_3 z_1$ (D) $2\,(z_1^2 + z_2^2 + z_3^2) = z_1 z_2 + z_2 z_3 + z_3 z_1$

86. If $|z_1 + z_2| = |z_1 - z_2|$ then

(A) $|\text{amp } z_1 - \text{amp } z_2| = \frac{\pi}{2}$ (B) $|\text{ amp } z_1 - \text{amp}_2| = \pi$

(C) $\frac{z_1}{z_2}$ is purely real (D) $\frac{z_1}{z_2}$ is purely imaginary

87. If $\cos\alpha + \cos\beta + \cos\gamma = 0$ and also $\sin\alpha + \sin\beta + \sin\gamma = 0$, then which of the following is true.

(A) $\cos 2\alpha + \cos 2\beta + \cos 2\gamma = \sin 2\alpha + \sin 2\beta + \sin 2\gamma$

(B) $\sin 3\alpha + \sin 3\beta + \sin 3\gamma = 3\sin(\alpha + \beta + \gamma)$

(C) $\cos 3\alpha + \cos 3\beta + \cos 3\gamma = 3\cos(\alpha + \beta + \gamma)$

(D) $\sin 2\alpha + \sin 2\beta + \sin 2\gamma = 0$

88. If $\sum_{r=1}^{n} r(r+1)\,(2r + 3) = an^4 + bn^3 + cn^2 + dn + e$, then

(A) $a + c = b + d$ (B) $e = 0$

(C) a, b – 2/3, c – 1 are in A.P. (D) c/a is an integer

89. The sides of a right triangle form a G.P. The tangent of the smallest angle is

(A) $\sqrt{\frac{\sqrt{5}+1}{2}}$ (B) $\sqrt{\frac{\sqrt{5}-1}{2}}$ (C) $\sqrt{\frac{2}{\sqrt{5}+1}}$ (D) $\sqrt{\frac{2}{\sqrt{5}-1}}$

90. Sum to n terms of the series $S = 1^2 + 2(2)^2 + 3^2 + 2(4^2) + 5^2 + 2(6^2) + \ldots$ is

(A) $\frac{1}{2}n\,(n+1)^2$ when n is even (B) $\frac{1}{2}n^2\,(n+1)$ when n is odd

(C) $\frac{1}{4}\,n^2\,(n+2)$ when n is odd (D) $\frac{1}{4}\,n(n+2)^2$ when n is even.

91. If a, b, c are in H.P., then:

(A) $\frac{a}{b+c-a}, \frac{b}{c+a-b}, \frac{c}{a+b-c}$ are in H.P.

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

(C) $a - \frac{b}{2}, \frac{b}{2}, c - \frac{b}{2}$ are in G.P. (D) $\frac{a}{b+c}, \frac{b}{c+a}, \frac{c}{a+b}$ are in H.P.

92. If b_1, b_2, b_3 ($b_i > 0$) are three successive terms of a G.P. with common ratio r, the value of r for which the inequality $b_3 > 4b_2 - 3b_1$ holds is given by

(A) $r > 3$ (B) $r < 1$ (C) $r = 3.5$ (D) $r = 5.2$

93. If a, b are non-zero real numbers, and α, β the roots of $x^2 + ax + b = 0$, then

(A) α^2, β^2 are the roots of $x^2 - (2b - a^2)x + a^2 = 0$

(B) $1/\alpha, 1/\beta$ are the roots of $bx^2 + ax + 1 = 0$

(C) $\alpha/\beta, \beta/\alpha$ are the roots of $bx^2 + (2b - a^2)x + b = 0$

(D) $-\alpha, -\beta$ are the roots of $x^2 + ax - b = 0$

94. $x^2 + x + 1$ is a factor of $ax^3 + bx^2 + cx + d = 0$, then the real root of above equation is ($a, b, c, d \in R$)

(A) $-d/a$ (B) d/a (C) $(b - a)/a$ (D) $(a - b)/a$

95. If $(x^2 + x + 1) + (x^2 + 2x + 3) + (x^2 + 3x + 5) + ... + (x^2 + 20x + 39) = 4500$, then x is equal to:

(A) 10 (B) -10 (C) 20.5 (D) -20.5

96. $\cos\alpha$ is a root of the equation $25x^2 + 5x - 12 = 0$, $-1 < x < 0$, then the value of $\sin 2\alpha$ is:

(A) 24/25 (B) $-12/25$ (C) $-24/25$ (D) 20/25

97. If the quadratic equations, $x^2 + abx + c = 0$ and $x^2 + acx + b = 0$ have a common root then the equation containing their other roots is/are:

(A) $x^2 + a(b + c)x - a^2bc = 0$ (B) $x^2 - a(b + c)x + a^2bc = 0$

(C) $a(b + c)x^2 - (b + c)x + abc = 0$ (D) $a(b + c)x^2 + (b + c)x - abc = 0$

98. ${}^{n+1}C_6 + {}^{n}C_4 > {}^{n+2}C_5 - {}^{n}C_5$ for all 'n' greater than:

(A) 8 (B) 9 (C) 10 (D) 11

99. There are 10 points $P_1, P_2, ..., P_{10}$ in a plane, no three of which are collinear. Number of straight lines which can be determined by these points which do not pass through the points P_1 or P_2 is:

(A) ${}^{10}C_2 - 2.\,{}^{9}C_1$ (B) 27 (C) ${}^{8}C_2$ (D) ${}^{10}C_2 - 2.\,{}^{9}C_1 + 1$

100. You are given 8 balls of different colour (black, white,...). The number of ways in which these balls can be arranged in a row so that the two balls of particular colour (say red & white) may never come together is:

(A) $8! - 2.7!$ (B) $6.\,7!$ (C) $2.\,6!.\,{}^{7}C_2$ (D) none

101. A man is dealt a poker hand (consisting of 5 cards) from an ordinary pack of 52 playing cards. The number of ways in which he can be dealt a "straight" (a straight is five consecutive values not of the same suit, eg. {Ace· 2· 3· 4· 5}, {2, 3, 4, 5, 6}......................... & {10· J· Q· K· Ace}) is

(A) $10(4^5 - 4)$ (B) $4!\cdot 2^{10}$ (C) $10\cdot 2^{10}$ (D) 10200

102. Number of ways in which 3 numbers in A.P. can be selected from 1, 2, 3,...... n is:

(A) $\left(\frac{n-1}{2}\right)^2$ if n is even (B) $\frac{n(n-2)}{4}$ if n is odd

(C) $\frac{(n-1)^2}{4}$ if n is odd (D) $\frac{n(n-2)}{4}$ if n is even

103. Consider the expansion $(a_1 + a_2 + a_3 + ... + a_p)^n$ where $n \in N$ and $n \le p$. The correct statement(s) is/are:

(A) number of different terms in the expansion is ${}^{n+p-1}C_n$

(B) co-efficient of any term in which none of the variables $a_1, a_2, .., a_p$ occur more than once is 'n'

(C) co-efficient of any term in which none of the variables $a_1, a_2, .., a_p$ occur more than once is $n!$ if $n = p$

(D) Number of terms in which none of the variables $a_1, a_2, ..., a_p$ occur more than once is $\binom{p}{n}$.

104. In the expansion of $(x + y + z)^{25}$

(A) every term is of the form ${}^{25}C_r.\,{}^{r}C_k.\,x^{25-r}.\,y^{r-k}.\,z^k$

(B) the coefficient of $x^8 y^9 z^9$ is 0

(C) the number of terms is 325 (D) none of these

SECTION - 3: (COMPREHENSION TYPE)

COMPREHENSION-1

Paragraph for Questions Nos. 105 to 107

Let t be a real number satisfying

$2t^3 - 9t^2 + 30 - a = 0$ . . . (1)

And $x + \frac{1}{x} = t$ . . . (2)

105. If equation (1) has three real and distinct roots then

(A) a > 30 (B) a < 3 (C) 3 < a < 30 (D) a < 3 or a > 30

106. If equation (2) has two real and distinct roots then

(A) - 2 < t < 2 (B) - 1 < t < 1 (C) t < - 2 or t > 2 (D) none of these

107. If $x + \frac{1}{x} = t$ gives six real and distinct values of x, then

(A) 3 < a < 30 (B) $a \in \phi$ (C) $a \in (2, 5)$ (D) none of these

COMPREHENSION-2

Paragraph for Questions Nos. 108 to 110

Consider the equation x + y – [x] [y] = 0, where [·] = Greatest integer function.

108. The number of integral solutions to the equation, is

(A) 0 (B) 1 (C) 2 (D) none of these

109. Equation of one of the lines on which the non integral solution of given equation, lies is

(A) x + y = -1 (B) x + y = 0 (C) x + y = 1 (D) x + y = 5

110. Number of the point of intersection between all the possible lines on which the non-integral solutions of the given equation lies, is

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

COMPREHENSION-3

Paragraph for Questions Nos. 111 to 113

$y = ax^2 + bx + c = 0$ is a quadratic equation which has real roots if and only if $b^2 - 4ac \geq 0$. If f(x, y) = 0 is a second degree equation, then using above fact we can get the range of x and y by treating it as quadratic equation in y or x. Similarly $ax^2 + bx + c \geq 0 \ \forall x \in R$ if a > 0 and $b^2 - 4ac \leq 0$.

111. If $0 < \alpha, \beta < 2\pi$, then the number of ordered pairs (α, β) satisfying $\sin^2(\alpha + \beta) - 2 \sin\alpha \sin(\alpha + \beta) + \sin^2\alpha + \cos^2\beta = 0$ is:

(A) 2 (B) 0 (C) 4 (D) none of these

112. If $A + B + C = \pi$, then the maximum value of cosA + cosB + k cosC (where k > 1/2) is

(A) $\frac{1}{k} + \frac{k}{2}$ (B) $\frac{2k^2 + 1}{3}$ (C) $\frac{k^2 + 2}{2}$ (D) $\frac{1}{2k} + k$

113. A circle with radius |a| and centre on y-axis slides along it and a variable line through (a, 0) cuts the circle at points P and Q. The region in which the point of intersection of tangents to the circle at points P and Q lies is represented by

(A) $y^2 \ge 4(ax - a^2)$ (B) $y^2 \le 4(ax - a^2)$ (C) $y \ge 4(ax - a^2)$ (D) $y \le 4(ax - a^2)$

COMPREHENSION-4

Paragraph for Questions Nos. 114 to 116

Let N = $p_1^{\alpha_1} p_2^{\alpha_2} \cdots p_n^{\alpha_n}$ be a natural number where p_i $(1 \le i \le n)$ is a prime number. The total number of divisors of N is $(\alpha_1 + 1)(\alpha_2 + 1)\ldots(\alpha_n + 1)$. The sum of all divisors is $\left(\frac{p_1^{\alpha_1+1}-1}{p_1-1}\right)\left(\frac{p_2^{\alpha_2+1}-1}{p_2-1}\right)\cdots\left(\frac{p_n^{\alpha_n+1}-1}{p_n-1}\right)$. The number of ways in which N can be resolved in two factors is $\frac{(\alpha_1+1)(\alpha_2+1)\cdots(\alpha_n+1)+1}{2}$ or $\frac{(\alpha_1+1)(\alpha_2+1)\cdots(\alpha_n+1)}{2}$ as N is a perfect square or not. Number of ways of resolving N in two coprime factors is 2^{n-1}.

114. The number of ways in which 420 can be factorised in two non coprime factors is

(A) 24 (B) 8 (C) 12 (D) 4

115. The number of positive integral solution of $x_1x_2x_3x_4 = 420$ is

(A) 420 (B) 240 (C) 640 (D) none of these

116. The sum of all the even divisors of 420 is

(A) 860 (B) 192 (C) 1344 (D) 1152

COMPREHENSION-5

Paragraph for Questions Nos. 117 to 119

If z_1, z_2 be the complex numbers representing two points A and B, then we define the complex slope of the line AB as $\mu = \frac{z_1 - z_2}{\bar{z}_1 - \bar{z}_2}$, it can be noted that $|\mu| = 1$ and μ remains same for any two points on the line AB, since if z_3 . z_4 be complex numbers representing some other points on the same line, then

$$\mu' = \frac{z_3 - z_4}{\bar{z}_3 - \bar{z}_4} = \frac{\lambda(z_1 - z_2)}{\bar{\lambda}(\bar{z}_1 - \bar{z}_2)} \quad (\because z_3 - z_4 = \lambda(z_1 - z_2)\ \lambda \text{ real}) = \frac{z_1 - z_2}{\bar{z}_1 - \bar{z}_2} = \mu$$

117. The complex slope of the line $\bar{a}z + a\bar{z} + b = 0$ where a is complex and b is real is

(A) $\frac{a}{a}$ (B) $-\frac{a}{a}$ (C) $\frac{\bar{a}}{a}$ (D) $-\frac{\bar{a}}{a}$

118. If the complex slope of a line which is not parallel to y-axis is $\cos\phi + i\sin\phi$, then the line makes an angle θ with x-axis, θ must be

(A) 2ϕ (B) $90° - \phi$

(C) $\frac{\phi}{2}$ (D) ϕ

119. If μ and μ' be complex slopes of two perpendicular lines, then

(A) $\mu\mu' = 1$ (B) $\mu\mu' = -1$

(C) $\mu + \mu' = 0$ (D) none of these

COMPREHENSION-6

Paragraph for Questions Nos. 120 to 122

Let z be a complex number lying on a circle $|z| = \sqrt{2}\,a$ and $b = b_1 + ib_2$ (any complex number), then

120. The equation of tangent at the point 'b' is

(A) $z\bar{b} + \bar{z}b = a^2$ (B) $z\bar{b} + \bar{z}b = 2a^2$ (C) $z\bar{b} + \bar{z}b = 3a^2$ (D) $z\bar{b} + \bar{z}b = 4a^2$

121. The equation of straight line parallel to the tangent at the point b and passing through centre of circle is

(A) $z\bar{b} + \bar{z}b = 0$ (B) $2z\bar{b} + \bar{z}b = \lambda$ (C) $2z\bar{b} + 3\bar{z}b = 0$ (D) $z\bar{b} + \bar{z}b = \lambda$

122. The equation of lines passing through the centre of the circle and making an angle $\frac{\pi}{4}$ with the normal at 'b' are

(A) $z = \pm\frac{ib^2}{2a^2}\bar{z}$ (B) $z = \pm\frac{ib^2}{a^2}\bar{z}$ (C) $z = \pm\frac{ib^2}{3a^2}\bar{z}$ (D) $z = \pm\frac{ib^2}{4a^2}\bar{z}$

COMPREHENSION-7

Paragraph for Questions Nos. 123 to 125

Suppose $f(x) = 3x^3 - 13x^2 + 14x - 2$. It is assumed that $f(x) = 0$ have three real roots say α, β and γ where $\alpha < \beta < \gamma$.

123. $[\alpha]$, $[\beta]$, $[\gamma]$ (where [.] denotes the greatest integer function) are in

(A) A.P (B) G.P (C) H.P (D) none of these

124. $\lim\limits_{n\to\infty} \alpha^{n!} \cdot \beta^{1/n!}$ will be equal to

(A) 1 (B) e (C) 0 (D) none of these

125. The value of $\tan^{-1}\alpha + \tan^{-1}\beta + \tan^{-1}\gamma$ is

(A) $\frac{\pi}{2}$ (B) $\frac{3\pi}{2}$ (C) $\frac{\pi}{4}$ (D) $\frac{3\pi}{4}$

COMPREHENSION-8

Paragraph for Questions Nos. 126 to 128

The quantities $1 + x$, $1 + x + x^2$, $1 + x + x^2 + x^3$, …, $1 + x + x^2 + \ldots + x^n$ are multiplied and terms of the product are arranged in increasing powers of x in the form $a_0 + a_1 x + a_2 x^2 + \ldots$, then

126. The number of terms in the product is

(A) n^2 (B) $n(n + 1)$ (C) $\frac{n(n+1)}{2}$ (D) $\frac{n^2+n+2}{2}$

127. The coefficients of equidistant terms from beginning and end are

(A) always equal (B) never equal
(C) sometimes equal (D) can't be said

128. The sum of odd coefficients = sum of even coefficients = ?

(A) $n!$ (B) $(n + 1)!$
(C) $\frac{(n+1)!}{2}$ (D) none of these

COMPREHENSION-9

Paragraph for Questions Nos. 129 to 131

Consider the quadratic equation $az^2 + bz + c = 0$ where a , b , c and z are complex numbers

129. The condition that the equation has both real roots is

(A) $\frac{a}{\bar{a}} = -\frac{b}{\bar{b}} = \frac{c}{\bar{c}}$ (B) $\frac{a}{\bar{a}} = \frac{b}{\bar{b}} = \frac{c}{\bar{c}}$ (C) $\frac{a}{\bar{a}} = \frac{b}{\bar{b}} = -\frac{c}{\bar{c}}$ (D) none of these

130. The condition that equation has both roots purely imaginary

(A) $\frac{a}{\bar{a}} = -\frac{b}{\bar{b}} = -\frac{c}{\bar{c}}$ (B) $\frac{a}{\bar{a}} = -\frac{b}{\bar{b}} = \frac{c}{\bar{c}}$ (C) $\frac{a}{\bar{a}} = \frac{b}{\bar{b}} = -\frac{c}{\bar{c}}$ (D) none of these

131. Condition that equation has one complex root m such that |m| = 1

(A) $\frac{\bar{b}c - b\bar{a}}{a\bar{a} - c\bar{c}} = \frac{a\bar{a} + c\bar{c}}{\bar{c}b + a\bar{b}}$ (B) $\frac{\bar{b}c + b\bar{a}}{a\bar{a} + c\bar{c}} = \frac{a\bar{a} + c\bar{c}}{\bar{c}b + a\bar{b}}$

(C) $(\bar{b}c - b\bar{a})(\bar{c}b - a\bar{b}) = (a\bar{a} - c\bar{c})^2$ (D) none of these

COMPREHENSION-10

Paragraph for Questions Nos. 132 to 134

8 players compete in a tournament, everyone plays everyone else just once. The winner of a game gets 1, the loser 0 or each gets $\frac{1}{2}$ if the game is drawn. The final result is that everyone gets a different score and the player playing placing second gets the same score as the total of four bottom players.

Now answer the following questions:

132. The total of the player placing II was

(A) 6 (B) $6\frac{1}{2}$ (C) $5\frac{1}{2}$ (D) can't say

133. The result of the game between player placing III and player placing VII was

(A) player III was the winner (B) player VII was the winner

(C) the game ended in a drawn (D) can't say

134. The total score of the top four players was

(A) 22 (B) 21 (C) 20 (D) 19

COMPREHENSION-11

Paragraph for Questions Nos. 135 to 137

Let z_1, z_2, z_3 be the complex number associated with vertices A, B, C of a triangle ABC which is circumscribed by the circle |z| = 1. Altitude through A meets the side BC and D and circum-circle at E. Let P be the image of E about BC and F be the image of E about origin.

Now answer the following questions:

135. The complex number of point P is

(A) $\frac{z_1 + z_2 + z_3}{3}$ (B) $\frac{2(z_1 + z_2 + z_3)}{3}$

(C) $z_1 + z_2 + z_3$ (D) none of these

136. The complex number of point E is

(A) $\frac{z_1z_2}{z_3}$ (B) $\frac{z_2z_3}{z_1}$

(C) $-\frac{z_2z_3}{z_1}$ (D) $-\frac{z_1z_2}{z_3}$

137. The distance of point C from F i.e. CF is equal to

(A) $|z_1 - z_2|$ (B) $|z_1 + z_2|$

(C) $\frac{|z_1 - z_3|}{2}$ (D) $\frac{|z_1 + z_3|}{2}$

COMPREHENSION-12

Paragraph for Questions Nos. 138 to 140

A complex number z = x + iy satisfies $\arg\left(\frac{z-1}{z+1}\right) = \frac{\pi}{3}$. Then-

138. Locus of z is

(A) major arc of the circle (B) minor arc of the circle

(C) circle having centre at origin (D) none of these

139. Radius of the circle given by above equation is

(A) $\frac{1}{\sqrt{3}}$ (B) $\frac{2}{\sqrt{3}}$

(C) $\sqrt{3}$ (D) 1

140. Maximum value of |z| satisfying the given equation is

(A) $\frac{2}{\sqrt{3}} + 1$ (B) $\frac{1}{\sqrt{3}} + 1$

(C) $\sqrt{3}$ (D) $\frac{4}{\sqrt{3}}$

SECTION-4: (MATRIX MATCH TYPE)

141. Match the following

	Column I		*Column II*
(A)	The number of integral solutions of the equation x + 2y = 2xy is	(p)	1
(B)	The number of real solutions of the system of equations $x = \frac{2z^2}{1+z^2}, y = \frac{2x^2}{1+x^2}, z = \frac{2y^2}{1+y^2}$	(q)	2
(C)	If a(y + z) = x, b(z + x) = y, c(x + y) = z, where $a \neq -1, b \neq -1, c \neq -1$ admit non-trivial solutions, then $\frac{1}{1+a} + \frac{1}{1+b} + \frac{1}{1+c}$ is	(r)	0
(D)	The number of solutions of the equation $\sqrt{3x^2 + 6x + 7} + \sqrt{5x^2 + 10x + 14} \le 4 - 2x - x^2$ is	(s)	Infinite

142. Match the following

List – I	List – II
(A) $\arg\left(\frac{z+1}{z-1}\right) = \frac{\pi}{4}$	(i) parabola
(B) $z = \frac{3i - t}{2 + it}$ $(t \in R)$	(ii) part of a circle
(C) $\arg z = \frac{\pi}{4}$	(iii) full circle
(D) $z = t + it^2$ $(t \in R)$	(iv) line

143. Match the following:

List – I	List – II
(A) If the roots of the equation $x^2 - 2ax + a^2 + a - 3 = 0$ are real and less than 3, then a is	(i) $(0, 1]$
(B) Let $f(x) = (1 + b^2)x^2 + 2bx + 1$ and let m(b) be the minimum value of f(x). As b varies, then m(b) is	(ii) $\left[\frac{2+\sqrt{3}}{2}, \infty\right)$
(C) If a, b, c $\in$ R and equation $px^2 + qx + r = 0$ has two real roots α and β such that $\alpha < -1$ and $\beta > 1$, then $x^2 + \left\|\frac{q}{p}\right\|x + \frac{r}{p}$ is	(iii) < 2
(D) The set of values of a for which both the roots of the equation $x^2 + (2a - 1)x + a = 0$ are positive is	(iv) < 0

144. Match the following:

List – I	List – I
(A) If $\|x^2 - x\| \geq x^2 + x$, then x	(i) $[0, \infty)$
(B) $\|x + y\| > x - y$, where $x > 0$, then y =	(ii) $(-\infty, 0]$
(C) If $\log_2 x \geq \log_3^{(x^2)}$, then x =	(iii) $[-1, \infty)$
(D) $[x] + 2 \geq \|x\|$ (where [.] denotes the greatest integer function)	(iv) $(0, 1]$

145. Match the following:

List – I	List – II
(A) If inequation $ax^2 - ax + 1 < 0$ $\forall$ x $\in$ R, then a belongs to	(i) $[0, 4)$
(B) If $x^3 - 3x + \frac{a}{2} = 0$ has three real and distinct root, then $\|a\|$ belongs to	(ii) $[0, 3]$
(C) If $x^3 + ax^2 + x + 1 = 0$ has exactly one real root, then a^2 may belongs to	(iii) $(0, 4)$
(D) If quadratic equation $x^2 - 3ax + a^2 - 9 = 0$ has roots of opposite sign then a belongs to	(iv) $(-3, 3)$

146. Match the following:

List – I	List – II
(A) $\underbrace{1\ 1\ 1 \ldots 1}_{91 \text{ times}}$	(i) is a prime
(B) 1.2.3. … n(n + 1) (n …3.2.1)	(ii) is not a prime
(C) $10^{4n} + 10^{4(n-1)} \ldots + 10^8 + 10^4 + 1, n \in N$	(iii) is a perfect square integer
(D) $\underbrace{4\ 4\ 4 \ldots 4}_{n \text{ times}}\ \underbrace{8\ 8\ 8 \ldots 9}_{(n-1) \text{ times}}$	(iv) is a perfect square of odd integer.

147. Match the following:

List – I	List – II
(A) The least value of $2\log_{100}^{a} - \log_{a}^{0.0001}, a > 1$ is	(i) 0
(B) If α, β are the roots of $6x^2 - 2x + 1 = 0$ and $S_n = \alpha^n + \beta^n$, the $\lim\limits_{n\to\infty} \sum\limits_{r=1}^{n} S_r$ is	(ii) 1
(C) If $x^2 - x + 1 = 0$, then the value of x^{3n} where n is even	(iii) 2
(D) The number of roots of the equation $x - \frac{10^2}{x-1} = 1 - \frac{10^2}{x-1}$ is	(iv) 3
	(v) 4

148. Match the following:

List –I	List-II
(A) $(x - 1)(x - 3) + k(x - 2)(x - 4) = 0$ $(k \in R)$ has real roots for $k \in$	(i) $(-5, -1)$
(B) Range of the function $\frac{x-1}{x^2 - k + 1}$ does not contain any value in the interval $[-1, 1]$ for $k \in$	(ii) ϕ
(C) The equation $x \in \left(0, \frac{\pi}{2}\right)$, secx + cosecx = k has real roots if $k \in$	(iii) $(-\infty, \infty)$
(D) The equation $x^2 + 2(k - 1)x + k + 5 = 0$ has roots positive and distinct if $k \in$	(iv) $[2\sqrt{2}, \infty)$

149. Match the following:

List – I	List – II
(A) Given positive rational numbers a, b, c such that $a + b + c = 1$, then $a^a b^b c^c + a^b b^c c^a + a^c b^a c^b$	(i) is equal to $-\frac{1}{2}(n-1)$
(B) If n is a positive integer ≥ 1, then $\frac{3^n}{2^n + n \cdot 6^{\frac{n-1}{2}}}$	(ii) is equal to $\frac{2}{n}$
(C) If $n \in N > 1$, then sum of real part of roots of $z^n = (z + 1)^n$	(iii) ≤ 1
(D) If the quadratic equations $2x^2 + bx + 1 = 0$ and $4x^2 + ax + 1 = 0$ have a common root, then the value of $\frac{a^2 + 2b^2 - 3ab + 4}{n}$, when $n \in N$	(iv) ≥ 1

150. Match the following:

List – I	List – II
(A) If $a - b$, $ax - by$, $ax^2 - by^2$ ($a, b \neq 0$) are in G.P., then x, y, $\frac{ax-by}{a-b}$ are in	(i) A.P.
(B) If the slope of one of the lines represented by $a^3x^2 - 2hxy + b^3y^2 = 0$ be the square of the other, then ab^2, h, a^2b are in	(ii) G.P.
(C) a, b, c, d are distinct positive numbers, then $\frac{a^n}{b^n} > \frac{c^n}{d^n}$ for	(iii) H.P.
(D) If $a_1, a_2, a_3, \ldots$ are in H.P. and $f(k) = \sum_{r=1}^{n} a_r - a_k$, then $\frac{a_1}{f(1)}, \frac{a_2}{f(2)}, \frac{a_3}{f(3)} \ldots \frac{a_n}{f(n)}$ are in	

151. Match the following:

List – I		List – II	
(A)	If x, y, z ∈ N then number of ordered triplet (x, y, z) satisfying xyz = 243 is	(i)	19
(B)	The number of terms in the expansion of $(x + y + z)^6$ is	(ii)	28
(C)	If x ∈ N, then number of solutions of $x^2 + x - 400 \leq 0$ is	(iii)	21
(D)	If x, y, z ∈ N, then number of solution of x + y + z = 10	(iv)	36

152. If $f(x) = x^3 + ax^2 + bx + c = 0$ has three distinct integral roots and $(x^2 + 2x + 2)^3 + a(x^2 + 2x + 2)^2 + b(x^2 + 2x + 2) + c = 0$ has no real roots then

(A) a = (1) 0
(B) b = (2) 2
(C) c = (3) 3
(D) If the roots of $f'(x) = k$ are equal then k = (4) –1

153. Match the following:

(A) The coefficient of x^{-15} in $\left(3x^2 + \frac{3^{-4/7}}{x^3}\right)^{10}$ is (i) 41

(B) If $(1 - x + x^2)^4 = a_0 + a_1x + a_2x^2 + \ldots + a_8x^8$, then $a_0 + a_2 + a_4 + a_6 + a_8$ is equal to (ii) 34

(C) $(\sqrt{2}+1)^4 + (\sqrt{2}-1)^4$ is equal to (iii) 40

(D) Coefficient of x^{11} in the expansion of $\frac{1}{6}(2x^2 + x - 3)^6$ is equal to (iv) 32

154. Match the following:

(A) Locus of $\left|2z - (\sqrt{3}i + 1)\right| + \left|2z - (\sqrt{3}i - 1)\right| = 2$ (i) two infinite line segments

(B) Locus of $|z + i| + |z - i| = 4$ (ii) ellipse

(C) Locus of $||z - i| - |z + i|| = 4$ (iii) line segment

(D) Locus of $||z + i| - |z - i|| = 2$ (iv) nothing on the plane

155. Match the following :

	Column – I	Column – II
(a)	$\frac{5x+1}{(x+1)^2} < 1$	(P) $x \in (-\infty, 0) \cup (0, 2) \cup (2, \infty)$
(b)	$\|x\| + \|x-3\| > 3$	(Q) $x \in (-\infty, -5) \cup (-3, 3) \cup (5, \infty)$
(c)	$\frac{1}{\|x\|-3} < \frac{1}{2}$	(R) $x \in (-\infty, -1) \cup (-1, 0) \cup (3, \infty)$
(d)	$\frac{x^4}{(x-2)^2} > 0$	(S) $x \in (-\infty, 0) \cup (3, \infty)$

156. Match the following :

	Column - I		Column - II
(a)	If $\frac{x(y+z-x)}{\log x} = \frac{y(z+x-y)}{\log y} = \frac{z(x+y-z)}{\log z}$ and $a.\ x^y\ .\ y^x = b.y^z.\ z^y = cz^x.\ x^z$, then $\frac{a+b}{c}$ equals	(P)	1
(b)	$y = 10^{\frac{1}{1-\log_{10} x}}$, $z = 10^{\frac{1}{1-\log_{10} y}}$ implies $x = 10^{\frac{1}{a+b\log_{10} z}}$, than a – b equals	(Q)	2
(c)	If $a^2 + b^2 = c^2 \Rightarrow \log_{c+b} a + \log_{c-b} a = k \log_{c+b} a \log_{c-b} a$, then k equals	(R)	3
(d)	If $b = \sqrt{ac}$ where $a > 0$, $c > 0$ & $b \neq 1$ and if $\frac{\log_a N - \log_b N}{\log_b N - \log_c N} = k.\ \log_a c$, then k equals	(S)	0

157. Match the following

	Column – I		Column – II
(A)	If $\log_{\sin x} \log_3 \log_{0.2} x < 0$, then	(p)	$x \in [-1, 1]$
(B)	If $\frac{(e^x-1)(2x-3)(x^2+x+2)}{(\sin x-2)\ x(x+1)} \leq 0$, then	(q)	$x \in [-3, 6)$
(C)	If $\|2 - \|[x] - 1\|\| \leq 2$, then [.] represents greatest integer function.	(r)	$x \in \left(0, \frac{1}{125}\right)$
(D)	If $\|\sin^{-1}(3x - 4x^3)\| \leq \frac{\pi}{2}$, then	(s)	$x \in (-\infty, -1) \cup \left[\frac{3}{2}, \infty\right)$

158 Match the column

Column – I		Column – II	
(A)	$x\|x\| =$	(p)	$\begin{cases} -2x & : & x < -1 \\ 2 & : & -1 \le x \le 1 \\ 2x & : & x \ge 1 \end{cases}$
(B)	$\|x-1\| + \|x+1\| =$	(q)	$\begin{cases} -x^2 & : & x \le 0 \\ x^2 & : & x > 0 \end{cases}$
(C)	If $-1 \le x \le 2$, then $2x - \{x\} =$	(q)	$\begin{cases} -x & : & -1 \le x < 0 \\ 0 & : & 0 \le x < 1 \\ x & : & 1 \le x < 2 \end{cases}$
(D)	If $-1 \le x \le 2$, then $x[x] =$	(s)	$\begin{cases} x-1 & : & -1 \le x < 0 \\ x & : & 0 \le x < 1 \\ x+1 & : & 1 \le x < 2 \end{cases}$

159 **Match The column**

Column – I		Column – II	
(A)	Number of real solution of $a^2 + b^2 + c^2 = x^2$ is	(p)	2
(B)	The number of non-negative real roots of $2^x - x - 1 = 0$, equals	(q)	∞
(C)	Let p and q be the roots of the quadratic equation $x^2 - (\alpha - 2)x - \alpha - 1 = 0$. What is the minimum possible value of $p^2 + q^2$?	(r)	6
(D)	The value of 'c' for which $\|\alpha^2 - \beta^2\| = \frac{7}{4}$, where α and β are the roots of $2x^2 + 7x + c = 0$, is	(s)	5

160. **Match the column**

Column – I		Column – II	
(A)	Find all possible values of k for which every solution of the inequation $x^2 - (3k-1)x + 2k^2 - 3k - 2 \ge 0$ is also a solution of the inequation $x^2 - 1 \ge 0$.	(p)	16
(B)	If a, b, c and d are four positive real numbers such that abcd = 1, the minimum value of $(1 + a)(1 + b)(1 + c)(1 + d)$ is	(q)	[0, 1]
(C)	Solution set of the inequality $5^{x+2} > \left(\frac{1}{25}\right)^{1/x}$ is	(r)	$\frac{1}{6}$
(D)	Let $f(x) = x^3 + 3x + 1$ if g(x) is the inverse function of f(x). Then $g'(5)$ equal to	(s)	$(0, \infty)$

161 Match the column

Column – I		Column – II	
(A)	Suppose that $F(n + 1) = \frac{2F(n)+1}{2}$ for $n = 1, 2, 3, \ldots$ and $F(1) = 2$. Then $F(101)$ equals	(p)	42
(B)	If $a_1, a_2, a_3, \ldots\ldots\ldots. a_{21}$ are in A.P. and $a_3 + a_5 + a_{11} + a_{17} + a_{19} = 10$ then the value of $\sum_{i=1}^{21} a_i$ is	(q)	1620
(C)	10^{th} term of the sequence $S = 1 + 5 + 13 + 29 + \ldots..$, is	(r)	52
(D)	The sum of all two digit numbers which are not divisible by 2 or 3 is	(s)	2045

162. Match the column

Column – I		Column – II	
(A)	The arithmetic mean of two numbers is 6 and their geometric mean G and harmonic mean H satisfy the relation $G^2 + 3H = 48$. Find the two numbers.	(p)	$\frac{240}{77}$
(B)	The sum of the series $\frac{5}{1^2.4^2} + \frac{11}{4^2.7^2} + \frac{17}{7^2.10^2} + \ldots$ is.	(q)	(4,8)
(C)	If the first two terms of a Harmonic Progression be $\frac{1}{2}$ and $\frac{1}{3}$, then the Harmonic Mean of the first four terms is	(r)	$\frac{1}{3}$

163. Match the column

Column – I			Column – II
(A)	${}^mC_1\,{}^nC_m - {}^mC_2\,{}^{2n}C_m + {}^mC_3\,{}^{3n}C_m \ldots\ldots\ldots$	(p)	coefficient of x^m in the expansion of $((1 +)^n - 1)^m$
(B)	${}^nC_m + {}^{n-1}C_m + {}^{n-2}C_m + \ldots\ldots. + {}^mC_m$	(q)	coefficient of x^m in $\frac{(1+x)^{n+1}}{x}$
(C)	$C_0 C_n + C_1 C_{n-1} + \ldots\ldots\ldots + C_n C_0$	(r)	coefficient of x^n in $(1 + x)^{2n}$
(D)	$2^k\,{}^nC_0 - 2^{k-1}\,{}^nC_1\,{}^{n-1}C_{k-1} \ldots\ldots\ldots (-1)^k\,{}^nC_k\,{}^{n-k}C_0$	(s)	coefficient of x^k in the exp. of $(1 + x)^n$

164. Match the column

Column – I		Column – II	
(A)	The number of distinct terms in the expansion of $(x_1 + x_2 + x_3 + ... + x_n)^3$ is	(p)	${}^{n+3}C_n$
(B)	The number of Integral terms in ther expansion of $[5^{1/2} + 7^{1/8}]^{1024}$	(q)	${}^{n+2}C_3$
(C)	Degree of polynomial $[x + (x^3 - 1)^{1/2}]^5 + [x - (x^3 - 1)^{1/2}]^5$ is	(r)	129
(D)	Coefficients of the second, third and fourth terms in the expansion of $(1 + x)^n$ are in A.P. the n is equal to	(s)	7

165.

Column – I		**Column – II**	
(A)	If (r + 1) th term is the first negative term in the expansion of $(1 + x)^{7/2}$, then the value of r (where $\|x\| < 1$) is	(p)	divisible by 2
(B)	The coefficient of y in the expansion of $(y^2 + 1/y)^5$ is	(q)	divisible by 5
(C)	If the second term in the expansion $\left(a^{\frac{1}{13}} + \frac{a}{\sqrt{a^{-1}}}\right)^n$ is $14a^{5/2}$, then the value of n is	(r)	divisible by 10
(D)	The coefficient of x^4 in the expression $(1 + 2x + 3x^2 + 4x^3 + ...\text{up to } \infty)^{1/2}$ is c, $(c \in N)$, then c + 1 (where $\|x\| < 1$) is	(s)	a prime number

166. **Match the following :**

Column - I		**Column - II**	
(a)	The number of cubes with the six faces numbered 1 to 6 can be made, if the sum of the number in each pair of opposite faces is 7, is equal to	(P)	2
(b)	A citizen is expected to vote for atleast one of three positions mayor, secretary and attorney. The number of ways he/she can vote if there are 3 candidates each for three position, is 9 k where k is	(Q)	4
(c)	The number of ways in which 4 married couples can be seated at a round table if no husband and wife as well as no two men are to seat together is 3 k where k is	(R)	3
(d)	The sum of all numbers of the form $\frac{12!}{a!b!c!}$ where a, b, c $\in$ W, satisfy a + b + c = 12, is 3^{3k} where k is	(S)	7

167. **Match the following :**

Column - I		**Column - II**	
(a)	The number of five - digit numbers having the product of digits 20 is	(P)	77
(b)	A man took 5 space plays out of an engine to clean them. The number of ways in which he can place atleast two plays in the engine from where they came out is	(Q)	31
(c)	The number of integer between 1 & 1000 inclusive in which atleast two consecutive digits are equal is	(R)	50
(d)	The value of $\frac{1}{15}\sum_{1\le i\le j\le 9}\sum i\cdot j$	(S)	181

168. **Match the following :**

Column - I		**Column - II**	
(A)	The number of arrangements that can be made taking 4 letters, at a time, out of the letters of the word "PASSPORT" is :	(p)	2454
(B)	The numberof ways of forming a 4 letter word using the letters of the word MATHEMATICS, is	(q)	606
(C)	The number of selections of four letters from the letters of the word ASSASSINATION is	(r)	72
(D)	The total number of ways of selecting five letters from the letter of the words INDEPENDENT is	(s)	2424

169.

Column – I		**Column – II**	
(A)	The total number of selections of fruits which can be made from, 3 bananas, 4 apples and 2 oranges is	(p)	Greater than 50
(B)	If 7 points out of 12 are in the same straight line, then the number of triangles formed is	(q)	Greater than 100
(C)	The number of ways of selecting 10 balls from unlimited number of red, black, white and green balls is	(r)	Greater than 150
(D)	The total number of proper divisors of 38808 is	(s)	Greater than 200

170. **Column – I** | **Column – II**

	Column – I		Column – II
(A)	Number of 4 letter words that can be formed using the letter of the words 'RESONANCE' is	(p)	$\frac{11!}{3!}$
(B)	Number of ways of selecting 3 persons out of 12 sitting in a row, if no two selected persons were sitting together, is	(q)	1206
(C)	Number of solutions of the equation x + y + z = 20, where $1 \le x < y < z$ and $x, y, z \in I$, is	(r)	24
(D)	Number of ways in which indian team can bat, if Yuvraj wants to bat before Dhoni and Pathan wants to bat after Dhoni is (assume all the batsman bat)	(s)	120

SECTION5: (INTEGER TYPE)

171. In a class tournament where the participants were to play one game with another, two class players fell ill, having played 3 games each. If the total number of games played is 84, then the number of participants at the beginning is _______________

172. If $|z|^2 + (3 - 4i)z + (3 + 4i)\bar{z} + 75 = 0$ and $(1 - i)z + (1 + i)\bar{z} - 16 = 0$ intersect at z_1 and z_2, then the integral part of the sum of the areas of the quadrilaterals having $(z_1 + z_2)$ and $(z_1 - z_2)$ as diagonals passing through origin is ____________ (Two vertices of 1st quadrilateral are z_1 and z_2 and of 2nd quadrilateral are z_1 and $-z_2$).

173. If x = 1.2 $(2^2 - 1^2)$ + 2.3 $(3^2 - 2^2)$ + 3.4 $(4^2 - 3^2)$ + … upto 50 terms, then the value of $\frac{x}{51^3}$ is ________

174. If α is the absolute maximum value of the expression $\frac{3x^2+2x-1}{x^2+x+1}$ $\forall$ x $\in$ R, then $[\alpha]$is _______, (where [.] denotes the greatest integer function)

175. The number of solutions of the equation $e^{|x|} = |x| + 1$ is __________

176. The value of x satisfying the equations $\log_3(\log_2 x) + \log_{1/3}(\log_{1/2} y) = 1$; $xy^2 = 9$is________

177. If there are six letters $L_1, L_2, L_3, L_4, L_5, L_6$ and their corresponding six envelopes $E_1, E_2, E_3, E_4, E_5, E_6$. Letters having odd value can be put into odd value envelopes and even value letter can be put into even value envelopes, so that no letter go into the right envelopes, the number of arrangement will be equal to ________

178. The number of integral values of a ; a $\in$ (6, 100) for which the equation $[\tan x]^2 + \tan x - a = 0$ has real roots; where [.] denotes greatest integer function is _________

179. If the co-efficient of rth, (r+1)th and (r + 2)th terms in the expansion of $(1 + x)^{14}$ are in A.P. then the greatest possible value of r is ___________

180. The remainder when $(3m + (-1)^n)^{18}$ is divided by 9 is __________ (m, n are natural numbers).

181. The numbers of five digits that can be made with the digits 1, 2, 3 each of which can be used at most thrice in a number, is ______________

182. The number of TIMES the digit 0 will be written when listing of the integers from 1 to 100 is _____________

183. If 6-digit number abcdef is multiplied with 6 and the resulting number is defabc. The number is ____________.

184. If $f:\{a,b,c,d,e\} \to \{a,b,c,d,e\}$ f is onto and $f(x) + x$ for each $x \in \{a,b,c,d,e\}$ is equal to ____.

185. The number of real solutions of the equation $x^6 - x^5 + x^4 - x^3 + x^2 - x + \frac{3}{4} = 0$ is ________

186. The number of ordered triplets (a, b, c) such that L.C.M (a, b) = 1000, L.C.M (b, c) = 2000 and L.C.M (c, a) = 2000 is _______________

187. If the number of ordered pairs of (x, y) satisfying the system of equations $5x\left(1+\frac{1}{x^2+y^2}\right)=12$ and $5y\left(1-\frac{1}{x^2+y^2}\right)=4$ is n, then n is ———————

188. Consider the sequence a_n given by $a_1 = \frac{1}{3}$, $a_{n+1} = a_n^2 + a_n$. Let $S = \frac{1}{a_2}+\frac{1}{a_3}+\cdots+\frac{1}{a_{2008}}$, then [S] is equal to ___________ (where [ ] represents greatest integer function)

189. Let (x_i, y_i) where i = 1, 2, 3, 4 are the integral solutions of equation $2x^2y^2 + y^2 - 6x^2 - 12 = 0$. The area of quadrilateral whose vertices are (x_i, y_i), i = 1, 2, 3, 4 is _______

190. In the expansion of $(a^{1/3} + b^{1/9})^{6561}$, where a, b are distinct prime numbers, then the number of irrational terms are ________

191. If $(1 + 2x + 3x^2)^{10} = a_0 + a_1x + a_2x^2 + ... + a_{20}x^{20}$, then calculate $a_1 + a_2 + a_4$

192. Given that a, g are roots of the equation, $A\,x^2 - 4\,x + 1 = 0$ and b, d the roots of the equation, $B\,x^2 - 6\,x + 1 = 0$, find values of A *B, such that a, b, g & d are in H.P.

193. In maths paper there is a question on "Match the column" in which column A contains 6 entries & each entry of column A corresponds to exactly one of the 6 entries given in column B written randomly. 2 marks are awarded for each correct matching & 1 mark is deducted from each incorrect matching. A student having no subjective knowledge decides to match all the 6 entries randomly. Find the number of ways in which he can answer, to get atleast 25 % marks in this question.

194. Find the number of positive integral solutions of, $x^2 - y^2 = 352706$

195. Find the nonzero value of ' x ' for which the fourth term in the expansion $\left(5^{\frac{2}{5}\log_5\sqrt{4^x + 44}} + \frac{1}{5^{\log_5\sqrt[3]{2^{x-1} + 7}}}\right)^8$, is 336.

196. In the binomial expansion of $\left(\sqrt[3]{2} + \frac{1}{\sqrt[3]{3}}\right)^n$, the ratio of the 7th term from the beginning to the 7th term from the end is 1 : 6 ; find n.

197. Find the coefficient of $a^5\,b^4\,c^7$ in the expansion of $(bc + ca + ab)^8$.

198. Find the number of positive integral solutions of xyz = 21600

199. Find the value of 8k for which the expression $3x^2 + 2xy + y^2 + 4x + y + k$ can be resolved into two linear factors.

200. How many five digits numbers divisible by 3 can be formed using the digits 0, 1, 2, 3, 4, 7 and 8 if, each digit is to be used atmost one.

END OF EXERCISE # 01

EXERCISE # 02

SECTION-1 : (ONE OPTION CORRECT TYPE)

201. $\begin{bmatrix} \alpha & \beta \\ \gamma & \delta \end{bmatrix}$ is a square root of the unit matrix of second order if δ is equal to

(A) α (B) β

(C) γ (D) none of these

202. Let $\vec{a}$ and $\vec{b}$ are unit vectors such that $|\vec{a} + \vec{b}| = \sqrt{3}$, then the value of $(2\vec{a}+5\vec{b})\cdot(3\vec{a}+\vec{b}+\vec{a}\times\vec{b})$ is equal to

(A) $\frac{11}{2}$ (B) $\frac{13}{2}$

(C) $\frac{39}{2}$ (D) none of these

203. Out of 40 consecutive integers two are chosen at random, the probability that their sum is odd is

(A) $\frac{14}{29}$ (B) $\frac{20}{39}$

(C) $\frac{1}{2}$ (D) none of these

204. 5 different games are to be distributed among 4 children randomly. The probability that each child get atleast one game is

(A) $\frac{1}{4}$ (B) $\frac{15}{64}$

(C) $\frac{21}{64}$ (D) None of these

205. If the shortest distance between lines $\vec{r} = \hat{i} + 2\hat{j} + 3\hat{k} + \lambda_1(2\hat{i} + 3\hat{j} + 4\hat{k})$ and $\vec{r} = 2\hat{i} + 4\hat{j} + 5\hat{k} + \lambda_2(3\hat{i} + 4\hat{j} + 5\hat{k})$ is x, then $\cos^{-1}\cos\sqrt{6}x$ is equal to

(A) $\frac{1}{2}$ (B) 0

(C) 1 (D) π

206. Let $|\vec{a}| = 3,\ |\vec{b}| = 4,\ |\vec{c}| = 5$ and $\vec{a} \perp (\vec{b}+\vec{c}),\ \vec{b} \perp (\vec{c}+\vec{a})$ and $\vec{c} \perp (\vec{a}+\vec{b})$. Then $|\vec{a}+\vec{b}+\vec{c}|$ is

(A) $\sqrt{14}$ (B) $\sqrt{6}$

(C) $\sqrt{12}$ (D) None of these

207. $\frac{d}{dx}\begin{vmatrix} x^2 & x+1 & 3 \\ 1 & 2x-1 & x^3 \\ 0 & x & -2 \end{vmatrix} = -6x^5 - 3$. Number of possible solution of the given equation is

(A) 5 (B) 3

(C) 2 (D) 1

208. A pair of dice is rolled till a sum of either 5 or 7 is obtained. Then the probability that 5 comes before 7 is

(A) $\frac{1}{5}$ (B) $\frac{2}{3}$

(C) $\frac{4}{7}$ (D) $\frac{2}{5}$

209. Let $\Delta = \begin{vmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{vmatrix}$ and $a_{pq} = (i^p)^q$, where $i = \sqrt{-1}$. The value of Δ is

(A) real and positive (B) real and negative

(C) 0 (D) imaginary

210. If $f(x) = \begin{cases} x\left[\dfrac{e^{(1/x)^n} - e^{-(1/x)^n}}{e^{(1/x)^n} + e^{-(1/x)^n}}\right] & x \neq 0 \\ 0 & x = 0 \end{cases}$ where, $n \in \{1, 2, 3, \ldots, 15\}$, then the probability that f(x) is differentiable is

(A) $\frac{1}{2}$ (B) $\frac{8}{15}$

(C) $\frac{7}{15}$ (D) $\frac{1}{3}$

211. $\vec{b} = \left(\sqrt{4\cos\frac{\alpha}{2}},\ -5,\ \tan\alpha\right)$, $\vec{c} = \left(\dfrac{3}{\sqrt{\cos\frac{\alpha}{2}}},\ \tan\alpha,\ \tan\alpha\right)$ are perpendicular to each other, $\vec{a}$ = (sin 2α, 1, – 2) makes an obtuse angle with x-axis, then α is equal to

(A) $2n\pi + \tan^{-1} 2$ (B) $n\pi + \tan^{-1} 2$

(C) $2n\pi + \pi + \tan^{-1} 3$ (D) none of these

212. The probability that quadratic equation $x^2 + ax + b = 0$ does not have real distinct roots if a, b are selected at random from the set {1, 2, 3, 4} is

(A) $\frac{9}{16}$ (B) $\frac{11}{16}$

(C) $\frac{13}{16}$ (D) None of these

213. Let, $\vec{a} = \hat{i} + \hat{j} + \hat{k}; \vec{b} = \hat{i} - \hat{j} + \hat{k}$, then the point of intersection of lines $\vec{r} \times \vec{a} = \vec{b} \times \vec{a}$ and $\vec{r} \times \vec{b} = \vec{a} \times \vec{b}$ is

(A) (1, 2, 2) (B) (2, 1, 2)

(C) (2, 1, 1) (D) (2, 0, 2)

214. If A and B are squares matrices such that $A^{2006} = 0$ and AB = A + B, then det(B) =

(A) 0 (B) 1

(C) – 1 (D) None of these

215. Given 2006 vectors in the plane. The sum of every 2005 vectors is a multiple of the vector. Not all the vectors all multiple of each other. The sum of all the vectors is

(A) necessarily a zero vector (B) may be a zero vector

(C) can never be a zero vector (D) can't say

216. Box A contains black balls and box B contains white balls take a certain number of balls from A and place them in B, then take same number of balls from B and place them in A. The probability that number of white balls in A is equal to number of black balls in B is equal to

(A) $\frac{1}{2}$ (B) $\frac{1}{3}$

(C) 1 (D) None of these

217. The number of planes that are equidistant from four non-coplanar points is

(A) 3 (B) 4

(C) 7 (D) 9

218. A plane passing through (1, 1, 1) cuts positive direction of co-ordinate axes at A, B and C the volume of tetrahedron OABC satisfies

(A) $V \le \frac{9}{2}$ (B) $V \ge \frac{9}{2}$

(C) $V = \frac{9}{2}$ (D) None of these

219. A unit vector is orthogonal to $5\hat{i}+2\hat{j}+6\hat{k}$ and is coplanar to $2\hat{i}+\hat{j}+\hat{k}$ and $\hat{i}-\hat{j}+\hat{k}$, then the vector is

(A) $\frac{3\hat{j}-\hat{k}}{\sqrt{10}}$ (B) $\frac{2\hat{i}+5\hat{j}}{\sqrt{29}}$

(C) $\frac{6\hat{i}-5\hat{k}}{\sqrt{61}}$ (D) $\frac{2\hat{i}+2\hat{j}-\hat{k}}{3}$

220. A cubical die with faces marked 1, 2, 3, …, 6 is loaded such that the probability of throwing the number t is proportional to t^2. The probability that the number 5 has appeared given that when the die is rolled the number turned up is not even, is

(A) $\frac{1}{7}$ (B) $\frac{3}{7}$

(C) $\frac{5}{7}$ (D) $\frac{2}{3}$

221. Let X be a set containing n elements. If two subsets A and B of X are picked at random, the probability that A and B have the same number of elements is

(A) $\frac{{}^{2n}C_n}{2^n}$ (B) $\frac{1}{{}^{2n}C_n}$

(C) $\frac{1\cdot 3\cdot 5..(2n-1)}{2^n\cdot n!}$ (D) $\frac{3^n}{4^n}$

222. If $\vec{a}, \vec{b}, \vec{c}$ are non-coplanar vectors such that $\vec{b}\times\vec{c}=\vec{a}$, $\vec{a}\times\vec{b}=\vec{c}$ and $\vec{c}\times\vec{a}=\vec{b}$ then

(A) $[\vec{a}\ \vec{b}\ \vec{c}] = 1$ (B) $[\vec{a}\ \vec{b}\ \vec{c}] \ne 1$

(C) $|\vec{a}|+|\vec{b}|+|\vec{c}| = 3$ (D) None of these

223. Value of $\Delta = \begin{vmatrix} \sin(2\alpha) & \sin(\alpha+\beta) & \sin(\alpha+\gamma) \\ \sin(\beta+\alpha) & \sin(2\beta) & \sin(\gamma+\beta) \\ \sin(\gamma+\alpha) & \sin(\gamma+\beta) & \sin(2\gamma) \end{vmatrix}$ is

(A) $\Delta = 0$ (B) $\Delta = \sin^2\alpha + \sin^2\beta + \sin^2\gamma$
(C) $\Delta = 3/2$ (D) None of these

224. $\Delta = \begin{vmatrix} 1 & \frac{4\sin B}{b} & \cos A \\ 2a & 8\sin A & 1 \\ 3a & 12\sin A & \cos B \end{vmatrix}$ is (where a, b, c are the sides opposite to angles A, B, C respectively in a triangle)

(A) $\frac{1}{2}\cos 2A$ (B) 0 (C) $\frac{1}{2}\sin 2A$ (D) $\frac{1}{2}(\cos^2 A + \cos^2 B)$

225. Let m be a positive integer & $D_r = \begin{vmatrix} 2r-1 & {}^mC_r & 1 \\ m^2-1 & 2^m & m+1 \\ \sin^2(m^2) & \sin^2(m) & \sin^2(m+1) \end{vmatrix}$ $(0 \le r \le m)$, then the value of $\sum_{r=0}^{m} D_r$ is given by:

(A) 0 (B) $m^2 - 1$ (C) 2^m (D) $2^m \sin^2(2^m)$

226. If a, b, c, are real numbers, and D = $\begin{vmatrix} a & 1+2i & 3-5i \\ 1-2i & b & -7-3i \\ 3+5i & -7+3i & c \end{vmatrix}$ then D is

(A) purely real (B) purely imaginary
(C) non real (D) integer

227. 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:

(A) 0 (B) 1 (C) 100 (D) -100

228. Identity the correct statement

(A) If system of n simultaneous linear equations has a unique solution, then coefficient matrix is singular

(B) If system of n simultaneous linear equations has a unique solution, then coefficient matrix is non singular

(C) If A^{-1} exists, $(\text{adj } A)^{-1}$ may or may not exist

(D) $F(x) = \begin{bmatrix} \cos x & -\sin x & 0 \\ \sin x & \cos x & 0 \\ 0 & 0 & 0 \end{bmatrix}$, then $F(x) . F(y) = F(x - y)$

229. Matrix A = $\begin{bmatrix} x & 3 & 2 \\ 1 & y & 4 \\ 2 & 2 & z \end{bmatrix}$, if x y z = 60 and 8x + 4y + 3z = 20, then A(adj A) is equal to

(A) $\begin{bmatrix} 64 & 0 & 0 \\ 0 & 64 & 0 \\ 0 & 0 & 64 \end{bmatrix}$

(B) $\begin{bmatrix} 88 & 0 & 0 \\ 0 & 88 & 0 \\ 0 & 0 & 88 \end{bmatrix}$

(C) $\begin{bmatrix} 68 & 0 & 0 \\ 0 & 68 & 0 \\ 0 & 0 & 68 \end{bmatrix}$

(D) $\begin{bmatrix} 34 & 0 & 0 \\ 0 & 34 & 0 \\ 0 & 0 & 34 \end{bmatrix}$

230. $\left[\dfrac{\vec{a}}{|\vec{a}|^2} - \dfrac{\vec{b}}{|\vec{b}|^2}\right]^2$ =

(A) $|\vec{a}|^2 - |\vec{b}|^2$

(B) $\left[\dfrac{\vec{a} - \vec{b}}{|\vec{a}|\,|\vec{b}|}\right]^2$

(C) $\left[\dfrac{\vec{a}\,|\vec{a}| - \vec{b}\,|\vec{b}|}{|\vec{a}|\,|\vec{b}|}\right]^2$

(D) None

231. A, B, C & D are four points in a plane with pv's $\vec{a}$, $\vec{b}$, $\vec{c}$ & $\vec{d}$ respectively such that

$(\vec{a} - \vec{d}) . (\vec{b} - \vec{c}) = (\vec{b} - \vec{d}) . (\vec{c} - \vec{a})$ = 0. Then for the triangle ABC, D is its:

(A) incentre
(B) circumcentre
(C) orthocentre
(D) centroid

232. Vectors $\vec{a}$ & $\vec{b}$ make an angle $\theta = \dfrac{2\pi}{3}$. If $|\vec{a}|$ = 1, $|\vec{b}|$ = 2 then $\left\{(\vec{a} + 3\vec{b}) \text{ x } (3\vec{a} - \vec{b})\right\}^2$ =

(A) 225
(B) 250
(C) 275
(D) 300

233. Consider a tetrahedron with faces f_1, f_2, f_3, f_4. Let $\vec{a}_1$, $\vec{a}_2$, $\vec{a}_3$, $\vec{a}_4$ be the vectors whose magnitudes are respectively equal to the areas of f_1, f_2, f_3, f_4 & whose directions are perpendicular to these faces in the outward direction. Then,

(A) $\vec{a}_1 + \vec{a}_2 + \vec{a}_3 + \vec{a}_4$ = 0
(B) $\vec{a}_1 + \vec{a}_3 = \vec{a}_2 + \vec{a}_4$
(C) $\vec{a}_1 + \vec{a}_2 = \vec{a}_3 + \vec{a}_4$
(D) None

234. For non–zero vectors $\vec{a}$, $\vec{b}$, $\vec{c}$, $|\vec{a} \times \vec{b}.\vec{c}| = |\vec{a}|\,|\vec{b}|\,|\vec{c}|$ holds if and only if;

(A) $\vec{a}.\vec{b} = 0, \vec{b}.\vec{c} = 0$ (B) $\vec{c}.\vec{a} = 0, \vec{a}.\vec{b} = 0$

(C) $\vec{a}.\vec{c} = 0, \vec{b}.\vec{c} = 0$ (D) $\vec{a}.\vec{b} = \vec{b}.\vec{c} = \vec{c}.\vec{a} = 0$

235. If $\vec{a} = \hat{i} + \hat{j} + \hat{k}, \vec{b} = \hat{i} - \hat{j} + \hat{k}, \vec{c} = \hat{i} + 2\hat{j} - \hat{k}$, then the value of $\begin{vmatrix} \vec{a}.\vec{a} & \vec{a}.\vec{b} & \vec{a}.\vec{c} \\ \vec{b}.\vec{a} & \vec{b}.\vec{b} & \vec{b}.\vec{c} \\ \vec{c}.\vec{a} & \vec{c}.\vec{b} & \vec{c}.\vec{c} \end{vmatrix}$ =

(A) 2 (B) 4 (C) 16 (D) 64

236. A point taken on each median of a triangle divides the median in the ratio 1 : 3, reckoning from the vertex. Then the ratio of the area of the triangle with vertices at these points to that of the original triangle is:

(A) 5 : 13 (B) 25 : 64 (C) 13 : 32 (D) Nnone

237. Let the centre of the parallelopiped formed by $\vec{PA} = \hat{i} + 2\hat{j} + 2\hat{k}; \vec{PB} = 4\hat{i} - 3\hat{j} + \hat{k};$

$\vec{PC} = 3\hat{i} + 5\hat{j} - \hat{k}$ is given by the position vector (7, 6, 2). Then the position vector of the point P is:

(A) (3, 4, 1) (B) (6, 8, 2) (C) (1, 3, 4) (D) (2, 6, 8)

238. Taken on side $\vec{AC}$ of a triangle ABC, a point M such that $\vec{AM} = \frac{1}{3}\vec{AC}$. A point N is taken on the side $\vec{CB}$ such that $\vec{BN} = \vec{CB}$ then, for the point of intersection X of $\vec{AB}$ & $\vec{MN}$ which of the following holds good?

(A) $\vec{XB} = \frac{1}{3}\vec{AB}$ (B) $\vec{AX} = \frac{1}{3}\vec{AB}$ (C) $\vec{XN} = \frac{3}{4}\vec{MN}$ (D) $\vec{XM} = 3\vec{XN}$

239. If the acute angle that the vector, $\alpha\hat{i} + \beta\hat{j} + \gamma\hat{k}$ makes with the plane of the two vectors $2\hat{i} + 3\hat{j} - \hat{k}$ & $\hat{i} - \hat{j} + 2\hat{k}$ is $\cot^{-1}\sqrt{2}$ then:

(A) $\alpha(\beta + \gamma) = \beta\gamma$ (B) $\beta(\gamma + \alpha) = \gamma\alpha$

(C) $\gamma(\alpha + \beta) = \alpha\beta$ (D) $\alpha\beta + \beta\gamma + \gamma\alpha = 0$

240. Locus of the point P for which $\vec{OP}$ represents a vector with direction cosine $\cos\alpha = \frac{1}{2}$ ('O' is the origin) is:

(A) A circle parallel to y z plane with centre on the x – axis

(B) a cone concentric with positive x – axis having vertex at the origin and the slant height equal to the magnitude of the vector

(C) a ray emanating from the origin and making an angle of 60º with x – axis

(D) a disc parallel to y z plane with centre on x – axis & radius equal to $|\vec{OP}|\sin 60^\circ$

241. There are 4 urns. The first urn contains 1 white & 1 black ball, the second urn contains 2 white & 3 black balls, the third urn contains 3 white & 5 black balls & the fourth urn contains 4 white & 7 black balls. The selection of each urn is not equally likely. The probability of selecting i^{th} urn is $\frac{i^2+1}{34}$ (i = 1, 2, 3, 4). If we randomly select one of the urns & draw a ball, then the probability of ball being white is :

(A) $\frac{569}{1496}$ (B) $\frac{27}{56}$

(C) $\frac{8}{73}$ (D) none of these

242. 2/3rd of the students in a class are boys & the rest girls. It is known that probability of a girl getting a first class is 0.25 & that of a boy is 0.28. The probability that a student chosen at random will get a first class is:

(A) 0.26 (B) 0.265

(C) 0.27 (D) 0.275

243. The contents of urn I and II are as follows,

Urn I: 4 white and 5 black balls

Urn II: 3 white and 6 black balls

One urn is chosen at random and a ball is drawn and its colour is noted and replaced back to the urn. Again a ball is drawn from the same urn, colour is noted and replaced. The process is repeated 4 times and as a result one ball of white colour and 3 of black colour are noted. Find the probability the chosen urn was I.

(A) $\frac{125}{287}$ (B) $\frac{64}{127}$

(C) $\frac{25}{287}$ (D) $\frac{79}{192}$

244. The sides of a rectangle are chosen at random, each less than 10 cm, all such lengths being equally likely. The chance that the diagonal of the rectangle is less than 10 cm is

(A) 1/10 (B) 1/20

(C) $\pi/4$ (D) $\pi/8$

245. The sum of two positive quantities is equal to 2n. The probability that their product is not less than 3/4 times their greatest product is

(A) $\frac{3}{4}$ (B) $\frac{1}{2}$

(C) $\frac{1}{4}$ (D) None of these

SECTION–2 : (MORE THAN ONE OPTION CORRECT TYPE)

246. A plane through the line $\frac{x+1}{2} = \frac{y-1}{1} = \frac{z}{3}$ has the equation

(A) $x + y - z = 0$ (B) $2x - 7y + z + 9 = 0$

(C) $x + 4y - 2z - 3 = 0$ (D) None of these

247. Let $\hat{\alpha}$, $\hat{\beta}$ and $\hat{\gamma}$ be the unit vectors such that $\hat{\alpha}$ and $\hat{\beta}$ are mutually perpendicular and $\hat{\gamma}$ is equally inclined to $\hat{\alpha}$ and $\hat{\beta}$ at an angle θ. If $\hat{\gamma} = x\hat{\alpha} + y\hat{\beta} + z\left(\hat{\alpha}\times\hat{\beta}\right)$, then

(A) $z^2 = 1 - 2x^2$ (B) $z^2 = 1 - 2y^2$ (C) $z^2 = 1 - x^2 - y^2$ (D) $x^2 = y^2$

248. If a, b, c form an A.P. with common difference d ($\neq 0$) and x, y, z form a G.P. with common ratio r ($\neq 1$), then the area of the triangle with vertices; (a, x), (b, y) and (c, z) is independent of

(A) a (B) b (C) x (D) r

249. The digits A, B, C are such that the three digit numbers A88, 6B8, 86C are divisible by 72, then the determinant $\begin{vmatrix} A & 6 & 8 \\ 8 & B & 6 \\ 8 & 8 & C \end{vmatrix}$ is divisible by

(A) 216 (B) 72

(C) 144 (D) 288

250. If $\vec{a} + 2\vec{b} + 3\vec{c} = 0$, then $\vec{a}\times\vec{b} + \vec{b}\times\vec{c} + \vec{c}\times\vec{a} =$

(A) $2\left(\vec{a}\times\vec{b}\right)$ (B) $6\left(\vec{b}\times\vec{c}\right)$

(C) $3\left(\vec{a}\times\vec{b}\right)$ (D) 0

251. Which of the following is/are orthogonal matrix

(A) $\begin{bmatrix} \frac{\sqrt{3}}{2} & \frac{1}{2} \\ -\frac{1}{2} & \frac{\sqrt{3}}{2} \end{bmatrix}$ (B) $\begin{bmatrix} \frac{1}{2} & \frac{\sqrt{3}}{2} & 0 \\ -\frac{\sqrt{3}}{2} & \frac{1}{2} & 0 \\ 0 & 0 & 1 \end{bmatrix}$

(C) $\begin{bmatrix} 0 & -1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ (D) $\begin{bmatrix} \sqrt{3} & 1 & 0 \\ -1 & \sqrt{3} & 0 \\ 0 & 0 & 1 \end{bmatrix}$

252. If $\vec{a}$ and $\vec{b}$ are two vectors such that $|\vec{a}+\vec{b}| - |\vec{a}-\vec{b}| = 0$, then which of the following case(s) is/are true

(A) $\vec{a}$ is perpendicular to $\vec{b}$ (B) either $\vec{a}$ or $\vec{b}$ is $\vec{0}$

(C) $\vec{a} + \vec{b}$ must be equal to $\vec{a} - \vec{b}$ (D) None of these

253. The det $\Delta = \begin{vmatrix} d^2+r & de & df \\ de & e^2+r & ef \\ df & ef & f^2+r \end{vmatrix}$ is divisible by

(A) r^2 (B) $(d + e^2 + f^2 + r)$

(C) $(d^2 + e^2 + f^2 + r)$ (D) $(d^2 + e + f^2 + r^2)$

254. Let $\phi_1(x) = x + a_1$, $\phi_2(x) = x^2 + b_1x + b_2$ and $\Delta = \begin{vmatrix} 1 & 1 & 1 \\ \phi_1(x_1) & \phi_1(x_2) & \phi_1(x_3) \\ \phi_2(x_1) & \phi_2(x_2) & \phi_2(x_3) \end{vmatrix}$, then

(A) Δ is independent of a_1 (B) Δ is independent of b_1 and b_2

(C) Δ is independent of x_1, x_2 and x_3 (D) None of these

255. If $\Delta = \begin{vmatrix} x & 2y-z & -z \\ y & 2x-z & -z \\ y & 2y-z & 2x-2y-z \end{vmatrix}$, then

(A) $x - y$ is a factor of Δ (B) $(x - y)^2$ is a factor of Δ

(C) $(x - y)^3$ is a factor of Δ (D) Δ is independent of z

256. Let $\Delta = \begin{vmatrix} \sin\theta\cos\phi & \sin\theta\sin\phi & \cos\theta \\ \cos\theta\cos\phi & \cos\theta\sin\phi & -\sin\theta \\ -\sin\theta\sin\phi & \sin\theta\cos\phi & 0 \end{vmatrix}$, then

(A) Δ is independent of θ (B) Δ is indepedent of ϕ

(C) Δ is a constant (D) $\left.\dfrac{d\Delta}{d\theta}\right]_{\theta=\pi/2} = 0$

257. Let $\Delta = \begin{vmatrix} a & -1 & 0 \\ ax & a & -1 \\ ax^2 & ax & a \end{vmatrix}$, then

(A) $x + a$ is a factor of Δ (B) $(x + a)^2$ is a factor of Δ

(C) $(x + a)^3$ is a factor of Δ (D) $(x + a)^4$ is not a factor of Δ

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

(A) $1 - x^3$ is a factor of Δ (B) $(1 - x^3)^2$ is factor of Δ

(C) $\Delta(x) = 0$ has 4 real roots (D) $\Delta'(1) = 0$

259. The determinent $\Delta = \begin{vmatrix} b & c & b\alpha+c \\ c & d & c\alpha+d \\ b\alpha+c & c\alpha+d & a\alpha^3-c\alpha \end{vmatrix}$ is equal to zero if

(A) b, c, d are in A.P. (B) b, c, d are in G.P.

(C) b, c, d are in H.P. (D) α is a root of $ax^3 - bx^2 - 3cx - d = 0$

260. The rank of the matrix $\begin{bmatrix} -1 & 2 & 5 \\ 2 & -4 & a-4 \\ 1 & -2 & a+1 \end{bmatrix}$ is :

(A) 2 if a = 6 (B) 2 if a = 1 (C) 1 if a = 2 (D) 1 if a = – 6

261. Which of the following statement is always true

(A) Adjoint of a symmetric matrix is a symmetric matrix
(B) Adjoint of a unit matrix is unit matrix
(C) A (adj A) = (adj A) A
(D) Adjoint of a diagonal matrix is diagonal matrix

262. Matrix $\begin{bmatrix} a & b & (a\alpha - b) \\ b & c & (b\alpha - c) \\ 2 & 1 & 0 \end{bmatrix}$ is non invertible if

(A) $\alpha = 1/2$ (B) a, b, c are in A.P.
(C) a, b, c are in G.P. (D) a, b, c are in H.P.

263. The singularity of matrix $\begin{bmatrix} 1 & a & a^2 \\ \cos(p-d)x & \cos px & \cos(p+d)x \\ \sin(p-d)x & \sin px & \sin(p+d)x \end{bmatrix}$ depends upon which of the following parameter

(A) a (B) p (C) x (D) d

264. Which of the following statement is true

(A) Every skew symmetric matrix of odd order is non singular
(B) If determinant of a square matrix is nonzero, then it non singular
(C) Rank of a matrix is equal or higher than the order of the matrix
(D) Adjoint of a singular matrix is always singular

265. If A = $\begin{bmatrix} a & b \\ c & d \end{bmatrix}$ (where $bc \neq 0$) satisfies the equations $x^2 + k = 0$, then

(A) a + d = 0 (B) k = – |A| (C) k = |A| (D) none of these

266 If $A^{-1} = \begin{bmatrix} 1 & -1 & 0 \\ 0 & -2 & 1 \\ 0 & 0 & -1 \end{bmatrix}$, then

(A) | A | = 2 (B) A is non-singular
(C) Adj. A = $\begin{bmatrix} 1/2 & -1/2 & 0 \\ 0 & -1 & 1/2 \\ 0 & 0 & -1/2 \end{bmatrix}$ (D) A is skew symmetric matrix

267. If $\vec{a}$, $\vec{b}$, $\vec{c}$ & $\vec{d}$ are linearly independent set of vectors & $K_1\vec{a} + K_2\vec{b} + K_3\vec{c} + K_4\vec{d}$ = 0 then:

(A) $K_1 + K_2 + K_3 + K_4 = 0$ (B) $K_1 + K_3 = K_2 + K_4 = 0$
(C) $K_1 + K_4 = K_2 + K_3 = 0$ (D) None of these

268. Given three vectors $\vec{a}$, $\vec{b}$, $\vec{c}$ such that they are non – zero, non – coplanar vectors, then which of the following are coplanar.

(A) $\vec{a} + \vec{b}$, $\vec{b} + \vec{c}$, $\vec{c} + \vec{a}$ (B) $\vec{a} - \vec{b}$, $\vec{b} + \vec{c}$, $\vec{c} + \vec{a}$
(C) $\vec{a} + \vec{b}$, $\vec{b} - \vec{c}$, $\vec{c} + \vec{a}$ (D) $\vec{a} + \vec{b}$, $\vec{b} - \vec{c}$, $\vec{c} - \vec{a}$

269. Let $\vec{p} = 2\hat{i} + 3\hat{j} + a\hat{k}$, $\vec{q} = b\hat{i} + 5\hat{j} - \hat{k}$ & $\vec{r} = \hat{i} + \hat{j} + 3\hat{k}$. If $\vec{p}, \vec{q}, \vec{r}$ are coplanar and $\vec{p} \cdot \vec{q}$ = 20, a & b have the values:

(A) 1, 3 (B) 9, 7 (C) 5, 5 (D) 13, 9

270. If $\vec{z}_1 = a\hat{i} + b\hat{j}$ & $\vec{z}_2 = c\hat{i} + d\hat{j}$ are two vectors in $\hat{i}$ & $\hat{j}$ system where $|\vec{z}_1| = |\vec{z}_2|$ = r & $\vec{z}_1 \cdot \vec{z}_2$ = 0 then $\vec{w}_1 = a\hat{i} + c\hat{j}$ & $\vec{w}_2 = b\hat{i} + d\hat{j}$ satisfy:

(A) $|\vec{w}_1|$ = r (B) $|\vec{w}_2|$ = r (C) $\vec{w}_1 \cdot \vec{w}_2$ = 0 (D) None of these

271. If $\vec{a}$ & $\vec{b}$ are two non colinear unit vectors & $\vec{a}, \vec{b}, x\vec{a} - y\vec{b}$ form a triangle, then:

(A) x = – 1; y = 1 & $|\vec{a} + \vec{b}| = 2\cos\left(\frac{\vec{a}\,\hat{}\,\vec{b}}{2}\right)$

(B) x = – 1; y = 1 & $\cos\left(\vec{a}\,\hat{}\,\vec{b}\right) + |\vec{a} + \vec{b}|\cos\left[\vec{a}, \hat{-}(\vec{a} + \vec{b})\right] = -1$

(C) $|\vec{a} + \vec{b}| = -2\cot\left(\frac{\vec{a}\,\hat{}\,\vec{b}}{2}\right)\cos\left(\frac{\vec{a}\,\hat{}\,\vec{b}}{2}\right)$ & x = – 1, y = 1

(D) none

272. The value(s) of $\alpha \in [0, 2\pi]$ for which vector $\vec{a} = \hat{i} + 3\hat{j} + (\sin 2\alpha)\hat{k}$ makes an obtuse angle with the Z-axis and the vectors $\vec{b} = (\tan\alpha)\hat{i} - \hat{j} + 2\sqrt{\sin\frac{\alpha}{2}}\,\hat{k}$ and $\vec{c} = (\tan\alpha)\hat{i} + (\tan\alpha)\hat{j} - 3\sqrt{\operatorname{cosec}\frac{\alpha}{2}}\,\hat{k}$ are orthogonal, is/are:

(A) $\tan^{-1} 3$ (B) $\pi - \tan^{-1} 2$ (C) $\pi + \tan^{-1} 3$ (D) $2\pi - \tan^{-1} 2$

273. A parallelogram is constructed on the vectors $\vec{p}$ & $\vec{q}$. A vector which coincides with the altitude of the parallelogram & perpendicular to the side $\vec{p}$ expressed in terms of the vectors $\vec{p}$ & $\vec{q}$ is:

(A) $\vec{q} - \frac{\vec{q} \cdot \vec{p}}{(\vec{p})^2}\vec{p}$ (B) $\frac{(\vec{p} \times \vec{q}) \times \vec{p}}{\vec{p}^2}$ (C) $\frac{\vec{q} \cdot \vec{p}}{\vec{p}^2}\vec{p} - \vec{q}$ (D) $\frac{\vec{p} \times (\vec{p} \times \vec{q})}{\vec{p}^2}$

274. Identify the statement(s) which is/are incorrect?

(A) $\vec{a} \times \left[\vec{a} \times (\vec{a} \times \vec{b})\right] = (\vec{a} \times \vec{b})(\vec{a}^2)$

(B) If $\vec{a}, \vec{b}, \vec{c}$ are non coplanar vectors and $\vec{v} \cdot \vec{a} = \vec{v} \cdot \vec{b} = \vec{v} \cdot \vec{c} = 0$ then $\vec{v}$ must be a null vector

(C) If $\vec{a}$ and $\vec{b}$ lie in a plane normal to the plane containing the vectors $\vec{c}$ and $\vec{d}$ then $(\vec{a} \times \vec{b}) \times (\vec{c} \times \vec{d}) = 0$

(D) If $\vec{a}, \vec{b}, \vec{c}$ and $\vec{a}', \vec{b}', \vec{c}'$ are reciprocal system of vectors then $\vec{a} \cdot \vec{b}' + \vec{b} \cdot \vec{c}' + \vec{c} \cdot \vec{a}' = 3$

275. If $a = \hat{i} + 2\hat{j} + 4\hat{k}$, $\vec{b} = 2\hat{i} - 3\hat{j} + \hat{k}$, $\vec{c} = \hat{i} + 4\hat{j} - 4\hat{k}$, then the vector $\vec{a} \times (\vec{b} \times \vec{c})$ is orthogonal to:

(A) $\vec{a}$ (B) $\vec{b}$ (C) $\vec{c}$ (D) $\vec{a} + \vec{b} + \vec{c}$

276. If $\vec{a}$, $\vec{b}$, $\vec{c}$ are non-zero, non-collinear vectors such that a vector $\vec{p}$ = a b $\cos\left(2\pi - (\vec{a} \wedge \vec{b})\right)\ \vec{c}$ and a vector $\vec{q}$ = a c $\cos\left(\pi - (\vec{a} \wedge \vec{c})\right)\ \vec{b}$ then $\vec{p} + \vec{q}$ is

(A) parallel to $\vec{a}$ (B) perpendicular to $\vec{a}$

(C) coplanar with $\vec{b}$ & $\vec{c}$ (D) none of these

277. Which of the following statement(s) is/are true?

(A) If $\vec{n} \cdot \vec{a} = 0$, $\vec{n} \cdot \vec{b} = 0$ & $\vec{n} \cdot \vec{c} = 0$ for some non zero vector $\vec{n}$, then $\left[\vec{a}\ \vec{b}\ \vec{c}\right] = 0$

(B) there exist a vector having direction angles $\alpha = 30°$ & $\beta = 45°$

(C) locus of point for which x = 3 & y = 4 is a line parallel to the z - axis whose distance from the z axis is 5

(D) the vertices of a regular tetrahedron are OABC where ' O ' is the origin. The vector $\vec{OA} + \vec{OB} + \vec{OC}$ is perpendicular to the plane ABC.

278. In a ΔABC, let M be the mid point of segment AB and let D be the foot of the bisector of $\angle$C. Then the ratio $\dfrac{\text{Area } \Delta \text{ CDM}}{\text{Area } \Delta \text{ ABC}}$ is:

(A) $\dfrac{1}{4}\dfrac{a-b}{a+b}$ (B) $\dfrac{1}{2}\dfrac{a-b}{a+b}$

(C) $\dfrac{1}{2}\tan\dfrac{A-B}{2}\cot\dfrac{A+B}{2}$ (D) $\dfrac{1}{4}\cot\dfrac{A-B}{2}\tan\dfrac{A+B}{2}$

279. The vectors $\vec{a}$, $\vec{b}$, $\vec{c}$ are of the same length & pairwise form equal angles. If $\vec{a} = \hat{i} + \hat{j}$ & $\vec{b} = \hat{j} + \hat{k}$ the pv's of $\vec{c}$ can be:

(A) (1, 0, 1) (B) $\left(-\dfrac{4}{3}, \dfrac{1}{3}, -\dfrac{4}{3}\right)$ (C) $\left(\dfrac{1}{3}, -\dfrac{4}{3}, \dfrac{1}{3}\right)$ (D) $\left(-\dfrac{1}{3}, \dfrac{4}{3}, -\dfrac{1}{3}\right)$

280. Equation of the plane passing through A(x_1, y_1, z_1) and containing the line $\dfrac{x - x_2}{d_1} = \dfrac{y - y_2}{d_2} = \dfrac{z - z_2}{d_3}$ is

(A) $\begin{vmatrix} x - x_1 & y - y_1 & z - z_1 \\ x_2 - x_1 & y_2 - y_1 & z_2 - z_1 \\ d_1 & d_2 & d_3 \end{vmatrix} = 0$ (B) $\begin{vmatrix} x - x_2 & y - y_2 & z - z_2 \\ x_1 - x_2 & y_1 - y_2 & z_1 - z_2 \\ d_1 & d_2 & d_3 \end{vmatrix} = 0$

(C) $\begin{vmatrix} x - d_1 & y - d_2 & z - d_3 \\ x_1 & y_1 & z_1 \\ x_2 & y_2 & z_2 \end{vmatrix} = 0$ (D) $\begin{vmatrix} x & y & z \\ x_1 - x_2 & y_1 - y_2 & z_1 - z_2 \\ d_1 & d_2 & d_3 \end{vmatrix} = 0$

281. The equations of the line of shortest distance between the lines

$\frac{x}{2} = \frac{y}{-3} = \frac{z}{1}$ and $\frac{x-2}{3} = \frac{y-1}{-5} = \frac{z-2}{2}$ are

(A) $3(x - 21) = 3y + 92 = 3z - 32$

(B) $\frac{x-(62/3)}{1/3} = \frac{y+31}{1/3} = \frac{z-(31/3)}{1/3}$

(C) $\frac{x-21}{1/3} = \frac{y+(92/3)}{1/3} = \frac{z-(32/3)}{1/3}$

(D) $\frac{x-2}{1/3} = \frac{y+3}{1/3} = \frac{z-1}{1/3}$

282. A line passes through a point A with p.v. $3\hat{i} + \hat{j} - \hat{k}$ & is parallel to the vector $2\hat{i} - \hat{j} + 2\hat{k}$. If P is a point on this line such that AP = 15 units, then the p.v. of the point P is:

(A) $13\hat{i} + 4\hat{j} - 9\hat{k}$

(B) $13\hat{i} - 4\hat{j} + 9\hat{k}$

(C) $7\hat{i} - 6\hat{j} + 11\hat{k}$

(D) $-7\hat{i} + 6\hat{j} - 11\hat{k}$

283. The equations of the planes through the origin which are parallel to the line

$\frac{x-1}{2} = \frac{y+3}{-1} = \frac{z+1}{-2}$ and at a distance $\frac{5}{3}$ from it are

(A) $2x + 2y + z = 0$

(B) $x + 2y + 2z = 0$

(C) $2x - 2y + z = 0$

(D) $x - 2y + 2z = 0$

284. The value(s) of k for which the equation $x^2 + 2y^2 - 5z^2 + 2kyz + 2zx + 4xy = 0$ represents a pair of planes passing through origin is/are

(A) 2 (B) – 2 (C) 6 (D) – 6

285. The equation of lines AB is $\frac{x}{2} = \frac{y}{-3} = \frac{2}{6}$. Through a point P(1, 2, 5), line PN is drawn perpendicular to AB and line PQ is drawn parallel to the plane $3x + 4y + 5z = 0$ to meet AB is Q. Then

(A) coordinate of N is $\left(\frac{52}{49}, -\frac{78}{49}, \frac{156}{49}\right)$

(B) the coordinates of Q is $\left(3, -\frac{9}{2}, 9\right)$

(C) the equation of PN is $\frac{x-1}{3} = \frac{y-2}{-176} = \frac{z-5}{-89}$

(D) the equation of PQ is $\frac{x-1}{4} = \frac{y-2}{-13} = \frac{z-5}{8}$

286. Let a perpendicular PQ be drawn from P (5, 7, 3) to the line $\frac{x-15}{3} = \frac{y-29}{8} = \frac{z-5}{-5}$ when Q is the foot. Then

(A) Q is (9, 13, – 15)

(B) PQ = 14

(C) the equation of plane containing PQ and the given line is $9x - 4y - z - 14 = 0$

(D) none of these

287. In throwing a die let A be the event 'coming up of an odd number', B be the event 'coming up of an even number', C be the event 'coming up of a number ≥ 4' and D be the event 'coming up of a number < 3', then

(A) A and B are mutually exclusive and exhautive

(B) A and C are mutually exclusive and exhautive

(C) A, C and D form an exhautive system

(D) B, C and D form an exhautive system

288. Let $0 < P(A) < 1$, $0 < P(B) < 1$ & $P(A \cup B) = P(A) + P(B) - P(A).P(B)$, then:

(A) $P(B/A) = P(B) - P(A)$

(B) $P(A^C \cup B^C) = P(A^C) + P(B^C)$

(C) $P((A \cup B)^C) = P(A^C).P(B^C)$

(D) $P(A/B) = P(A)$

289. For any two events A & B defined on a sample space,

(A) $P(A/B) \geq \frac{P(A) + P(B) - 1}{P(B)}$, $P(B) \neq 0$ is always true

(B) $P(A \cup \overline{B}) = P(A) - P(A \cap B)$

(C) $P(A \cup B) = 1 - P(A^c).P(B^c)$, if A & B are independent

(D) $P(A \cup B) = 1 - P(A^c).P(B^c)$, if A & B are disjoint

290. If A, B & C are three events, then the probability that none of them occurs is given by:

(A) $P(\overline{A}) + P(B) + P(C) - P(A \cap B) - P(B \cap C) - P(A \cap C) + P(A \cap B \cap C)$

(B) $P(\overline{A}) + P(\overline{B}) + P(\overline{C})$

(C) $P(\overline{A}) - P(B) - P(C) + P(A \cap B) + P(B \cap C) + P(C \cap A) - P(A \cap B \cap C)$

(D) $P(\overline{A} \cup \overline{B} \cup \overline{C}) - P(A) - P(B) - P(C) + P(A \cap B) + P(B \cap C) + P(C \cap A)$

291. A student appears for tests I, II & III. The student is successful if he passes either in tests I & II or tests I & III. The probabilities of the student passing in the tests I, II & III are p, q & 1/2 respectively. If the probability that the student is successful is 1/2, then:

(A) $p = 1, q = 0$

(B) $p = 2/3, q = 1/2$

(C) $p = 3/5, q = 2/3$

(D) there are infinitely many values of p & q.

SECTION–3 : (COMPREHENSION TYPE)

COMPREHENSION-1

Paragraph for Questions Nos. 292 to 294

Letters of word TITANIC are arranged to form all the possible anagrams. What is the probability that anagrams (words) will have

292. Both T together

(A) $\frac{1}{7}$ (B) $\frac{2}{7}$ (C) $\frac{5}{7}$ (D) $\frac{6}{7}$

293. Starting letter T and ending with A

(A) $\frac{2}{15}$ (B) $\frac{3}{16}$ (C) $\frac{1}{21}$ (D) None of these

294. Starting letter as either T or vowel

(A) $\frac{4}{7}$ (B) $\frac{5}{7}$ (C) $\frac{6}{7}$ (D) $\frac{3}{7}$

COMPREHENSION-2

Paragraph for Questions Nos. 295 to 297

A and B are square matrices of order 3 given by $A = \begin{bmatrix} 1 & -3 & 2 \\ 2 & k & 5 \\ 4 & 2 & 1 \end{bmatrix}$, $B = \begin{bmatrix} 2 & 1 & 3 \\ 4 & 2 & 4 \\ 3 & 3 & 5 \end{bmatrix}$.

295. If matrix A is singular matrix, then value of k is

(A) 5 (B) – 8 (C) 8 (D) – 5

296. If k = 2, then tr(AB) is equal to

(A) 66 (B) 42 (C) 84 (D) 63

297. If C = A – B and tr(C) = 0, then k is equal to

(A) 5 (B) – 5 (C) 7 (D) – 7

COMPREHENSION-3

Paragraph for Questions Nos. 298 to 300

Two lines whose equations are $\frac{x-3}{2} = \frac{y-2}{3} = \frac{z-1}{\lambda}$ and $\frac{x-2}{3} = \frac{y-3}{2} = \frac{z-2}{3}$ lie in the same plane, then

298. The value of $\sin^{-1}\sin\lambda$ is equal to

(A) 3 (B) $\pi - 3$ (C) 4 (D) $\pi - 4$

299. Point of intersection of the lines lies on

(A) $3x + y + z = 20$ (B) $3x + y + z = 25$

(C) $3x + 2y + z = 24$ (D) None of these

300. Equation of plane containing both lines

(A) $x + 5y - 3z = 10$ (B) $x + 6y + 5z = 20$

(C) $x + 6y - 5z = 10$ (D) None of these

COMPREHENSION-4

Paragraph for Questions Nos. 301 to 303

Each question contains 4 statements, each statement is either true or false. You have to tick the correct order of sequence. If you tick the alternative marked as TFFT it would mean that 1st is true, 2nd and 3rd false and 4th is true.

301. A and B are symmetric matrices of same order then

Statement (1): A + B is skew–symmetric

Statement (2): AB – BA is skew–symmetric

Statement (3): AB + BA is skew–symmetric

Statement (4): A – B is skew–symmetric

(A) TFTF (B) FTFT (C) TTTT (D) FTFF

302. Statement (1): if A and B are symmetric then AB is symmetric $\Leftrightarrow$ A and B commute

Statement (2): if A is symmetric, then B^TAB is symmetric

Statement (3): All positive odd integral power of skew-symmetric matrix are symmetric

Statement (4): All positive even integral power of skew-symmetric matrix are symmetric

(A) TFTF (B) FFFF (C) TTFT (D) TFFF

303. The matrix which commute with A = $\begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$

Statement (1): Are always singular

Statement (2): Are always non-singular

Statement (3): Are always symmetric

Statement (4): Are always of the form $\begin{bmatrix} x & y \\ 0 & x \end{bmatrix}$, where x and y are variable,

(A) FFFF (B) TFTF (C) FTFT (D) FFFT

COMPREHENSION-5

Paragraph for Questions Nos. 304 to 306

T is the region of the plane x + y + z = 1 with x, y, z > 0. S is the set of points (a, b, c) in T such that just two of the following three inequalities hold: $a \le \frac{1}{2}$, $b \le \frac{1}{3}$, $c \le \frac{1}{6}$.

304. Area of the region T is

(A) $\frac{\sqrt{3}}{4}$ (B) $\frac{\sqrt{3}}{2}$ (C) $\sqrt{3}$ (D) none of these

305. Area of the region S is

(A) $\frac{\sqrt{3}}{72}$ (B) $\frac{7\sqrt{3}}{36}$ (C) $\frac{\sqrt{3}}{4}$ (D) None of these

306. The difference of the region T and region S consists of

(A) three parallelograms (B) three equilateral triangles

(C) three rectangles (D) none of these

COMPREHENSION # 06

Paragraph for Questions Nos. 307 to 309

There are four boxes A_1, A_2, A_3 and A_4. Box A_i has i cards and on each card a number is printed, the numbers are from 1 to i. A box is selected randomly, the probability of selection of box A_i is $\frac{i}{10}$ and then a card is drawn. Let E_i represents the event that a card with number 'i' is drawn.

307. $P(E_1)$ is equal to

(A) $\frac{1}{5}$ (B) $\frac{1}{10}$ (C) $\frac{2}{5}$ (D) $\frac{1}{4}$

308. $P(A_3/E_2)$ is equal to

(A) $\frac{1}{4}$ (B) $\frac{1}{3}$

(C) $\frac{1}{2}$ (D) $\frac{2}{3}$

309. Expectation of the number on the card is

(A) 2 (B) 2.5

(C) 3 (D) 3.5

COMPREHENSION # 07

Paragraph for Questions Nos. 310 to 312

Sania Mirza is to play with Sharapova in a three set match. For a particular set, the probability of Sania winning the set is y and if she wins probability of her winning the next set becomes $\sqrt{y}$ else the probability that she wins the next one becomes y^2. There is no possibility that a set is to be abondoned. R is probability that Sania wins the first set.

310. If R = $\frac{1}{2}$ then the probability that match will end in first two sets is nearly equal to

(A) 0.73 (B) 0.95

(C) 0.51 (D) 0.36

311. If R = $\frac{1}{2}$ and Sania wins the second set probability that she has won first set as well is equal to

(A) 0.74 (B) 0.46

(C) 0.26 (D) 0.54

312. If Sania looses the first set then the values of R such that her probability of winning the match is still larger than that of her loosing is given by

(A) $R \in \left(\frac{1}{2}, 1\right)$ (B) $R \in \left(\left(\frac{1}{2}\right)^{\frac{1}{3}}, 1\right)$

(C) $R \in \left(\left(\frac{1}{2}\right)^{3/2}, 1\right)$ (D) no values of R

COMPREHENSION # 08

Paragraph for Questions Nos. 313 to 315

If a pair of fair and ubaised dice are rolled randomly. The events A, B, C, D, E, F are as follows :

A : getting an even number on the first die.
B : getting an odd number on the first die.
C : getting the sum of numbers on the dice ≤ 5.
D : getting the sum of numbers on the dice > 5 and less than 10.
E : getting the sum of numbers on the dice ≥ 10.
F : getting an odd number on exactly one of the dice.

Make your choice to the most appropriate answer on the basics of above information.

313. Which one of the following is **CORRECT**?
(A) A and C are mutually exclusive
(B) A, B, F are mutually exclusive and exchausive events
(C) A and F are mutually exclusive
(D) $B \subset F$

314. P(E/F) equals
(A) $\frac{1}{6}$ (B) $\frac{2}{27}$ (C) $\frac{1}{9}$ (D) $\frac{2}{9}$

315. P(A/C) =
(A) $\frac{1}{5}$ (B) $\frac{2}{5}$ (C) $\frac{3}{5}$ (D) $\frac{3}{4}$

COMPREHENSION # 09

Paragraph for Questions Nos. 316 to 318

Consider the experiment of distribution of balls among urns. Suppose we are given M urns, numbered 1 to M, among which we are to distribute n balls (n < M). Let P(A) denote the probability that each of the urns numbered 1 to n will contain exactly one ball. Then answer the following questions.

316. If the balls are different and any number of balls can go to any urns, then P(A) is equal to
(A) $\frac{M!}{n^M}$ (B) $\frac{n!}{M^n}$
(C) $\frac{n!}{{}^MP_n}$ (D) $\frac{1}{M^n}$

317. If the balls are identical and any number of balls can go to any urns, then P(A) equals
(A) $\frac{1}{M^n}$ (B) $\frac{1}{{}^{M+n-1}C_{M-1}}$
(C) $\frac{1}{{}^{M+n-1}C_{n-1}}$ (D) $\frac{1}{{}^{M+n-1}P_{M-1}}$

318. If the balls are identical but atmost one ball can be put in any box, then P(A) is equal to
(A) $\frac{1}{{}^MP_n}$ (B) $\frac{n!}{{}^nC_M}$ (C) $\frac{n!}{{}^MC_n}$ (D) $\frac{1}{{}^MC_n}$

COMPREHENSION # 10

Paragraph for Questions Nos. 319 to 321

If $\vec{a}$, $\vec{b}$, $\vec{c}$ are non-zero and non-coplanar vectors and $\vec{a}' = \frac{\vec{b}\times\vec{c}}{[\vec{a}\ \vec{b}\ \vec{c}]}$, $\vec{b}' = \frac{\vec{c}\times\vec{a}}{[\vec{a}\ \vec{b}\ \vec{c}]}$ and $\vec{c}' = \frac{\vec{a}\times\vec{b}}{[\vec{a}\ \vec{b}\ \vec{c}]}$, then

$\vec{a}'$, $\vec{b}'$, $\vec{c}'$ are said to form the reciprocal system of the system of vectors $\vec{a}$, $\vec{b}$, $\vec{c}$.

319. $[\vec{a}\ \vec{b}\ \vec{c}'] =$

(A) 0 (B) 1 (C) $\frac{|\vec{a}\times\vec{b}|}{[\vec{a}\ \vec{b}\ \vec{c}]}$ (D) $\frac{|\vec{a}\times\vec{b}|^2}{[\vec{a}\ \vec{b}\ \vec{c}]}$

320. $[\vec{a}\ \vec{b}'\ \vec{c}'] =$

(A) 0 (B) 1 (C) $\frac{\vec{a}^2}{[\vec{a}\ \vec{b}\ \vec{c}]}$ (D) $\frac{|\vec{a}|}{[\vec{a}\ \vec{b}\ \vec{c}]}$

321. $[\vec{a}+\vec{b}\ \ \vec{b}+\vec{c}\ \ \vec{c}+\vec{a}] =$

(A) $[\vec{a}\ \vec{b}\ \vec{c}]$ (B) $[\vec{a}'\ \vec{b}'\ \vec{c}']$ (C) $\frac{2}{[\vec{a}'\ \vec{b}'\ \vec{c}']}$ (D) $2[\vec{a}'\ \vec{b}'\ \vec{c}']$

COMPREHENSION # 11

Paragraph for Questions Nos. 322 to 324

Let $\vec{a} = 2\hat{i}+3\text{j}-6\hat{k}$, $\vec{b} = 2\hat{i}-3\hat{j}+6\hat{k}$ and $\vec{c} = -2\hat{i}+3\hat{j}+6\hat{k}$. Let $\vec{a}_1$ be projection of $\vec{a}$ on $\vec{b}$ and $\vec{a}_2$ be the projection of $\vec{a}_1$ on $\vec{c}$. then

322. $\vec{a}_2 =$

(A) $\frac{943}{49}(2\hat{i}-3\hat{j}-6\hat{k})$ (B) $\frac{943}{49^2}(2\hat{i}-3\hat{j}-6\hat{k})$

(C) $\frac{943}{49}(-2\hat{i}+3\hat{j}+6\hat{k})$ (D) $\frac{943}{49^2}(-2\hat{i}+3\hat{j}+6\hat{k})$

323. $\vec{a}_1 . \vec{b} =$

(A) -41 (B) $-\frac{41}{7}$

(C) 41 (D) 287

324. Which of the following is true.

(A) $\vec{a}$ and $\vec{a}_2$ are collinear (B) $\vec{a}_1$ and $\vec{c}$ are collinear

(C) $\vec{a}$, $\vec{a}_1$, $\vec{b}$ are coplanar (D) $\vec{a}$, $\vec{a}_1$, $\vec{a}_2$ are coplanar

COMPREHENSION # 12

Paragraph for Questions Nos. 325 to 327

ABCD is a parallelogram . L is a point on BC which divides BC in the ratio 1 : 2. AL intersects BD at P. M is a point on DC which divides DC in the ratio 1 : 2 and AM intesects BD in Q

325. Point P divides AL in the ratio

(A) 1 : 2 (B) 1 : 3

(C) 3 : 1 (D) 2 : 1

326. Point Q divides DB in the ratio

(A) 1 : 2 (B) 1 : 3

(C) 3 : 1 (D) 2 : 1

327. PQ : DB =

(A) 2/3 (B) 1/3

(C) 1/2 (D) 3/4

COMPREHENSION # 13

Paragraph for Questions Nos. 328 to 330

Three vector $\vec{a}$, $\vec{b}$ and $\vec{c}$ are forming a right handed system, if $\vec{a}\times\vec{b}=\vec{c}$, $\vec{b}\times\vec{c}=\vec{a}$, $\vec{c}\times\vec{a}=\vec{b}$. If vectors $\vec{a}$, $\vec{b}$ and $\vec{c}$ are forming a right handed system, then answer the following question

328. If vector $3\vec{a}-2\vec{b}+2\vec{c}$ and $-\vec{a}-2\vec{c}$ are adjacent sides of a parallelogram the angle between the diagonal is

(A) $\frac{\pi}{4}$ (B) $\frac{\pi}{3}$

(C) $\frac{\pi}{2}$ (D) $\frac{2\pi}{3}$

329. If $\vec{x}=\vec{a}+\vec{b}-\vec{c}$, $\vec{y}=-\vec{a}+\vec{b}-2\vec{c}$, $\vec{z}=-\vec{a}+2\vec{b}-\vec{c}$, then a unit vector normal to the vectors $\vec{x}+\vec{y}$ and $\vec{y}+\vec{z}$ is

(A) $\vec{a}$ (B) $\vec{b}$

(C) $\vec{c}$ (D) none of these

330. Vectors $2\vec{a}-3\vec{b}+4\vec{c}$, $\vec{a}+2\vec{b}-\vec{c}$ and $x\vec{a}-\vec{b}+2\vec{c}$ are coplanar, then x =

(A) $\frac{8}{5}$ (B) $\frac{5}{8}$

(C) 0 (D) 1

COMPREHENSION # 13

Paragraph for Questions Nos. 331 to 333

Let a point P whose position vector is $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$ is called Lattice point if x, y, z $\in$ N. If atleast two of x, y, z are equal then this Lattice point is called isosceles Lattice point. If all x, y, z are equal then this Lattice point is called equilateral Lattice point.

331. The number of Lattice points on the plane $\vec{r}.(\hat{i} + \hat{j} + \hat{k}) = 10$ are

(A) 36 (B) 45 (C) 84 (D) 120

332. If a Lattice point is selected at random from Lattice points which satisfy $\vec{r}.(\hat{i} + \hat{j} + \hat{k}) \le 11$, then the probability that the selected Lattice point is equilateral given that it is isosceles Lattice point is

(A) $\frac{1}{22}$ (B) $\frac{1}{23}$

(C) $\frac{2}{33}$ (D) $\frac{5}{22}$

333. Area of triangle formed by the isosceles Lattice points lying on the plane $\vec{r}.(\hat{i} + \hat{j} + \hat{k}) = 4$ is

(A) $2\sqrt{2}$ (B) $\sqrt{2}$

(C) $\frac{\sqrt{3}}{2}$ (D) $\frac{3}{2}\sqrt{2}$

COMPREHENSION # 14

Paragraph for Questions Nos. 334 to 336

Let AB be the st.line $\frac{x}{2} = \frac{y}{-3} = \frac{z}{6}$. From the point P(1, 2, 5) perpendicular PN is drawn to AB, where N is the foot of perpendicular. A st.line PQ is drawn parallel to the plane 3x + 4y + 5z = 0 to meet AB in Q. Then.

334. Coordinates of N are

(A) $\left(\frac{52}{49}, \frac{78}{49}, \frac{156}{49}\right)$ (B) $\left(-\frac{52}{49}, \frac{78}{49}, \frac{156}{49}\right)$

(C) $\left(\frac{52}{49}, \frac{-78}{49}, \frac{156}{49}\right)$ (D) $\left(\frac{52}{49}, \frac{78}{49}, \frac{-156}{49}\right)$

335. Coordinates of Q are

(A) (3, –9/2, 9) (B) (–3, 9/2, 9)

(C) (3, 9/2, –9) (D) None

336. Equation of PQ is

(A) $\frac{x-1}{4} = \frac{2-y}{13} = \frac{z-5}{8}$ (B) $\frac{x-1}{4} = \frac{y-2}{13} = \frac{z-5}{8}$

(C) $\frac{x-1}{4} = \frac{y-2}{13} = \frac{5-z}{8}$ (D) $\frac{x-1}{-4} = \frac{y-2}{13} = \frac{z-5}{8}$

COMPREHENSION # 15

Paragraph for Questions Nos. 337 to 339

Intersection of a sphere by a plane is called circular section.

(i) If the plane intersects the sphere in more than one different points, than the section is called a circle.

(ii) If the circle of section is of greatest possible radius , then the circle is called great circle.

(iii) If the radius of circular section is zero, then the section is a point circle.

(iv) If the plane does not meet the sphere at all, then the section is an imaginary circle.

337. Sphere $x^2 + y^2 + z^2 = 4$ intersected by the plane $2x + 3y + 6z + 7 = 0$ is

(A) a great circle
(B) a real circle but not great
(C) a point circle
(D) an imaginary circle

338. Sphere $x^2 + y^2 + z^2 – 2x + 4y + 6z – 17 = 0$ interected by the plane $3x – 4y + 2z – 5 = 0$ is

(A) a great circle
(B) a real circle but not great
(C) a point circle
(D) an imaginary circle

339. The sphere $x^2 + y^2 + z^2 + 2x + 6y – 8z – 1 = 0$ intersected by the plane $x + 2y – 3z – 7 = 0$ is

(A) a great circle
(B) a real circle but not great
(C) a point circle
(D) an imaginary circle

COMPREHENSION # 16

Paragraph for Questions Nos. 340 to 342

Let $a_1x + b_1y + c_1z + d_1 = 0$ and $a_2x + b_2y + c_2z + d_2 = 0$ be two planes, where $d_1, d_2 > 0$. Then origin lies in acute angle if $a_1a_2 + b_1b_2 + c_1c_2 < 0$ and origin lies in obtuse angle if $a_1a_2 + b_1b_2 + c_1c_2 > 0$.
Further point (x_1, y_1, z_1) and origin both lie either in acute angle or in obtuse angle , if one of (x_1, y_1, z_1) and origin lie in acute angle and the other in obtuse angle, if

$$(a_1x_1 + b_1y_1 + c_1z_1 + d_1)(a_2x_1 + b_2y_1 + c_2z_1 + d_2) < 0$$

340. Given the planes $2x + 3y – 4z + 7 = 0$ and $x – 2y + 3z – 5 = 0$, if a point P is (1, – 2, 3), then

(A) O and P both lie in acute angle between the planes
(B) O and P both lie in obtuse angle
(C) O lies in acute angle, P lies in obtuse angle.
(D) O lies in obtue angle, P lies an acute angle.

341. Given the planes $x + 2y – 3z + 5 = 0$ and $2x + y + 3z + 1 = 0$. If a point P is (2, –1, 2), then

(A) O and P both lie in acute angle between the planes
(B) O and P both lie in obtuse angle
(C) O lies in acute angle, P lies in obtuse angle.
(D) O lies in obtue angle, P lies an acute angle.

342. Given the planes $x + 2y – 3z + 2 = 0$ and $x – 2y + 3z + 7 = 0$, if the point P is (1, 2, 2), then

(A) O and P both lie in acute angle between the planes
(B) O and P both lie in obtuse angle
(C) O lies in acute angle, P lies in obtuse angle.
(D) O lies in obtue angle, P lies an acute angle.

COMPREHENSION # 17

Paragraph for Questions Nos. 343 to 345

A tetrahedron is a triangular pyramid. If position vector of all the vertices of tetrahedron are $\vec{a}, \vec{b}, \vec{c}$ and $\vec{d}$, then position vector of centroid of $\frac{\vec{a}+\vec{b}+\vec{c}+d}{4}$. If $\overrightarrow{AB}$, $\overrightarrow{AC}$, $\overrightarrow{AD}$ are adjacent sides of tetrahedron, then volume of tetrahedron is $\frac{1}{6}\left|\left[\overrightarrow{AB}\ \overrightarrow{AC}\ \overrightarrow{AD}\right]\right|$

343. In a regular tetrahedron angle between two opposite edges is

(A) $\frac{\pi}{3}$ (B) $\frac{\pi}{6}$ (C) $\frac{2\pi}{3}$ (D) $\frac{\pi}{2}$

344. In a regular tetrahedron if the distance between centroid and midpoint of any age of tetrahedron is equal to

(A) $\frac{1}{3}$ (edge of tetrahedron) (B) $\frac{1}{2\sqrt{2}}$ (edge of tetrahedron)

(C) $\frac{1}{2}$ (edge of tetrahedron) (D) $\frac{1}{3\sqrt{2}}$ (edge of tetrahedron)

345. If vector $\vec{a}, \vec{b}, \vec{c}, \vec{d}$ are four vectors whose magnitudes are equal to area of the faces of a tetrahedron and directions perpendicular and outward directions to the faces respectively then

(A) $\vec{a}+\vec{b}+\vec{c}+\vec{d} = 0$ (B) $\vec{a}+\vec{b} = \vec{c}+\vec{d}$

(C) $\vec{a}+\vec{c} = \vec{b}+\vec{d}$ (D) None of these

COMPREHENSION # 18

Paragraph for Questions Nos. 346 to 348

Consider the determinant

$$\Delta = \begin{vmatrix} a_1 & a_2 & a_3 \\ b_1 & b_2 & b_3 \\ d_1 & d_2 & d_3 \end{vmatrix}$$

M_{ij} = Minor of the element of i^{th} row and j^{th} column
C_{ij} = Cofactor of the element of i^{th} row and j^{th} column

346. Value of $b_1 . C_{31} + b_2 . C_{32} + b_3 . C_{33}$ is
(A) 0 (B) Δ (C) 2Δ (D) Δ^2

347. If all the elements of the determinant are multiplied by 2, then the value of new determinant is
(A) 0 (B) 8Δ (C) 2Δ (D) $2^9 . \Delta$

348. $a_3 M_{13} - b_3 . M_{23} + d_3 . M_{33}$ is equal to
(A) 0 (B) 4Δ
(C) 2Δ (D) Δ

COMPREHENSION # 19

Paragraph for Questions Nos. 349 to 351

$\begin{vmatrix} 0 & 2 & 3 \\ -2 & p & 5 \\ q & -5 & 0 \end{vmatrix}$ is a skew symmetric determinant then

349. Value of p is

(A) – 3 (B) 0 (C) 3 (D) 1

350. Value of determinant is

(A) 2 (B) 0 (C) – 2 (D) 1

351. Value of p – 2q is

(A) 3 (B) – 3 (C) – 6 (D) 6

COMPREHENSION # 20

Paragraph for Questions Nos. 352 to 354

Let A be a m × n matrix. If there exists a matrix L of type n × m such that LA = I_n, then L is called left inverse of A. Similarly, if there exists a matrix R of type n × m such that AR = I_m, then R is called right inverse of A.

For example to find right inverse of matrix

$$A = \begin{bmatrix} 1 & -1 \\ 1 & 1 \\ 2 & 3 \end{bmatrix} \text{ we take } R = \begin{bmatrix} x & y & z \\ u & v & w \end{bmatrix}$$

and solve AR = I_3 i.e.

$$\begin{bmatrix} 1 & -1 \\ 1 & 1 \\ 2 & 3 \end{bmatrix} \begin{bmatrix} x & y & z \\ u & v & w \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$\Rightarrow$ x – u = 1 y – v = 0 z – w = 0

x + u = 0 y + v = 1 z + w = 0

2x + 3u = 0 2y + 3v = 0 2z + 3w = 1

As this system of equations is inconsistent, we say there is no right inverse for matrix A.

352. Which of the following matrices is NOT left inverse of matrix $\begin{bmatrix} 1 & -1 \\ 1 & 1 \\ 2 & 3 \end{bmatrix}$

(A) $\begin{bmatrix} \frac{1}{2} & \frac{1}{2} & 0 \\ -\frac{1}{2} & \frac{1}{2} & 0 \end{bmatrix}$ (B) $\begin{bmatrix} 2 & -7 & 3 \\ -\frac{1}{2} & \frac{1}{2} & 0 \end{bmatrix}$ (C*) $\begin{bmatrix} -\frac{1}{2} & \frac{1}{2} & 0 \\ -\frac{1}{2} & \frac{1}{2} & 0 \end{bmatrix}$ (D) $\begin{bmatrix} 0 & 3 & -1 \\ -\frac{1}{2} & \frac{1}{2} & 0 \end{bmatrix}$

353. The number of right inverses for the matrix $\begin{bmatrix} 1 & -1 & 2 \\ 2 & -1 & 1 \end{bmatrix}$

(A) 0 (B) 1 (C) 2 (D*) infinite

354. For which of the following matrices number of left inverses is greater than the number of right inverses

(A) $\begin{bmatrix} 1 & 2 & 4 \\ -3 & 2 & 1 \end{bmatrix}$

(B) $\begin{bmatrix} 3 & 2 & 1 \\ 3 & 2 & 1 \end{bmatrix}$

(C) $\begin{bmatrix} 1 & 4 \\ 2 & -3 \\ 5 & 4 \end{bmatrix}$

(D) $\begin{bmatrix} 3 & 3 \\ 1 & 1 \\ 4 & 4 \end{bmatrix}$

COMPREHENSION # 21

Paragraph for Questions Nos. 355 to 357

Consider the determinant, $\Delta = \begin{vmatrix} p & q & r \\ x & y & z \\ \ell & m & n \end{vmatrix}$

M_{ij} denotes the minor of an element in i^{th} row and j^{th} column
C_{ij} denotes the cofactor of an element in i^{th} row and j^{th} column

355. The value of $p \cdot C_{21} + q \cdot C_{22} + r \cdot C_{23}$ is

(A) 0
(B) $-\Delta$
(C) Δ
(D) Δ^2

356. The value of $x \cdot C_{21} + y \cdot C_{22} + z \cdot C_{23}$ is

(A) 0
(B) $-\Delta$
(C) Δ
(D) Δ^2

357. The value of $q \cdot M_{12} - y \cdot M_{22} + m \cdot M_{32}$ is

(A) 0
(B) $-\Delta$
(C) Δ
(D) Δ^2

COMPREHENSION # 22

Paragraph for Questions Nos. 358 to 359

Read the following write up carefully and answer the following questions:

Let S = set of triplets (A, B, C) where A, B, C are subsets of {1,2,3,......, n}. E_1 = events that a selected triplet at random from set S will satisfy $A \cap B \cap C = \phi, A \cap B = \phi, B \cap C = \phi$. $E_2 =$ events that a selected triplet at random from set S will satisfy $A \cap B \cap C = \phi, A \cap B = \phi, B \cap C = \phi, A \cap C = \phi$. $P(\in)$ represents probability of an event E then -

358. $P(E_1)$ is equal to -

(A) $\frac{7^n - 6^n + 5^n}{8^n}$

(B) $\frac{7^n - 2 \times 6^n + 5^n}{8^n}$

(C) $\frac{7^n - 2 \times 6^n}{8^n}$

(D) $\frac{7^n - 2 \times 6^n + 5^n}{8^n}$

359. $P(E_2)$ is equal to-

(A) $\frac{7^n - 3 \times 6^n + 5^n}{8^n}$

(B) $\frac{7^n - 3 \times 6^n + 3 \times 5^n - 4^n}{8^n}$

(C) $\frac{7^n - 2 \times 6^n + 2 \times 5^n - 4^n}{8^n}$

(D) $\frac{7^n - 6^n + 5^n - 4^n}{8^n}$

SECTION-4: (MATRIX MATCH TYPE)

360. Match the followings -

	Column - I		Column - II
(A)	Sum of square of the direction cosines of line is	(P)	0
(B)	All the points on the z-axis have their x and y coordinate equal to	(Q)	1
(C)	Distance between the points (1,3,2) and (2, 3, 1) is	(R)	0
(D)	Shortest distance between the lines $\frac{x-6}{1} = \frac{y-2}{-2} = \frac{z-2}{2}$ and $\frac{x+4}{3} = \frac{y}{-2} = \frac{z+1}{-2}$ is	(S)	$\sqrt{2}$

361. Match the following:

	Column – I		Column – II
(A)	If a, b > 0 a + b = 1, then minimum value of $\left(a^2 + \frac{1}{a^2}\right)^2 + \left(b^2 + \frac{1}{b^2}\right)^2$ is	(p)	$\frac{3}{2}$
(B)	The perpendicular distance of the image of the point (3, 4 –12) in the xy-plane from the z-axis is	(q)	5
(C)	The area of the quadrilateral whose vertices are 1, i, ω, $i\omega$ is	(r)	$\frac{27}{4}$
(D)	The minimum value of $(\sin^2 x + \cos^2 x + \text{cosec}^2 2x)^3$ is	(s)	$\frac{289}{8}$

362. Match the following:

List – I	List – II
(A) Lines with direction ratios (1, – c, – b), (– c, – 1, – a) and (–b, – a, 1) are coplanar then $a^2 + b^2 + c^2 + 2abc$ is	(i) –1
(B) If the lines x = ay + 1, x = by + 2 and x = cy + 3, z = dy + 4 are perpendicular then ac + bd is equal to	(ii) 1
(C) If (a, b, c) lies on a plane which form ΔABC with axes whose centroid lies on (α, β, γ) then $\frac{a}{\alpha} + \frac{b}{\beta} + \frac{c}{\gamma}$ is equal to	(iii) 3
(D) Let [.] denotes the greatest integer less than or equal to x, then $f(x) = [x \sin \pi x]$ is not differentiable if x =	(iv) 0
	(v) 2

363. Match the following:

List – I	List – II
(A) If the line $\frac{x-1}{1}=\frac{y+1}{-2}=\frac{z+1}{\lambda}$ lies in the plane 3x – 2y + 5z = 0, then x is equal to	(i) $\sin^{-1}\sqrt{\frac{6}{25}}$
(B) If (3, λ, μ) is a point on the line 2x + y + z – 3 = 0 = x – 2y + z – 1, then $\lambda + \mu$ is equal to	(ii) $-\frac{7}{5}$
(C) The angle between the line x = y = z and the plane 4x – 3y + 5z = 2 is	(iii) – 3
(D) The angle between the planes x + y + z = 0 and 3x – 4y + 5z = 0 is	(iv) $\cos^{-1}\sqrt{\frac{8}{75}}$

364. Match the following:

List – I	List – II
(A) $\vec{a}, \vec{b}$ unit vectors and $\vec{a}+2\vec{b} \perp 5\vec{a}-4\vec{b}$, then $2(\vec{a}\cdot\vec{b})$ is equal to	(i) 0
(B) The points (1, 0, 3), (–1, 3, 4), (1, 2, 1), (k, 2, 5) are coplanar, then k =	(ii) – 1
(C) The vectors (1, 1, m), (1, 1, m + 1), (1, –1, m) are coplanar, then number of values of m is	(iii) 1
(D) $\vec{a}\times(\vec{b}\times\vec{c})+\vec{b}\times(\vec{c}\times\vec{a})+\vec{i}\times(\vec{a}\times\vec{b})$ is equal to	(iv) 2

365. **Match the following**

Column - I		**Column - II**	
(a)	The remainder when $(81)^{8^8}$ is divided by 26 is equal to	(P)	6
(b)	If $\sum_{r=1}^{8} \frac{r \cdot 2^r}{(r+2)!} = 1 - \frac{2^{p+1}}{q!}$, then $\frac{p+q}{6}$ is equal to	(Q)	5
(c)	If the number of 3 digit natural numbers in which no digit is smaller than a digit to its left is 33 k, then value of k is	(R)	4
(d)	If ten different things are distributed among 3 persons, the chance that a particular person received more then 7 things is $\frac{67k}{2.3^{10}}$, then value of k is	(S)	3

366. **Match the following**

Column - I		**Column - II**	
(a)	One ball is drawn from a bag containing 4 balls and is found to be white. The events that the bag contains "1 white", "2 white", "3 white" and "4 white" are equaly likely. If the probability that all the balls are white is $\frac{p}{15}$, then the value of p is	(P)	9
(b)	From a set of 12 persons, if the number of different selection of a committee, its chair person and its secretary (possibly same as chair person) is 13.2^{10} m, then value of m is	(Q)	3
(c)	If x, y, z > 0 and x + y + z = 1, then the least value of $\frac{5x}{2-x} + \frac{5y}{2-y} + \frac{5z}{2-z}$ is	(R)	12
(d)	If $\sum_{k=1}^{12} 12k.\, {}^{12}C_k . {}^{11}C_{k-1}$ is equal to $\frac{12 \times 21 \times 19 \times 17 \times ... \times 3}{11!} \times 2^{12} \times p$, then the value of p is	(S)	6

367. **Match the following**

	Column - I		Column - II
(a)	The number of five - digit numbers having the product of digits 20 is	(P)	77
(b)	A man took 5 space plays out of an engine to clean them. The number of ways in which he can place atleast two plays in the engine from where they came out is	(Q)	31
(c)	The number of integer between 1 & 1000 inclusive in which atleast two consecutive digits are equal is	(R)	50
(d)	The value of $\frac{1}{15}\sum_{1\le i\le j\le 9}\sum i\,.\,j$	(S)	181

368. **Match the following**

	Column - I		Column - II
(a)	A is a real skew symmetric matrix such that $A^2 + I = 0$. Then	(P)	BA – AB
(b)	A is a matrix such that $A^2 = A$. If $(I + A)^n = I + \lambda A$, then λ equals	(Q)	A is of even order
(c)	If for a matrix A, $A^2 = A$, and $B = I - A$, then $AB + BA + I - (I - A)^2$ equals	(R)	A
(d)	A is a matrix with complex entries and A* stands for transpose of complex conjugate of A. If A* = A & B* = B, then (AB – BA)* equals	(S)	$2^n - 1$

369. **Match the following**

	Column - I		Column - II
(a)	Let $\lvert A\rvert = \lvert a_{ij}\rvert_{3\times 3} \ne 0$. Each element a_{ij} is multiplied by k^{i-j}. Let $\lvert B\rvert$ the resulting determinant, where $k_1\lvert A\rvert + k_2\lvert B\rvert = 0$. Then $k_1 + k_2 =$	(P)	0
(b)	The maximum value of a third order determinant each of its entries are ± 1 equals	(Q)	4
(c)	$\begin{vmatrix} 1 & \cos\alpha & \cos\beta \\ \cos\alpha & 1 & \cos\gamma \\ \cos\beta & \cos\gamma & 1 \end{vmatrix} = \begin{vmatrix} 0 & \cos\alpha & \cos\beta \\ \cos\alpha & 0 & \cos\beta \\ \cos\beta & \cos\gamma & 0 \end{vmatrix}$ if $\cos^2\alpha + \cos^2\beta + \cos^2\gamma =$	(R)	1
(d)	$\begin{vmatrix} x^2+x & x+1 & x-2 \\ 2x^2+3x-1 & 3x & 3x-3 \\ x^2+2x+3 & 2x-1 & 2x-1 \end{vmatrix} = Ax + B$ where A and B are determinants of order 3. Then A + 2B =	(S)	2

370. **Let** $\vec{a} = 2\hat{i} - 3\hat{j} + 6\hat{k}$, $\vec{b} = -2\hat{i} + 2\hat{j} - \hat{k}$ if $\vec{a} = \lambda\vec{b} + \mu\,\hat{c}$ where $\hat{c}$ is perpendicular to $\vec{b}$, then

Column - I		**Column - II**
(A)	Magnitude of projection of $\vec{a}$ on $\vec{b}$ is	(p) $\frac{16}{7}$
(B)	Magnitude of projection of $\vec{b}$ on $\vec{a}$ is	(q) $\frac{16}{3}$
(C)	Value of $\|\lambda\|$ is	(r) $\frac{\sqrt{185}}{3}$
(D)	Value of $\|\mu\|$ is	(s) $\frac{16}{9}$

371. **Match the column**

Column - I			**Column - II**
(A)	If $\vec{a} + \vec{b} = \hat{j}$ and $2\vec{a} - \vec{b} = 3\hat{i} + \frac{\hat{j}}{2}$, then cosine of the angle between $\vec{a}$ and $\vec{b}$ is	(p)	1
(B)	If $\|\vec{a}\| = \|\vec{b}\| = \|\vec{c}\|$, angle between each pair of vectors is $\frac{\pi}{3}$ and $\|\vec{a} + \vec{b} + \vec{c}\| = \sqrt{6}$, then $\|\vec{a}\| =$	(q)	$5\sqrt{3}$
(C)	Area of the parallelogram whose diagonals represent the vectors $3\hat{i} + \hat{j} - 2\hat{k}$ and $\hat{i} - 3\hat{j} + 4\hat{k}$ is	(r)	7
(D)	If $\vec{a}$ is perpendicular to $\vec{b} + \vec{c}$, $\vec{b}$ is perpendicular to $\vec{c} + \vec{a}$, $\vec{c}$ is perpendicular to $\vec{a} + \vec{b}$, $\|\vec{a}\| = 2$, $\|\vec{b}\| = 3$ and $\|\vec{c}\| = 6$, then $\|\vec{a} + \vec{b} + \vec{c}\| =$	(s)	$-\frac{3}{5}$

372. **Match the column**

Column – I			**Column – II**
(A)	The area of the triangle whose vertices are the points with ractangular cartesian coordinates (1, 2, 3), (–2, 1, –4), (3, 4, –2) is	(p)	0
(B)	The value of $(\vec{a} \times \vec{b}) \cdot (\vec{c} \times \vec{d}) + (\vec{b} \times \vec{c}) \cdot (\vec{a} \times \vec{d}) + (\vec{c} \times \vec{a}) \cdot (\vec{b} \times \vec{d})$ is	(q)	1
(C)	A square PQRS of side length P is folded along the diagonal PR so that planes PRQ and PRS are perpendicular to one another, the shortest distance between PQ and RS is $\frac{P}{k\sqrt{2}}$, then k =	(r)	$\frac{\sqrt{1218}}{2}$
(D)	$\vec{a} = 2\hat{i} + 3\hat{j} - \hat{k}$, $\vec{b} = -\hat{i} + 2\hat{j} - 4\hat{k}$, $\vec{c} = \hat{i} + \hat{j} + \hat{k}$ and $\vec{d} = 3\hat{i} + 2\hat{j} + \hat{k}$ then $(\vec{a} \times \vec{b}) \cdot (\vec{c} \times \vec{d}) =$	(s)	21

373. **Column – I** **Column – II**

The lines

(A) $\frac{x-1}{2} = \frac{y-2}{3} = \frac{z-3}{4}$ and $\frac{x-1}{3} = \frac{y-3}{4} = \frac{z-5}{5}$ are

(B) $\frac{x-1}{2} = \frac{y-2}{3} = \frac{z-3}{4}$ and $\frac{x-3}{2} = \frac{y-5}{3} = \frac{z-7}{4}$ are

(C) $\frac{x-2}{5} = \frac{y+3}{4} = \frac{5-z}{2}$ and $\frac{x-7}{5} = \frac{y-1}{4} = \frac{z-2}{-2}$ are

(D) $\frac{x-3}{2} = \frac{y+2}{3} = \frac{z-4}{5}$ and $\frac{x-3}{3} = \frac{y-2}{2} = \frac{z-7}{5}$ are

(p) coincident

(q) Parallel and different

(r) skew

(s) Intersecting in a point

374. **Column – I** **Column – II**

(A) Foot of perp. drawn for point (1, 2, 3) to the line $\frac{x-2}{2} = \frac{y-1}{3} = \frac{z-2}{4}$ is

(B) Image of line point (1, 2, 3) in the line $\frac{x-2}{2} = \frac{y-1}{3} = \frac{z-2}{4}$ is

(C) Foot of perpendicular from the point (2, 3, 5) to the plane 2x + 3y – 4z + 17 = 0 is

(D) Image of the point (2, 5, 1) in the plane 3x – 2y + 4z – 5 = 0 is

(p) $\left(\frac{107}{29}, \frac{30}{29}, \frac{69}{29}\right)$

(q) $\left(\frac{88}{29}, \frac{125}{29}, \frac{69}{29}\right)$

(r) $\left(\frac{68}{29}, \frac{44}{29}, \frac{78}{29}\right)$

(s) $\left(\frac{38}{29}, \frac{57}{29}, \frac{185}{29}\right)$

375. Find the rank of the following matrices:

Column – I		**Column – II**	
(i)	$\begin{bmatrix} 1 & 2 & 3 & 2 \\ 2 & 3 & 5 & 1 \\ 1 & 3 & 4 & 5 \end{bmatrix}$	**(p)**	**1**
(ii)	$\begin{bmatrix} 1 & 2 & -1 & 3 \\ 4 & 1 & 2 & 1 \\ 3 & -1 & 1 & 2 \\ 1 & 2 & 0 & 1 \end{bmatrix}$	(q)	2
(iii)	$\begin{bmatrix} 1 & 3 & 4 & 3 \\ 3 & 9 & 12 & 3 \\ 1 & 3 & 4 & 1 \end{bmatrix}$	**(r)**	**3**
(iv)	$\begin{bmatrix} 0 & 1 & -3 & -1 \\ 1 & 0 & 1 & 1 \\ 3 & 1 & 0 & 2 \\ 1 & 1 & -2 & 0 \end{bmatrix}$	(s)	4

SECTION-5: (INTEGER TYPE)

376. A pack of playing cards was found to contain only 51 cards. If the first 13 cards which are examined are all black, If P is the probability that the missed one is red. Then the value of 3P is _________

377. A is a 4 × 4 matrix with $a_{11} = 1 + x_1$, $a_{22} = 1 + x_2$, $a_{33} = 1 + x_3$, $a_{44} = 1 + x_4$ and all other entries 1, where x_i are the roots of $n^4 - n^2 + 1 = 0$. The value of det(A) is ___________

378. The number of diagonal matrices of order 3 satisfying $A^2 = A$ is _________

379. The distance between the image of (8, –8, 2) in the plane 3x – y + 4z = 1 and the point of intersection of the line $\frac{x-2}{3} = \frac{y+1}{4} = \frac{z-2}{12}$ with the plane x – y + z = 5 is ___________

380. If $|\vec{a}| = 2, |\vec{b}| = 3,$ and $|\vec{c}| = 4$ then $|\vec{a}-\vec{b}|^2 + |\vec{b}-\vec{c}|^2 + |\vec{c}-\vec{a}|^2$ cannot exceed ________

381. If $\vec{\alpha} = \hat{i} + 2\hat{j} + 3\hat{k}$; $\vec{\beta} = 2\hat{i} - \hat{j} + \hat{k}$; $\vec{\gamma} = 3\hat{i} + 2\hat{j} + \hat{k}$ and $\vec{\alpha} \times (\vec{\beta} \times \vec{\gamma}) = p\vec{\alpha} + q\vec{\beta} + r\vec{\gamma}$ then find the value of p+ q-r

382. If $\vec{a} = 2\hat{i} - 3\hat{j} + \hat{k}$, $\vec{b} = \hat{i} - \hat{j} + 2\hat{k}$, $\vec{c} = 2\hat{i} + \hat{j} - \hat{k}$ & $\vec{d} = 3\hat{i} - \hat{j} - 2\hat{k}$ then find the absolute value of $(\vec{a} \times \vec{b}) \times (\vec{a} \times \vec{c}).\vec{d}$

383. It is given that $\vec{x} = \frac{\vec{b} x \vec{c}}{[\vec{a}\vec{b}\vec{c}]}$; $\vec{y} = \frac{\vec{c} x \vec{a}}{[\vec{a}\vec{b}\vec{c}]}$; $\vec{z} = \frac{\vec{a} x \vec{b}}{[\vec{a}\vec{b}\vec{c}]}$ where $\vec{a}, \vec{b}, \vec{c}$ are non – coplanar vectors. Find the value of $\vec{x}.(\vec{a}+\vec{b}) + \vec{y}.(\vec{b}+\vec{c}) + \vec{z}.(\vec{c}+\vec{a})$:

384. A letter is known to have come either from London or Clifton; on the postmark only the two consecutive letters ON are legible; the chance that it came from London is p. Find 1001p?

385. A speaks the truth 3 out of 4 times, and B 5 out of 6 times; the probability that they will contradict each other in stating the same fact is p,find 120p?

386. If on a straight line 10 cm. two length of 6 cm and 4 cm are measured at random, the probability that their common part does not exceed 3 cms is p. Find 48p?

387. A car is parked by an owner amongst 25 cars in a row, not at either end. On his return he finds that exactly 15 placed are still occupied. the probability that both the neighbouring places are emptyis p find 92p.

388. A gambler has one rupee in his pocket. He tosses an unbiased normal coin unless either he is ruined or unless the coin has been tossed for a maximum of five times. If for each head he wins a rupee and for each tail he looses a rupee, then the probability that the gambler is ruined is p find 80p.

389. Mr. Dupont is a professional wine taster. When given a French wine, he will identify it with probability 0.9 correctly as French, and will mistake it for a Californian wine with probability 0.1. When given a Californian wine, he will identify it with probability 0.8 correctly as Californian, and will mistake it for a French wine with probability 0.2. Suppose that Mr. Dupont is given ten unlabelled glasses of wine, three with French and seven with Californian wines. He randomly picks a glass, tries the wine and solemnly says. “French”. the probability that the wine he tasted was Californian is p/q(where p,q are relatively prime).find p+q

390. In ten trials of an experiment, if the probability of getting '4 successes’ is maximum, then the probability of failure in each trial can be equal to p/q(where p,q are relatively prime).find p+q

391. In a Nigerian hotel, among the english speaking people 40% are English & 60% Americans. The English & American spellings are **"RIGOUR" & "RIGOR"** respectively. An English speaking person in the hotel writes this word. A letter from this word is chosen at random & found to be a vowel.the probability that the writer is an Englishman is p/q(where p,q are relatively prime),find p+q.

392. The odds that a book will be favorably reviewed by three independent critics are 5 to 2, 4 to 3, and 3 to 4 respectively : the probability that of the three reviews a majority will be favourable is p/q(where p,q are relatively prime),find q-p?

393. If A, B, C are angles of a triangle ABC, then $8\begin{vmatrix} \sin\frac{A}{2} & \sin\frac{B}{2} & \sin\frac{C}{2} \\ \sin(A+B+C) & \sin\frac{B}{2} & \cos\frac{A}{2} \\ \cos\frac{(A+B+C)}{2} & \tan(A+B+C) & \sin\frac{C}{2} \end{vmatrix}$ is less than or equal to :

394. If $\begin{vmatrix} (b+c)^2 & a^2 & a^2 \\ b^2 & (c+a)^2 & b^2 \\ c^2 & c^2 & (a+b)^2 \end{vmatrix}$ = k abc (a + b + c)^3 then the value of k is

395. Find The distance of the point of intersection of the line x – 3 = (1/2) (y–4) = (1/2) (z–5) and the plane x + y + z = 17 from the point (3, 4, 5)

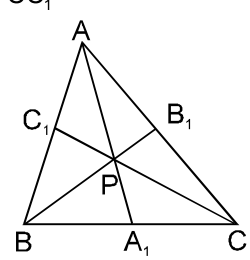
396. A, B are two inaccurate arithmeticians whose chance of solving a given question correctly are $\frac{1}{8}$ and $\frac{1}{12}$ respectively; if they obtain the same result, and if it is 1000 to 1 against their making the same mistake, the chance that the result is correct is p/q.Find p+q?

397. The value of $\left[\vec{d}\ \vec{b}\ \vec{c}\right]\vec{a} + \left[\vec{d}\ \vec{c}\ \vec{a}\right]\vec{b} + \left[\vec{d}\ \vec{a}\ \vec{b}\right]\vec{c} - \vec{d}\left[\vec{a}\ \vec{b}\ \vec{c}\right]$ is equal to:

398. The system of linear equations x + y – z = 6, x + 2y – 3z = 14 and 2x + 5y – λz = 9 ($\lambda \in R$) has a unique solution if $\lambda \neq$

399. Let f (θ) = $\begin{vmatrix} \cos^2\theta & \cos\theta\sin\theta & -\sin\theta \\ \cos\theta\sin\theta & \sin^2\theta & \cos\theta \\ \sin\theta & -\cos\theta & 0 \end{vmatrix}$ then f = $\left(\frac{\pi}{6}\right)$:

400. In the adjacent figure 'P' is any arbitrary interior point of the triangle ABC such that the lines AA_1, BB_1 and CC_1 are concurrent at P. Value of $\frac{PA_1}{AA_1} + \frac{PB_1}{BB_1} + \frac{PC_1}{CC_1}$ is always equal to



END OF EXERCISE # 02