1. The unit's place digit in the number $13^{25} + 11^{25} - 3^{25}$ is :
(a) 0 (b) 1
(c) 2 (d) 3

2. The angle of intersection of the curves $y = x^2$, $6y = 7 - x^3$ at (1, 1) is :
(a) $\frac{\pi}{4}$ (b) $\frac{\pi}{3}$
(c) $\frac{\pi}{2}$ (d) none of these

3. The value of x for which the equation
$$1 + r + r^2 + \dots + r^x = (1 + r)(1 + r^2)(1 + r^4)(1 + r^8)$$
holds is :
(a) 12 (b) 13
(c) 14 (d) 15

4. If $f(x) = \frac{x^2 - 1}{x^2 + 1}$, for every real number x; then minimum value of $f(x)$:
(a) does not exist (b) is equal to 1
(c) is equal to 0 (d) is equal to -1

5. The value of a for which the sum of the squares of the roots of the equation
$$x^2 - (a - 2)x - a - 1 = 0$$
assumes the least value is :
(a) 0 (b) 1
(c) 2 (d) 3

6. A particle is dropped under gravity from rest from a height h ($g = 9.8$ m/s^2) and it travels a distance $\frac{9h}{25}$ in the last second the height h is :
(a) 100 m (b) 122.5 m
(c) 145 m (d) 167.5 m

7. The number of onto mappings from the set $A = \{1, 2, \dots, 100\}$ to set $B = \{1, 2\}$ is :
(a) $2^{100} - 2$ (b) 2^{100}
(c) $2^{99} - 2$ (d) 2^{99}

8. Which of the following functions is inverse of itself ?
(a) $f(x) = \frac{1 - x}{1 + x}$ (b) $f(x) = 3^{\log x}$
(c) $f(x) = 3^{x(x+1)}$ (d) none of these

9. If $f(x) = \log (x + \sqrt{x^2 + 1})$, then $f(x)$ is :
(a) even function (b) odd function
(c) periodic function (d) none of these

10. The solution of $\log_{99} \{\log_2 (\log_3 x)\} = 0$ is :
(a) 4 (b) 9
(c) 44 (d) 99

11. If $n = 1000!$, then the value of sum $\frac{1}{\log_2 n} + \frac{1}{\log_3 n} + \dots + \frac{1}{\log_{1000} n}$ is :
(a) 0 (b) 1
(c) 10 (d) 10^3

12. If ω and ω^2 are the two imaginary cube roots of unity, then the equation whose roots are $a\omega^{317}$ and $a\omega^{382}$ is :
(a) $x^2 + ax - a^2 = 0$ (b) $x^2 + a^2 x + a = 0$
(c) $x^2 + ax + a^2 = 0$ (d) $x^2 - a^2 x + a = 0$

13. The value of
$$1 + \sum_{k=0}^{14} \left\{\cos \frac{(2k+1)}{15} \pi + i \sin \frac{(2k+1)}{15} \pi\right\}$$ is :
(a) 0 (b) -1
(c) 1 (d) i

14. If $1, a_1, a_2, \dots, a_{n-1}$ are roots of unity, then the value of $(1 - a_1)(1 - a_2) \dots (1 - a_{n-1})$ is :
(a) 0 (b) 1
(c) n (d) n^2

15. If α, β are the roots of $ax^2 + bx + c = 0$, $\alpha + h, \beta + h$ are roots of $px^2 + qx + r = 0$; and D_1, D_2 are the respective discriminants of these equations, then $D_1 : D_2$ is equal to :
(a) $\frac{a^2}{p^2}$ (b) $\frac{b^2}{q^2}$
(c) $\frac{c^2}{r^2}$ (d) none of these

16. If a, b, c are three unequal numbers such that a, b, c are in AP and $b - a, c - b, a$ are in GP, then $a : b : c$ is :
(a) 1 : 2 : 3 (b) 1 : 3 : 4
(c) 2 : 3 : 4 (d) 1 : 2 : 4

17. The number of divisors of 3×7^3, 7×11^2 and 2×61 are in :
(a) AP (b) GP
(c) HP (d) none of these

18. Suppose a, b, c are in AP and $|a|, |b|, |c| < 1$. If
$x = 1 + a + a^2 + \dots$ to ∞,
$y = 1 + b + b^2 + \dots$ to ∞,
$z = -1 + c + c^2 + \dots$ to ∞
then x, y, z are in :
(a) AP (b) GP
(c) HP (d) none of these

35. The length of perpendicular from (1, 6, 3) to the line $\frac{x}{1} = \frac{y-1}{2} = \frac{z-2}{3}$ is :

(a) 3 (b) $\sqrt{11}$

(c) $\sqrt{13}$ (d) 5

36. The plane $2x + 3y + 4z = 1$ meets the coordinate axes in A, B, C. The centroid of the triangle ABC is :

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

(c) $\left(\frac{1}{6}, \frac{1}{9}, \frac{1}{12}\right)$ (d) $\left(\frac{1}{2}, \frac{3}{3}, \frac{3}{4}\right)$

37. The vector equation of the sphere whose centre is the point (1, 0, 1) and radius is 4, is :

(a) $|\vec{r} - (\hat{i} + \hat{k})| = 4$ (b) $|\vec{r} + (\hat{i} + \hat{k})| = 4^2$

(c) $\vec{r}\,(\hat{i} + \hat{k}) = 4$ (d) $\vec{r}\,(\hat{i} + \hat{k}) = 4^2$

38. The plane $2\lambda x - (1 + \lambda)y + 3z = 0$ passes through the intersection of the planes :

(a) $2x - y = 0$ and $y + 3z = 0$

(b) $2x - y = 0$ and $y - 3z = 0$

(c) $2x + 3z = 0$ and $y = 0$

(d) none of the above

39. If $\vec{a} + \vec{b} + \vec{c} = \vec{0}$ and $|\vec{a}| = \sqrt{37}, |\vec{b}| = 3, |\vec{c}| = 4,$ then angle between $\vec{b}$ and $\vec{c}$ is :

(a) 30° (b) 45°

(c) 60° (d) 90°

40. If $\vec{a} = \hat{i} + \hat{j} - \hat{k}$, $\vec{b} = -\hat{i} + \hat{k}$, $\vec{c} = 2\hat{i} + \hat{j}$ the value of λ such that $\vec{a} + \lambda\vec{c}$ is perpendicular to $\vec{b}$ is :

(a) 1 (b) −1

(c) 0 (d) none of these

41. The total work done by two forces $\vec{F}_1 = 2\hat{i} - \hat{j}$ at $\vec{F}_2 = 3\hat{i} + 2\hat{j} - \hat{k}$ acting on a particle when it is displace from the point $3\hat{i} + 2\hat{j} + \hat{k}$ to $5\hat{i} + 5\hat{j} + 3\hat{k}$ is :

(a) 8 unit (b) 9 unit

(c) 10 unit (d) 11 unit

42. Let $\vec{a}, \vec{b}$ and $\vec{c}$ be three non-coplanar vectors, and let $\vec{p}$ and $\vec{r}$ be vectors defined by the relations

$$\vec{p} = \frac{\vec{b} \times \vec{c}}{[\vec{a}\,\vec{b}\,\vec{c}]},\ \vec{q} = \frac{\vec{c} \times \vec{a}}{[\vec{a}\,\vec{b}\,\vec{c}]} \text{ and } \vec{r} = \frac{\vec{a} \times \vec{b}}{[\vec{a}\,\vec{b}\,\vec{c}]}.$$

Then, the value of the expression $(\vec{a} + \vec{b})\cdot\vec{p} + (\vec{b} + \vec{c})\cdot\vec{q} + (\vec{c} + \vec{a})\cdot\vec{r}$ is equal to :

(a) 0 (b) 1

(c) 2 (d) 3

43. If $\begin{vmatrix} x^n & x^{n+2} & x^{n+3} \\ y^n & y^{n+2} & y^{n+3} \\ z^n & z^{n+2} & z^{n+3} \end{vmatrix}$

$$= (y - z)(z - x)(x - y)\left(\frac{1}{x} + \frac{1}{y} + \frac{1}{z}\right),$$

then n is equal to :

(a) 2 (b) − 2

(c) − 1 (d) 1

44. If $a_1, a_2, \ldots, a_n, \ldots$ are in GP and $a_i > 0$ for each i, then determinant

$$\Delta = \begin{vmatrix} \log a_n & \log a_{n+2} & \log a_{n+4} \\ \log a_{n+6} & \log a_{n+8} & \log a_{n+10} \\ \log a_{n+12} & \log a_{n+14} & \log a_{n+16} \end{vmatrix}$$

is equal to :

(a) 0 (b) 1

(c) 2 (d) n

45. The values of a for which the system of equation $x + y + z = 0$, $x + ay + az = 0$, $x - ay + z = 0$, possess non-zero solutions, are given by :

(a) 1, 2 (b) 1 , −1

(c) 1, 0 (d) none of these

46. If a square matrix A is such that $AA^T = I = A^T A$, then $|A|$ is equal to :

(a) 0 (b) ± 1

(c) ± 2 (d) none of these

47. $\int_a^b \frac{|x|}{x} dx$, $a < 0 < b$, is equal to :

(a) $|b| - |a|$ (b) $|b| + |a|$

(c) $|a - b|$ (d) none of these

48. A and B are two events. Odds against A are 2 to 1. Odds in favour of $A \cup B$ are 3 to 1. If $x \le P(B) \le y$, then ordered pair (x, y) is :

(a) $\left(\frac{5}{12}, \frac{3}{4}\right)$ (b) $\left(\frac{2}{3}, \frac{3}{4}\right)$

(c) $\left(\frac{1}{3}, \frac{3}{4}\right)$ (d) none of these