MATHEMATICS

1. Let S be the sum of the first 9 term of the series : $(x+ka\}+(x^2+(k+2)a\}+\{x^3+(k+4)a\}+\{x^4+(k+6)a\}+$ ……… where $a\neq 0$ and $x\neq 1$. If $S=\frac{x^{10}-x+45a(x-1)}{x-1}$, then k is equal to

(a) –3 (b) 1
(c) –5 (d) 3

2. The imaginary part of $(3+2\sqrt{-54})^{\frac{1}{2}}-(3-2\sqrt{-54})^{\frac{1}{2}}$ can be

(a) $\sqrt{-6}$ (b) $\sqrt{6}$
(c) $-2\sqrt{6}$ (d) 6

3. A plane passing through the point (3, 1, 1) contains two lines whose direction rations are 1, –2, 2 and 2, 3, –1 respectively. If this plane also passes through the point $(\alpha,-3,5)$, then α is equal to

(a) 5 (b) 10
(c) –5 (d) –10

4. The equation of the normal to the curve $y=(1+x)^{2y}+cos^2(sin^{-1}x)$ at x = 0 is :

(a) y = 4x + 2 (b) y + 4x = 2
(c) x + 4y = 8 (d) 2y + x = 4

5. $\lim_{x\to 0}\left(tan\left(\frac{\pi}{4}+x\right)\right)^{1/x}$ is equal to

(a) 2 (b) 1
(c) e (d) e^2

6. For some $\theta\in\left(0,\frac{\pi}{2}\right)$, if the eccentricity of the hyperbola $x^2-y^2sec^2\theta=10$ is $\sqrt{5}$ times the eccentricity of the ellipse, $x^2sec^2\theta+y^2=5$, then the length of the latus rectum of the ellipse, is

(a) $\frac{2\sqrt{5}}{3}$ (b) $2\sqrt{6}$
(c) $\frac{4\sqrt{5}}{3}$ (d) $\sqrt{30}$

7. Which of the following is a tautology ?

(a) $(\sim p)\wedge(p\vee q)\to q$ (b) $(q\to p)\vee\sim(p\to q)$
(c) $(\sim p)\vee(p\wedge q)\to q$ (d) $(p\to q)\wedge(q\to p)$

8. Let E^C denote the complement of an event E. Let E_1, E_2 and E_3 be any pairwise independent events with $P(E_1) > 0$ and $P(E_1\cap E_2\cap E_3)=0$ then $(E_3^C\cap E_3^C/E_1)$ is equal to

(a) $P(E_3^C)-P(E_2)$ (b) $P(E_3^C)-P(E_2^C)$
(c) $P(E_3)-P(E_2^C)$ (d) $P(E_2^C)+P(E_3)$

9. Let $A=\{x=(x,y,z)^T:PX=0\ and\ x^2+y^2+z^2=1\}$, where $P=\begin{bmatrix}1&2&1\\-2&3&-4\\1&-&-1\end{bmatrix}$ then the set A :

(a) is a singleton
(b) contains more than two elements
(c) contains exactly two elements
(d) is an ampty set

10. If a curve y = f(x), passing through the point (1, 2), is the solution of the differential equation, $2x^2\mathrm{dy}=(2\mathrm{xy}+\mathrm{y}^2)\mathrm{dx}$, then $f\left(\frac{1}{2}\right)$ is equal to

(a) $\frac{1}{1-log_e 2}$ (b) $1+loge^2$
(c) $\frac{1}{1+log_e 2}$ (d) $\frac{-1}{1+log_e 2}$

11. Let a, b, c ∈ R be all non-zero satisfy $a^3+b^3+c^3=2$. If the matrix $A=\begin{bmatrix}a&b&c\\b&c&a\\c&a&b\end{bmatrix}$ stratifies $A^T A = I$, then a value of abc can be :

(a) $\frac{1}{3}$ (b) $-\frac{1}{3}$
(c) 3 (d) $\frac{2}{3}$

12. If the equation $cos^4\theta+sin^4\theta+\lambda=0$ has real solutions for θ, then λ lies in interval :

(a) $\left(-\frac{5}{4},-1\right)$ (b) $\left[-1,-\frac{1}{2}\right]$
(c) $\left(-\frac{1}{2},-\frac{1}{4}\right]$ (d) $\left[-\frac{3}{2},-\frac{5}{4}\right]$

13. Consider a region $R=\{(x,y)\in R^2:x^2\leq y\leq 2x\}$. If a line y = α divides the area of region R into two equal parts, then which of the following is true ?

(a) $3\alpha^2-8\alpha+8=0$
(b) $\alpha^3-6\alpha^{3/2}-16=0$
(c) $\alpha^3-6\alpha^2+16=0$
(d) $3\alpha^2-8\alpha^{3/2}+8=0$

14. The set of all possible values of θ in the interval (0, π) for which the points (1, 2) and $(\sin\theta, cos\theta)$ lie on the same side of the line x + y = 1 is

(a) $\left(0,\frac{\pi}{2}\right)$ (b) $\left(0,\frac{\pi}{4}\right)$
(c) $\left(\frac{\pi}{4},\frac{3\pi}{4}\right)$ (d) $\left(0,\frac{3\pi}{4}\right)$

15. Let f(x) be a quadratic polynomial such that f(–1) + f(2) = 0. If one of the roots of f(x) = 0 is 3, then its other root lies in :

(a) (1, 3) (b) (–1, 0)
(c) (–3, –1) (d) (0, 1)

16. The area (in sq. units) of an equilateral triangle inscribed in the parabola $y^2=8x$, with one of its vertices on the vertex of this parabola is :

(a) $64\sqrt{3}$ (b) $192\sqrt{3}$
(c) $128\sqrt{3}$ (d) $256\sqrt{3}$

17. Let $f:R\to R$ be a function which satisfies $f(x+y)+f(x)+f(y)\forall x,y\in R$. If f(1) = 2 and $g(n)=\sum_{k=1}^{(n-1)}f(k)$, $n\in N$ then the value of n, for which g(n) = 20, is

(a) 9 (b) 20
(c) 5 (d) 4

18. If the sum of first 11 terms of an A.P., a_1,a_2,a_3 ……. is 0 $(a_1\neq 0)$, then the sum of the A.P., $a_1,a_3,a_{5,}\ldots\ldots a_{23}$ is ka_1, where k is equal to :

(a) $\frac{121}{10}$ (b) $-\frac{121}{10}$
(c) $-\frac{72}{5}$ (d) $\frac{72}{5}$

19. Let n > 2 be an integer. Suppose that there are n Metro stations in a city located around a circular path. Each pair of nearest stations is connected by a straight track only. Further, each pair of nearest station is connected by blue line, whereas all remaining pairs of stations are connected by red line. If number of red lines is 99 times the number of blue lines, then the value of n is

(a) 199 (b) 101

(c) 201 (d) 200

20. Let $f:(-1,\infty) \to R$ be defined by f(0) = 1 and $f(x) = \frac{1}{x}log_e(1+x), x \neq 0$. Then the function f :

(a) increases in (–1, 0) and decreases in (0, ∞)

(b) decreases in (–1, ∞)

(c) decreases in (–1, 0) and increases in (0, ∞)

(d) increases in (–1, ∞)

21. Let the position vectors of points 'A' and 'B' be $\hat{\imath} + \hat{\jmath} + \hat{k}$ and $2\hat{\imath} + \hat{\jmath} + 3\hat{k}$, respectively. A point 'P' divides the line segment AB internally in the ratio $\lambda : 1 (\lambda > 0)$. If O is the origin and $\overrightarrow{OB}.\overrightarrow{OP} - 3\left|\overrightarrow{OA} \times \overrightarrow{OP}\right|^2 = 6$, then λ is equal to

22. Let [t] denote the greatest integer less than or equal to t. Then the value of $\int_1^2 |2x - [3x]| dx$ is

23. For a positive integer n, $\left(1 + \frac{1}{x}\right)^n$ is expanded in increasing powers of x. If three consecutive coefficients in this expansion are the ratio, 2 : 5 : 12, then n is equal to ________

24. If $y = \sum_{k=1}^{6} k\, cos^{-1}\left\{\frac{3}{5}\cos kx - \frac{4}{5}\sin kx\right\}$ then $\frac{dy}{dx}$ at x = 0 is

25. If the variance of the terms in an increasing A.P. $b_1\, b_2, b_3, \ldots\ldots\ldots, b_{11}$ is 90, then the common difference of this A.P. is

ANSWER

1.	(a)	**2.**	(c)	**3.**	(a)	**4.**	(c)	**5.**	(d)	**6.**	(c)	**7.**	(a)	**8.**	(a)	**9.**	(c)	**10.**	(c)
11.	(a)	**12.**	(b)	**13.**	(d)	**14.**	(a)	**15.**	(b)	**16.**	(b)	**17.**	(c)	**18.**	(c)	**19.**	(c)	**20.**	(b)
21.	(0.8)	**22.**	(1)	**23.**	(118)	**24.**	(91)	**25.**	(3)										