MATHEMATICS

1. Let $\theta = \frac{\theta}{5}$ and $A = \begin{bmatrix} cos\theta & sin\theta \\ -sin\theta & cos\theta \end{bmatrix}$. If $B = A + A^4$, then det (B) :
(a) is zero (b) is one
(c) lies in (2, 3) (d) lies in (1, 2)

2. The area (in sq. units) of the region enclosed by the curves $y = x^2 - 1$ and $y = 1 - x^2$ is equal to :
(a) $\frac{8}{3}$ (b) $\frac{7}{2}$
(c) $\frac{4}{3}$ (d) $\frac{16}{3}$

3. Let L denote the line in the xy-plane with x and y intercepts as 3 respectively. Then the image of the point (–1, –4) in the line is
(a) $\left(\frac{8}{5}, \frac{29}{5}\right)$ (b) $\left(\frac{11}{5}, \frac{28}{5}\right)$
(c) $\left(\frac{29}{5}, \frac{8}{5}\right)$ (d) $\left(\frac{29}{5}, \frac{11}{5}\right)$

4. If α and β are the roots of the equation 2x(2x + 1) = 1, then β is equal to :
(a) $2\alpha(\alpha - 1)$ (b) $2\alpha(\alpha + 1)$
(c) $2\alpha^2$ (d) $-2\alpha(\alpha + 1)$

5. For a suitably chosen real constant a, let a function $f: R - \{-a\} \to R$ be defined by $f(x) = \frac{a-x}{a+x}$. Further suppose that for any real number $x \neq -a$ and $f(x) \neq -a$, (fof)(x) = x. Then $f\left(-\frac{1}{2}\right)$ is equal to :
(a) 3 (b) –3
(c) $\frac{1}{3}$ (d) $-\frac{1}{3}$

6. If the tangent to the curve, y = f(x) = x$\log_e$x, (x>0) at a point (c, f(c)) is parallel to the line-segment joining the points (1, 0) and (e, e), then c is equal to :
(a) $\frac{e-1}{e}$ (b) $\frac{1}{e-1}$ (c) $e^{\left(\frac{1}{e-1}\right)}$ (d) $e^{\left(\frac{1}{1-e}\right)}$

7. If the constant term in the binomial expansion of $\left(\sqrt{x} - \frac{k}{x^2}\right)^{10}$ is 405, then |k| equals :
(a) 3 (b) 2 (c) 1 (d) 9

8. The probabilities of three events A, B and C are given P(A) = 0.6, P(B) = 0.4 and P(C) = 0.5. If $P(A \cup B) = 0.8, P(A \cap C) = 0.3, P(A \cap B \cap C) = 0.2, P(B \cap C) = \beta$ and $P(A \cup B \cup C) = \alpha$, where $0.85 \leq \alpha \leq 0.95$, then β lies in the interval .
(a) [0.36, 0.40] (b) [0.35, 0.36]
(c) [0.25, 0.35] (d) [0.20, 0.25]

9. The integral $\int_1^2 e^x . x^2 (2 + log_e x) dx$ equals :
(a) e(2e – 1) (b) e(4e + 1)
(c) $4e^2 - 1$ (d) e(4e – 1)

10. The common difference of the A.P. $b_1, b_2, \ldots \ldots . b_m$ is 2 more than common difference of A.P. $a_1, a_2, \ldots \ldots . a_n$. If $a_{40} = -159$, $a_{100} = -399$ and $b_{100} = a_{70}$, then b_1 is equal to :
(a) 127 (b) 81 (c) –127 (d) –81

11. If the normal at an end of latus rectum of an ellipse passes through an extremity of the minor axis, the eccentricity e of the ellipse satisfies :
(a) $e^4 + 2e^2 - 1 = 0$ (b) $e^2 + e - 1 = 0$
(c) $e^2 + 2e - 1 = 0$ (d) $e^4 + e^2 - 1 = 0$

12. Let $f: R \to R$ be a function defined by f(x) = max {x, x^2}. Let S denote the set of all points in R, where f is not differentiable. Then :
(a) ϕ(an empty set) (b) {1}
(c) {0} (d) {0, 1}

13. The set of all real values λ for which the function $f(x) = (1 - cos^2 x).(\lambda + sinx), x\varepsilon \left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$, has exactly one maxima and exactly one minima, is :
(a) $\left(-\frac{1}{2}, \frac{1}{2}\right) - \{0\}$ (b) $\left(-\frac{3}{2}, \frac{3}{2}\right)$
(c) $\left(-\frac{1}{2}, \frac{1}{2}\right)$ (d) $\left(-\frac{3}{2}, \frac{3}{2}\right) - \{0\}$

14. Consider the statement: "For an integer n, if $n^3 - 1$ is even , then n is odd". The contrapositive statement of this statement is :
(a) For an integer n, if n is even, then $n^3 - 1$ is odd
(b) For an integer n, if n is even, then $n^3 - 1$ is even.
(c) For an integer n, if $n^3 - 1$ is not even, then n is not odd
(d) For an integer n, if n is odd, then $n^3 - 1$ is even.

15. The centre of the circle passing through the point (0, 1) and touching the parabola $y = x^2$ at the point (2, 4) is :
(a) $\left(\frac{3}{10}, \frac{16}{5}\right)$ (b) $\left(\frac{-53}{10}, \frac{16}{5}\right)$
(c) $\left(\frac{-16}{5}, \frac{53}{10}\right)$ (d) $\left(\frac{6}{5}, \frac{53}{10}\right)$

16. If $y = \left(\frac{2}{\pi}x - 1\right) cosec\, x$ is the solution of the differential equation, $\frac{dy}{dx} + p(x)y = \frac{2}{\pi} cosec\, x, 0 < x < \frac{\pi}{2}$, then the function p(x) is equal to :
(a) tan x (b) cosec x
(c) cot x (d) sec x

17. Let z = x + iy be a non-zero complex number such that $z^2 = i|z|^2$, where $i = \sqrt{-1}$, then z lies on the
(a) real axis (b) line, y = x
(c) line, y = –x (d) imaginary axis

18. A plane P meets the coordinate axes at A, B and C respectively. The centroid of ΔABC is given to be (1, 1, 2). Then the equation of the line through this centroid and perpendicular to the plane P is :
(a) $\frac{x-1}{2} = \frac{y-1}{1} = \frac{z-2}{1}$ (b) $\frac{x-1}{1} = \frac{y-1}{2} = \frac{z-2}{2}$
(c) $\frac{x-1}{1} = \frac{y-1}{1} = \frac{z-2}{2}$ (d) $\frac{x-1}{2} = \frac{y-1}{2} = \frac{z-2}{1}$

19. The angle of elevation of the summit of a mountain from a point on the ground is 45°. After climbing up one km towards the summit at an inclination of 30° from the ground, the angle of elevation of the summit is found to be 60°. Then the height (in km) of the summit from the ground is
(a) $\frac{\sqrt{3}+1}{\sqrt{3}-1}$ (b) $\frac{1}{\sqrt{3}+1}$ (c) $\frac{1}{\sqrt{3}-1}$ (d) $\frac{\sqrt{3}-1}{\sqrt{3}+1}$

20. For all twice differentiable functions $f : R \to R$, with f(0) = f(1) = f'(0) = 0,

(a) f''(x) = 0, for some x ε (0, 1)

(b) f''(x) = 0, at every point x ε (0, 1)

(c) f''(0) = 0

(d) f''(x) ≠ 0, at every point x ε (0, 1)

21. The number of words (with or without meaning) that can be formed from all the letters of the word "LETTER" in which vowels never come together is …….

22. Consider the data on x taking the values 0, 2, 4, 8, …. 2^n with frequencies ${}^nC_0$, ${}^nC_1$, ${}^nC_2$, ….., ${}^nC_n$ respectively. If the mean of this data is $\frac{728}{2^n}$, then n is equal to …….

23. Suppose that a function $f : R \to R$ satisfies f(x + y) = f(x) f(y) for all x, y ε R and f(1) = 3. If $\sum_{i=1}^{n} f(i) = 363$, then n is equal to ………..

24. If $\vec{x}$ and $\vec{y}$ be two non-zero vectors such that $|\vec{x}+\vec{y}| = |\vec{x}|$ and $2\vec{x}+\lambda\vec{y}$ is perpendicular to $\vec{y}$, then the value of λ is ……..

25. The sum of distinct values of l for which the system of equations :

$(\lambda-1)x+(3\lambda+1)y+2\lambda z=0$

$(\lambda-1)x+(4\lambda-2)y+(\lambda+3)z=0$

$2x+(3\lambda+1)y+3(\lambda-1)z=0,$

Has non-zero solutions, is ……….

ANSWER

1. (d)	**2.** (a)	**3.** (b)	**4.** (d)	**5.** (a)	**6.** (c)	**7.** (a)	**8.** (c)	**9.** (d)	**10.** (d)
11. (d)	**12.** (d)	**13.** (d)	**14.** (a)	**15.** (c)	**16.** (c)	**17.** (b)	**18.** (d)	**19.** (c)	**20.** (a)
21. (120)	**22.** (6)	**23.** (5)	**24.** (1)	**25.** (3)					