



General Instructions

- (i) **Duration:** The total duration of the examination is 1 hours (60 minutes).
- (ii) **Total Marks:** The complete Mathematics paper carries a maximum of 100 marks.
- (iii) **Structure:** The paper consists of two sections:
 - **Section A:** 20 Multiple Choice Questions (MCQs).
 - **Section B:** 5 Numerical Value Type Questions.
- (iv) **Compulsory Questions:** All 25 questions are compulsory.
- (v) Each question has four options. Only **one** option is correct.
- (vi) **Correct Answer:** +4 marks.
- (vii) **Incorrect Answer:** -1 mark (Negative marking).
- (viii) **Unanswered/Marked for Review:** 0 marks.

Mathematics Section - A

1. Let $\alpha, \alpha + 2, \alpha \in \mathbb{Z}$, be the roots of the quadratic equation $x(x + 2) + (x + 1)(x + 3) + (x + 2)(x + 4) + \dots + (x + n - 1)(x + n + 1) = 4n$ for some $n \in \mathbb{N}$. Then $n + \alpha$ is equal to :

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

2. Let x and y be real numbers such that $50\left(\frac{2x}{1+3i} - \frac{y}{1-2i}\right) = 31 + 17i, i = \sqrt{-1}$. Then the value of $10(x - 3y)$ is :

- (A) 20
- (B) 31
- (C) 35
- (D) 75

3. Let $\alpha, \beta \in \mathbb{R}$ be such that the system of linear equations

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

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

$$8x + 4y + \beta z = 18$$

has no solution. Then β/α is equal to :

- (A) -4
- (B) 4
- (C) 8
- (D) -8

4. Let $A = \begin{bmatrix} 1 & 2 \\ 1 & \alpha \end{bmatrix}$ and $B = \begin{bmatrix} 3 & 3 \\ \beta & 2 \end{bmatrix}$. If $A^2 - 4A + I = O$ and $B^2 - 5B - 6I = O$, then among the two statements:

$$(S1): [(B - A)(B + A)]^T = \begin{bmatrix} 13 & 15 \\ 7 & 10 \end{bmatrix}$$

and

$$(S2): \det(\text{adj}(A + B)) = -5,$$

- (A) only (S1) is correct
- (B) only (S2) is correct
- (C) both (S1) and (S2) are correct
- (D) both (S1) and (S2) are wrong

5. Let A be the set of first 101 terms of an A.P, whose first term is 1 and the common difference is 5 and let B be the set of first 71 terms of an A.P, whose first term is 9 and the common difference is 7. Then the number of elements in $A \cap B$, which are divisible by 3, is :

- (A) 4
- (B) 5
- (C) 6
- (D) 7

6. The number of seven-digit numbers, that can be formed by using the digits 1, 2, 3, 5 and 7 such that each digit is used at least once, is :

- (A) 15400
- (B) 17800
- (C) 16800
- (D) 29400

7. The number of elements in the set $S = \left\{ (r, k) : k \in Z \text{ and } {}^{36}C_{r+1} = \frac{6}{(k^2-3)} ({}^{35}C_r) \right\}$ is :

- (A) 2
- (B) 4
- (C) 8
- (D) 16

8. If the mean of the data

Class	5-10	10-15	15-20	20-25	25-30	30-35
Frequency	2	k	28	54	k+1	5

is 21, then k is one of the roots of the equation :

- (A) $2x^2 - 23x - 10 = 0$
- (B) $4x^2 - 35x + 24 = 0$
- (C) $2x^2 - 19x - 10 = 0$
- (D) $2x^2 - 35x + 98 = 0$

9. Let the mid points of the sides of a triangle ABC be $(5/2, 7)$, $(5/2, 3)$ and $(4, 5)$. If its incentre is (h, k) , then $3h + k$ is equal to :

- (A) 11
- (B) 12
- (C) 13
- (D) 14

10. Let an ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$, $a < b$, pass through the point $(4, 3)$ and have eccentricity $\frac{\sqrt{5}}{3}$. Then the length of its latus rectum is :

- (A) $\frac{4\sqrt{5}}{3}$
- (B) $2\sqrt{5}$
- (C) $\frac{7\sqrt{5}}{3}$
- (D) $\frac{8\sqrt{5}}{3}$

11. If $\sin\left(\frac{\pi}{18}\right)\sin\left(\frac{5\pi}{18}\right)\sin\left(\frac{7\pi}{18}\right) = K$, then the value of $\sin\left(\frac{10K\pi}{3}\right)$ is :

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

12. Let $S = \{x \in [-\pi, \pi] : \sin x(\sin x + \cos x) = a, a \in \mathbb{Z}\}$. Then $n(S)$ is equal to :

- (A) 3
 - (B) 6
 - (C) 7
 - (D) 9
-

13. If the point of intersection of the lines $\frac{x+1}{3} = \frac{y+a}{5} = \frac{z+b+1}{7}$ and $\frac{x-2}{1} = \frac{y-b}{4} = \frac{z-2a}{7}$ lies on xy -plane, then the value of $a + b$ is :

- (A) 2
 - (B) 5
 - (C) 7
 - (D) 9
-

14. If $\vec{a}$ and $\vec{b}$ are two vectors such that $|\vec{a}| = 2$ and $|\vec{b}| = 3$, then the maximum value of $3|3\vec{a} + 2\vec{b}| + 4|3\vec{a} - 2\vec{b}|$ is :

- (A) 30
 - (B) 36
 - (C) 60
 - (D) 72
-

15. Let a line L passing through the point $(1, 1, 1)$ be perpendicular to both the vectors $2\hat{i} + 2\hat{j} + \hat{k}$ and $\hat{i} + 2\hat{j} + 2\hat{k}$. If $P(a, b, c)$ is the foot of perpendicular from the origin on the line L , then the value of $34(a + b + c)$ is :

- (A) 50
 - (B) 80
 - (C) 100
 - (D) 120
-

16. If $\lim_{x \rightarrow 2} \frac{\sin(x^3 - 5x^2 + ax + b)}{(\sqrt{x} - 1 - 1)\log_e(x - 1)} = m$, then $a + b + m$ is equal to :

- (A) 5
 - (B) 6
 - (C) 8
 - (D) 10
-

17. If the curve $y = f(x)$ passes through the point $(1, e)$ and satisfies the differential equation $dy = y(2 + \log_e x)dx, x > 0$, then $f(e)$ is equal to :

- (A) e^e
 - (B) e^{e^2}
 - (C) e^{2e}
 - (D) $e^{e^{2e}}$
-

18. The number of critical points of the function $f(x) = \begin{cases} \left| \frac{\sin x}{x} \right|, & x \neq 0 \\ 1, & x = 0 \end{cases}$ in the interval $(-2\pi, 2\pi)$ is equal to :

- (A) 1
 - (B) 3
 - (C) 5
 - (D) 7
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19. Let $[\cdot]$ denote the greatest integer function. Then the value of $\int_0^3 \frac{e^x + e^{-x}}{[x]!} dx$ is :

- (A) $e^2 + e^3 - \frac{1}{e^2} - \frac{1}{e^3}$
 - (B) $\frac{1}{2}(e^2 + e^3 - \frac{1}{e^2} - \frac{1}{e^3})$
 - (C) $e^2 + e^3 - \frac{1}{2e^2} - \frac{1}{2e^3}$
 - (D) $\frac{1}{2}(e^2 + e^3) - \frac{1}{e^2} - \frac{1}{e^3}$
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20. Let $y = y(x)$ be the solution curve of the differential equation $(1 + \sin x) \frac{dy}{dx} + (y + 1) \cos x = 0, y(0) = 0$. If the curve $y = y(x)$ passes through the point $(\alpha, -1/2)$, then a value of α is :

- (A) $\pi/6$
 - (B) $\pi/4$
 - (C) $\pi/3$
 - (D) $\pi/2$
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Mathematics Section - B

21. If the domain of the function $f(x) = \sqrt{\log_{(0.6)}\left(\frac{2x-5}{x^2-4}\right)}$ is $(-\infty, a] \cup \{b\} \cup [c, d) \cup (e, \infty)$, then the value of $a + b + c + d + e$ is ____.

22. If $\sum_{k=1}^n a_k = 6n^3$, then $\sum_{k=1}^6 \left(\frac{a_{k+1}-a_k}{36}\right)^2$ is equal to ____.

23. Let $a, b, c \in \{1, 2, 3, 4\}$. If the probability that $ax^2 + 2\sqrt{2}bx + c > 0$ for all $x \in \mathbb{R}$ is m/n , $\gcd(m, n) = 1$, then $m + n$ is equal to ____.

24. Let a circle C have its centre in the first quadrant, intersect the coordinate axes at exactly three points and cut off equal intercepts from the coordinate axes. If the length of the chord of C on the line $x + y = 1$ is $\sqrt{14}$, then the square of the radius of C is ____.

25. If $\alpha = \int_0^{2\sqrt{3}} \log_2(x^2 + 4)dx + \int_2^4 \sqrt{2x-4}dx$, then α^2 is equal to ____.
