SEAL

SUBJECT : MATHEMATICS	DAY – 1
SESSION : AFTERNOON	TIME : 02.30 P.M. TO 03.50 P.M.

MAXIMUM MARKS	TOTAL DURATION	MAXIMUM TIME FOR ANSWERING
60	80 MINUTES	70 MINUTES

MENTION YOUR CET NUMBER					QUESTION BOOKLET DETAILS	
					VERSION CODE	SERIAL NUMBER
					A - 1	351345

DOs :

1. Check whether the CET No. has been entered and shaded in the respective circles on the OMR answer sheet.
2. This Question Booklet is issued to you by the invigilator after the 2nd **Bell i.e., after 02.30 p.m.**
3. The Serial Number of this question booklet should be entered on the OMR answer sheet.
4. The Version Code of this question booklet should be entered on the OMR answer sheet and the respective circles should also be shaded completely.
5. Compulsorily sign at the bottom portion of the OMR answer sheet in the space provided.

DON'TS :

1. **THE TIMING AND MARKS PRINTED ON THE OMR ANSWER SHEET SHOULD NOT BE DAMAGED / MUTILATED / SPOILED.**
2. The **3rd Bell rings at 02.40 p.m., till then;**
   - Do not remove the paper seals present on all the 3 sides of this question booklet.
   - Do not look inside this question booklet.
   - Do not start answering on the OMR answer sheet.

SEAL

IMPORTANT INSTRUCTIONS TO CANDIDATES

1. This question booklet contains 60 questions and each question will have one statement and four distracters. (Four different options / choices.)
2. After the **3rd Bell is rung at 02.40 p.m.,** remove the paper seals of this question booklet and check that this booklet does not have any unprinted or torn or missing pages or items etc., if so, get it replaced by a complete test booklet. Read each item and start answering on the OMR answer sheet.
3. During the subsequent 70 minutes:
   - Read each question carefully.
   - Choose the correct answer from out of the four available distracters (options / choices) given under each question / statement.
   - **Completely darken / shade the relevant circle with a BLUE OR BLACK INK BALL POINT PEN against the question number on the OMR answer sheet.**

CORRECT METHOD OF SHADING THE CIRCLE ON THE OMR SHEET IS AS SHOWN BELOW :

① ● ③ ④

4. Please note that even a minute unintended ink dot on the OMR answer sheet will also be recognised and recorded by the scanner. Therefore, avoid multiple markings of any kind on the OMR answer sheet.
5. Use the space provided on each page of the question booklet for Rough Work. Do not use the OMR answer sheet for the same.
6. After the **last bell is rung at 03.50 p.m.,** stop writing on the OMR answer sheet and affix your LEFT HAND THUMB IMPRESSION on the OMR answer sheet as per the instructions.
7. Hand over the **OMR ANSWER SHEET** to the room invigilator as it is.
8. After separating the top sheet (Our Copy), the invigilator will return the bottom sheet replica (Candidate's copy) to you to carry home for self-evaluation.
9. Preserve the replica of the OMR answer sheet for a minimum period of ONE year.

SEAL

1. Which of the following is incorrect ?

If a ≡ b (mod m) and x is an integer, then

(1) $(a + x) \equiv (b + x) \pmod{m}$ (2) $(a - x) \equiv (b - x) \pmod{m}$

(3) $ax \equiv bx \pmod{m}$ (4) $(a \div x) \equiv (b \div x) \pmod{m}$

2. Inverse of a diagonal non-singular matrix is

(1) scalar matrix (2) skew symmetric matrix

(3) zero matrix (4) diagonal matrix

3. If $ax^4 + bx^3 + cx^2 + dx + e = \begin{vmatrix} x^3 + 3x & x - 1 & x + 3 \\ x + 1 & -2x & x - 4 \\ x - 3 & x + 4 & 3x \end{vmatrix}$, then e =

(1) 1 (2) 0

(3) 2 (4) –1

4. If $\vec{a}$, $\vec{b}$ and $\vec{c}$ are three non-coplanar vectors and $\vec{p}$, $\vec{q}$ and $\vec{r}$ are vectors defined by $\vec{p} = \dfrac{\vec{b} \times \vec{c}}{[\vec{a}\ \vec{b}\ \vec{c}]}$, $\vec{q} = \dfrac{\vec{c} \times \vec{a}}{[\vec{a}\ \vec{b}\ \vec{c}]}$ and $\vec{r} = \dfrac{\vec{a} \times \vec{b}}{[\vec{a}\ \vec{b}\ \vec{c}]}$, then the value of

$(\vec{a} + \vec{b}) \cdot \vec{p} + (\vec{b} + \vec{c}) \cdot \vec{q} + (\vec{c} + \vec{a}) \cdot \vec{r} =$

(1) 0 (2) 1

(3) 2 (4) 3

Space For Rough Work

5. If $(\vec{a} \times \vec{b})^2 + (\vec{a} \cdot \vec{b})^2 = 144$ and $|\vec{a}| = 4$, then $|\vec{b}| =$

(1) 16 (2) 8

(3) 3 (4) 12

6. Which of the following is false ?

(1) (N, ·) is a group.

(2) (N, +) is a semi-group.

(3) (Z, +) is a group.

(4) Set of even integers is a group under usual addition.

7. $2\cos^{-1} x = \sin^{-1}\left(2x\sqrt{1-x^2}\right)$ is valid for all values of x satisfying

(1) $-1 \le x \le 1$ (2) $0 \le x \le 1$

(3) $\frac{1}{\sqrt{2}} \le x \le 1$ (4) $0 \le x \le \frac{1}{\sqrt{2}}$

8. If α is a complex number such that $\alpha^2 - \alpha + 1 = 0$, then $\alpha^{2011} =$

(1) $-\alpha$ (2) α^2

(3) α (4) 1

Space For Rough Work

9. If $\cos \alpha + 2 \cos \beta + 3 \cos \gamma = 0$, $\sin \alpha + 2 \sin \beta + 3 \sin \gamma = 0$ and $\alpha + \beta + \gamma = \pi$, then $\sin 3\alpha + 8 \sin 3\beta + 27 \sin 3\gamma =$

(1) -18 (2) 0

(3) 3 (4) 9

10. If the conjugate of $(x + iy)(1 - 2i)$ is $1 + i$, then

(1) $x - iy = \frac{1+i}{1-2i}$ (2) $x + iy = \frac{1-i}{1-2i}$

(3) $x = \frac{1}{5}$ (4) $x = -\frac{1}{5}$

11. If the straight line $3x + 4y = k$ touches the circle $x^2 + y^2 = 16x$, then the value of k is

(1) 16, 64 (2) $-16, -64$

(3) $-16, 64$ (4) $16, -64$

12. The locus of the point of intersection of perpendicular tangents to the ellipse is called

(1) hyperbola (2) ellipse

(3) auxiliary circle (4) director circle

13. If $m \sin^{-1}x = \log_e y$, then $(1 - x^2) y'' - xy' =$

(1) m^2y (2) $-m^2y$

(3) $2y$ (4) $-2y$

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14. If $y = e^{\log_e [1 + x + x^2 + \ldots]}$, then $\frac{dy}{dx} =$

(1) $\frac{1}{(1+x)^2}$

(2) $\frac{1}{(1-x)^2}$

(3) $\frac{-1}{(1+x)^2}$

(4) $\frac{-1}{(1-x)^2}$

15. Length of the subtangent at (x_1, y_1) on $x^n y^m = a^{m+n}$, $m, n > 0$, is

(1) $\frac{n}{m} x_1$

(2) $\frac{m}{n} |x_1|$

(3) $\frac{n}{m} |y_1|$

(4) $\frac{n}{m} |x_1|$

16. If a ball is thrown vertically upwards and the height 's' reached in time 't' is given by $s = 22\,t - 11\,t^2$, then the total distance travelled by the ball is

(1) 44 units

(2) 33 units

(3) 11 units

(4) 22 units

17. The sum of two positive numbers is given. If the sum of their cubes is minimum, then

(1) they are equal

(2) one is twice the other

(3) they are unequal

(4) one is thrice the other

Space For Rough Work

18. $\int_{\pi/6}^{\pi/3} \frac{\sin^3 x}{\sin^3 x + \cos^3 x} dx =$

(1) $\frac{\pi}{2}$
(2) $\frac{\pi}{3}$
(3) $\frac{\pi}{12}$
(4) $\frac{\pi}{6}$

19. $\underset{x \to 0}{lt} \frac{x\,2^x - x}{1 - \cos x} =$

(1) $2 \log 2$
(2) $\log 2$
(3) $\frac{1}{2} \log 2$
(4) $\frac{1}{2}$

20. If $\frac{3x + 1}{(x - 1)(x + 3)} = \frac{A}{x - 1} + \frac{B}{x + 3}$, then $\sin^{-1} \frac{A}{B} =$

(1) $\frac{\pi}{2}$
(2) $\frac{\pi}{3}$
(3) $\frac{\pi}{6}$
(4) $\frac{\pi}{4}$

21. If α, β, γ are the roots of the equation $x^3 + 4x + 2 = 0$, then $\alpha^3 + \beta^3 + \gamma^3 =$

(1) 2
(2) 6
(3) -2
(4) -6

Space For Rough Work

22. The value of ${}^{10}C_1 + {}^{10}C_2 + {}^{10}C_3 + \ldots + {}^{10}C_9$ is

(1) 2^{10} (2) 2^{11}

(3) $2^{10} - 2$ (4) $2^{10} - 1$

23. $p \rightarrow \sim q$ can also be written as

(1) $p \rightarrow q$ (2) $\sim p \vee \sim q$

(3) $q \rightarrow p$ (4) $\sim q \rightarrow \sim p$

24. If $f : \mathbb{R} \rightarrow \mathbb{R}$ is defined by $f(x) = 2x + 3$, then $f^{-1}(x)$

(1) is given by $\frac{x-3}{2}$

(2) is given by $\frac{1}{2x+3}$

(3) does not exist because 'f' is not injective

(4) does not exist because 'f' is not surjective

25. $\frac{\sin 70° + \cos 40°}{\cos 70° + \sin 40°} =$

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

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

Space For Rough Work

26. The points (11, 9), (2, 1) and (2, –1) are the midpoints of the sides of the triangle. Then the centroid is

(1) (–5, –3) (2) (5, –3)

(3) (3, 5) (4) (5, 3)

27. The reflection of the point (1, 1) along the line $y = -x$ is

(1) (0, 0) (2) (–1, 1)

(3) (–1, –1) (4) (1, –1)

28. The number of circles that touch the co-ordinate axes and the line whose slope is –1 and y-intercept is 1, is

(1) 1 (2) 4

(3) 2 (4) 3

29. If $f(x)$ is an even function, then $f'(x)$ is

(1) an odd function (2) an even function

(3) may be even or may be odd (4) nothing can be said

30. The perimeter of a sector is a constant. If its area is to be maximum, then the sectorial angle is

(1) $\frac{\pi^c}{6}$ (2) $\frac{\pi^c}{4}$

(3) 4^c (4) 2^c

Space For Rough Work

31. The last digit of number 7^{886} is

(1) 9 (2) 7

(3) 3 (4) 1

32. If (24, 92) = 24 m + 92 n, then (m, n) is

(1) (–1, 4) (2) (4, –1)

(3) (4, –3) (4) (–4, 3)

33. The characteristic equation of a matrix A is $\lambda^3 - 5\lambda^2 - 3\lambda + 2 = 0$ then | adj (A) | =

(1) 9 (2) 25

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

34. If $\hat{i} + \hat{j} - \hat{k}$ and $2\hat{i} - 3\hat{j} + \hat{k}$ are adjacent sides of a parallelogram, then the lengths of its diagonals are

(1) $\sqrt{3}, \sqrt{14}$ (2) $\sqrt{13}, \sqrt{14}$

(3) $\sqrt{21}, \sqrt{3}$ (4) $\sqrt{21}, \sqrt{13}$

35. If the volume of the parallelopiped formed by three non-coplanar vectors $\vec{a}$, $\vec{b}$ and $\vec{c}$ is 4 cubic units, then $[\vec{a} \times \vec{b} \quad \vec{b} \times \vec{c} \quad \vec{c} \times \vec{a}] =$

(1) 64 (2) 16

(3) 4 (4) 8

Space For Rough Work

36. Which of the following is a subgroup of the group $G = \{2^n \mid n \in Z\}$ under multiplication ?

(1) $\{4^n \mid n \in N\}$ (2) $\{3^n \mid n \in Z\}$

(3) $\{6^n \mid n \in N\}$ (4) $\{4^n \mid n \in Z\}$

37. In the group $G = \{1, 2, 3, 4, 5, 6\}$ under $\otimes_7$, the solution of $4 \otimes_7 x = 5$ is

(1) 3 (2) 2

(3) 4 (4) 5

38. The number of real solutions of the equation $\tan^{-1}\sqrt{x(x+1)} + \sin^{-1}\sqrt{x^2+x+1} = \frac{\pi}{2}$ is

(1) one (2) four

(3) two (4) infinitely many

39. If $\sin 2x = 4 \cos x$, then $x =$

(1) $n\frac{\pi}{2} \pm \frac{\pi}{4}$, $n \in Z$ (2) no value

(3) $n\pi + (-1)^n \frac{\pi}{4}$ $n \in Z$ (4) $2n\pi \pm \frac{\pi}{2}$, $n \in Z$

40. If α and β are different complex numbers with $|\beta| = 1$, then $\left|\frac{\beta - \alpha}{1 - \bar{\alpha}\beta}\right|$ is equal to

(1) $\frac{1}{2}$ (2) 1

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

Space For Rough Work

41. The equations of the two tangents from (–5, – 4) to the circle $x^2 + y^2 + 4x + 6y + 8 = 0$ are

(1) $x + 2y + 13 = 0,\quad 2x - y + 6 = 0$

(2) $2x + y + 13 = 0,\quad x - 2y = 6$

(3) $3x + 2y + 23 = 0,\quad 2x - 3y + 4 = 0$

(4) $x - 7y = 23,\quad 6x + 13y = 4$

42. If $x = t^2 + 2$ and $y = 2t$ represent the parametric equation of the parabola

(1) $x^2 = 4(y - 2)$
(2) $(y - 2)^2 = 4x$
(3) $y^2 = 4(x - 2)$
(4) $(x - 2)^2 = 4y$

43. If $x - y = 1$ is a tangent to the hyperbola $\frac{x^2}{4} - \frac{y^2}{3} = 1$, the point of contact is

(1) (4, 3)
(2) (3, 4)
(3) (2, 1)
(4) (5, 4)

44. If $y = \tan^{-1}\left(\frac{1}{1 + x + x^2}\right) + \tan^{-1}\left(\frac{1}{x^2 + 2x + 3}\right) + \tan^{-1}\left(\frac{1}{x^2 + 5x + 7}\right) + \ldots$ n terms, then $y'(0)$ is

(1) $\frac{\pi}{2}$
(2) $\frac{2n}{1 + n^2}$
(3) $\frac{n^2}{1 + n^2}$
(4) $-\frac{n^2}{1 + n^2}$

Space For Rough Work

45. If f(x) = sin [π^2] x + cos [$-\pi^2$] x then f '(x) is, here [π^2] and [$-\pi^2$] greatest integer function not greater than its value

(1) sin 9x + cos 9x (2) 9 cos 9x – 10 sin 10x

(3) 0 (4) –1

46. The tangent to the curve $xy = 25$ at any point on it cuts the coordinate axes at A and B, then the area of the triangle OAB is

(1) 50 sq. units (2) 25 sq. units

(3) 75 sq. units (4) 100 sq. units

47. The length of the sub-tangent, ordinate and the sub-normal are in

(1) A.P.

(2) H.P.

(3) G.P.

(4) Arithmetico geometric progression

48. The maximum value of $x e^{-x}$ is

(1) e (2) $\frac{1}{e}$

(3) – e (4) $-\frac{1}{e}$

Space For Rough Work

49. If $[x]$ is the greatest integer function not greater than x, then

$$\int_0^{11} [x]\, dx =$$

(1) 45
(2) 66
(3) 35
(4) 55

50. If $n \in N$ and $I_n = \int (\log x)^n\, dx$, then $I_n + n\, I_{n-1} =$

(1) $\dfrac{(\log x)^{n+1}}{n+1}$
(2) $x(\log x)^n + c$
(3) $(\log x)^{n-1}$
(4) $\dfrac{(\log x)^n}{n}$

51. Solution of $e^{\frac{dy}{dx}} = x$ when $x = 1$ and $y = 0$ is

(1) $y = x(\log x - 1) + 4$
(2) $y = x(\log x - 1) + 3$
(3) $y = x(\log x + 1) + 1$
(4) $y = x(\log x - 1) + 1$

52. If $f(x) = \begin{cases} \dfrac{x^2 - (a+2)x + a}{x-2} & x \neq 2 \\ 2 & x = 2 \end{cases}$ is continuous at $x = 2$, then the value of a is

(1) -6
(2) 0
(3) 1
(4) -1

Space For Rough Work

53. If $\log_2(9^{x-1}+7)-\log_2(3^{x-1}+1)=2$, then x values are

(1) 0, 2 (2) 0, 1

(3) 1, 4 (4) 1, 2

54. If $x-1$ is a factor of $x^5-4x^3+2x^2-3x+k=0$, then k is

(1) 4 (2) −4

(3) 2 (4) 3

55. If A and B have n elements in common, then the number of elements common to A × B and B × A is

(1) n (2) 2n

(3) n^2 (4) 0

56. The 13th term in the expansion of $\left(x^2+\frac{2}{x}\right)^n$ is independent of x then the sum of the divisors of n is

(1) 36 (2) 37

(3) 38 (4) 39

Space For Rough Work

57. If one of the slopes of the pair of lines $ax^2 + 2hxy + by^2 = 0$ is n times the other then

(1) $4(n+1)^2 ab = nab$

(2) $4h^2 = (n+1)^2 ab$

(3) $4nh^2 = (n+1)^2 ab$

(4) $4ab = (n+1)^2 h$

58. If $f(x) = \begin{vmatrix} \sin x & \cos x & \tan x \\ x^3 & x^2 & x \\ 2x & 1 & x \end{vmatrix}$ then $\underset{x \to 0}{\mathrm{Lt}} \dfrac{f(x)}{x^2} =$

(1) 0

(2) 3

(3) 2

(4) 1

59. The number of solutions of the equation $z^2 + \bar{z} = 0$ where $z \in C$ are

(1) 1

(2) 4

(3) 5

(4) 6

60. The least and the greatest distances of the point (10, 7) from the circle $x^2 + y^2 - 4x - 2y - 20 = 0$ are

(1) 10, 5

(2) 15, 20

(3) 12, 16

(4) 5, 15

Space For Rough Work

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