M

CET-2011

Sr. No. :

Booklet Series Code : A

Important : Please consult your Admit Card / Roll No. Slip before filling your Roll Number on the Test Booklet and Answer Sheet.

Roll No. *In Figures* *In Words*

O.M.R. Answer Sheet Serial No.

Signature of the Candidate : ____________________

Subject : Mathematics

Time : 70 minutes **Number of Questions : 60** **Maximum Marks : 120**

DO NOT OPEN THE SEAL ON THE BOOKLET UNTIL ASKED TO DO SO

INSTRUCTIONS

1. Write your Roll No. on the Question Booklet and also on the OMR Answer Sheet in the space provided and nowhere else.
2. Enter the Subject and Series Code of Question Booklet on the OMR Answer Sheet. Darken the corresponding bubbles with **Black Ball Point / Black Gel pen.**
3. Do not make any identification mark on the Answer Sheet or Question Booklet.
4. To open the Question Booklet remove the paper seal(s) gently when asked to do so.
5. Please check that this Question Booklet contains **60** questions. In case of any discrepancy, inform the Assistant Superintendent within 10 minutes of the start of test.
6. Each question has four alternative answers (A, B, C, D) of which only one is correct. For each question, darken only one bubble (A or B or C or D), whichever you think is the correct answer, on the Answer Sheet with **Black Ball Point / Black Gel pen.**
7. If you do not want to answer a question, leave all the bubbles corresponding to that question blank in the Answer Sheet. No marks will be deducted in such cases.
8. Darken the bubbles in the OMR Answer Sheet according to the Serial No. of the questions given in the Question Booklet.
9. Negative marking will be adopted for evaluation i.e., 1/4th of the marks of the question will be deducted for each wrong answer. A wrong answer means incorrect answer or wrong filling of bubble.
10. For calculations, use of simple log tables is permitted. Borrowing of log tables and any other material is not allowed.
11. For rough work only the sheets marked "Rough Work" at the end of the Question Booklet be used.
12. The Answer Sheet is designed for **computer evaluation**. Therefore, if you do not follow the instructions given on the Answer Sheet, it may make evaluation by the computer difficult. **Any resultant loss to the candidate on the above account, i.e., not following the instructions completely, shall be of the candidate only.**
13. After the test, hand over the Question Booklet and the Answer Sheet to the Assistant Superintendent on duty.
14. In no case the Answer Sheet, the Question Booklet, or its part or any material copied/noted from this Booklet is to be taken out of the examination hall. Any candidate found doing so, would be expelled from the examination.
15. A candidate who creates disturbance of any kind or changes his/her seat or is found in possession of any paper possibly of any assistance or found giving or receiving assistance or found using any other unfair means during the examination will be expelled from the examination by the Centre Superintendent/ Observer whose decision shall be final.
16. **Telecommunication equipment such as pager, cellular phone, wireless, scanner, etc., is not permitted inside the examination hall. Use of calculators is not allowed.**

1. If A and B are subsets of a universal set X such that $n(A) = 115$, $n(B) = 326$, $n(A - B) = 47$ then $n(A \cup B)$ equals

(A) 373 (B) 165

(C) 370 (D) none of these

2. Let $A = \{ (x, e^{x-1}) : x \in \mathbb{R} \}$ and $B = \{ (x, [x]) : x \in \mathbb{R} \}$ where $[\cdot]$ denotes the greatest integer value function. The number of points in $A \cap B$ is

(A) 0 (B) 1

(C) 2 (D) infinite

3. Let $A = \{ 1, 2, 3, 4, 5 \}$ and let $A_1 = \{1\}$, $A_2 = \{2, 3\}$, $A_3 = \{4, 5\}$. For $x, y \in A$ write $x R y$ iff x, y belong to A_i for some $i = 1, 2, 3$. Which of the followings is true ?

(A) R is reflexive and symmetric but not transitive

(B) R is reflexive and transitive but not symmetric

(C) R is symmetric and transitive but not reflexive

(D) R is an equivalence relation

4. The domain of definition of the function

$$f(x) = \sqrt{\log_{0\cdot4}\left(\frac{x-1}{x+5}\right)} \times \frac{1}{x^2 - 36} \text{ is}$$

(A) $(-\infty, 0) \setminus \{-6\}$ (B) $(0, \infty) \setminus \{1, 6\}$

(C) $(1, \infty) \setminus \{6\}$ (D) $[1, \infty) \setminus \{6\}$

5. Which of the followings is true ?

(A) $\sin 1^o = \sin 1$ (B) $\sin 1^o > \sin 1$

(C) $\sin 1^o < \sin 1$ (D) none of these

6. $\dfrac{\sin 7x + 6 \sin 5x + 17 \sin 3x + 12 \sin x}{\sin 6x + 5 \sin 4x + 12 \sin 2x}$ **is equal to**

(A) $\cos x$ (B) $2 \cos x$

(C) $\sin x$ (D) $2 \sin x$

7. If $\exp \{(\sin^2 x + \sin^4 x + \sin^6 x + ...) \log 3\}$ satisfies the equation $x^2 - 28x + 27 = 0$, $0 < x <$, then

(A) $x = \dfrac{\pi}{6}$ (B) $x =$

(C) $x =$ (D) none of these

8. Let P(n) denote the statement "$n^2 - n + 41$ is a prime". Which of the followings is not true ?

(A) P(1) is a prime (B) P(2) is a prime

(C) $P(n) \not\Rightarrow P(n + 1)$ for some n (D) P(n) is a prime $\forall\ n \in \mathbb{N}$

9. **The least positive argument of the complex numbers among $|Z - 5i| \leq 3$ is**

(A) 　　　　　　　　(B) $\sin^{-1}\frac{2}{5}$

(C) $\sin^{-1}\frac{3}{5}$ 　　　　　　　　(D) $\sin^{-1}\frac{4}{5}$

10. **If n > 3, the roots of $Z^n = (Z + 1)^n$ in $\mathbb{C}$ lie on a**

(A) straight line 　　　　　　　　(B) Circle

(C) ellipse 　　　　　　　　(D) none of these

11. **If Z_1 and Z_2 are two complex numbers such that**

$|Z_1| = |Z_2| + |Z_1 - Z_2|$, then

(A) Arg Z_1 = Arg Z_2 　　　　　　　　(B) Arg Z_1 > Arg Z_2

(C) Arg Z_1 < Arg Z_2 　　　　　　　　(D) None of these

12. **If n is a positive integer then**

$$\max_{x>0} \frac{x^n}{1 + x + x^2 + \ldots\ldots + x^{2n}} \text{ equals}$$

(A) $\frac{1}{2n+1}$ 　　　　　　　　(B)

(C) $\frac{1}{2n-1}$ 　　　　　　　　(D) 1

13. **The number of solutions (x, y); x, y $\in \mathbb{N}$ to**

$1! + 2! + 3! + \ldots\ldots + x! = y^3$ are

$(\sqrt{2}+1)^6$ $\sin^{-1}$ $\frac{1}{2n}$ $\frac{1}{5}$

(A) 0 　　　　　　　　(B) 1

(C) 2 　　　　　　　　(D) infinite

14. **The last three digits of 3^{100} are**

(A) 111 　　　　　　　　(B) 011

(C) 101 　　　　　　　　(D) 001

15. **The smallest integer greater than or equal to 　　　　 is**

(A) 196 　　　　　　　　(B) 197

(C) 198 　　　　　　　　(D) 199

16. **If log 2, log $(2^x - 1)$ and log $(2^x + 3)$ are in AP then x equals**

(A) 5/2 　　　　　　　　(B) $\log_2 5$

(C) $\log_3 2$ 　　　　　　　　(D) 3/2

17. **The real solutions of the equation**

$x^2 - |2x - 3| - 3x + 3 = 0$ form

(A) an AP 　　　　　　　　(B) a GP

(C) an HP 　　　　　　　　(D) a set of numbers with sum zero

18. The number of GP's containing 22, 333, 4444 as terms in each is

(A) 0 (B) 1

(C) 2 (D) infinite

19. If the points (2a, a), (a, 2a) and (a, a) enclose a triangle of area 18 sq. units then a possible centroid is

(A) (2, 2) (B) (4, 4)

(C) (6, 6) (D) (8, 8)

20. A triangle with integral vertices (both co-ordinates integers) can not

(A) be a right angled (B) be isosceles

(C) be equilateral (D) have its area to be a non-integer

21. Let P $\leftrightarrow$ (2, 3), Q $\leftrightarrow$ (3, 2). The length of the common chord of two circles, described on OP and OQ as diameters equals

(A) 1 (B) $\sqrt{2}$

(C) $\sqrt{3}$ (D) none of these

22. Eccentricity of the conic $x^2 - y^2 = -1$ is

(A) 1 (B) $1/\sqrt{2}$

(C) $\sqrt{2}$ (D) none of these

23. Perpendicular distance of the point (x, y, z) from x-axis is

(A) $\sqrt{x^2 + y^2}$ (B) $\sqrt{y^2 + z^2}$

(C) $\sqrt{z^2 + x^2}$ (D)

24. A function f(x) with domain $\mathbb{R}$ satisfies

$$|f(x) - f(y)| \le e^{x-y} \cdot |x - y|^2 \quad \forall \quad x, y \in \mathbb{R}.$$

If f(0) = 0 then

(A) $f(1) \neq 0$ (B) $f(2) = 2$

(C) $f(3) = e^3$ (D) none of these

25. If f(x) satisfies $\lim\limits_{x \to 1} \dfrac{f(x) - 2}{x^2 - 1} = \pi$ the $\lim\limits_{x \to 1} f(x)$ equals

(A) 0 (B) 1

(C) 2 (D) 2π

26. For arbitrary statements p and q, the statement

$$-(p \vee q) \vee (-p \wedge q) \text{ is}$$

(A) a tautology (B) a fallacy

(C) $\equiv -p$ (D) $\equiv -q$

27. Variance of a number of observations is 10. If each observation is multiplied by 2 and then added by 3, the variance of new observations will be

(A) 20 (B) 23

(C) 40 (D) 43

28. **If a variable takes the values 0, 1, 2, ..., n with respective frequencies being**

then the mean of the distribution is

(A) $\frac{n}{2}$ (B) $\frac{n(n+1)}{2}$

(C) (D) none of these

29. **One function is selected from all the functions**

F : S $\rightarrow$S, where S = {1, 2, 3, 4, 5, 6}.

The probability that it is an onto function is

(A) 5/324 (B) 7/324

(C) 5/162 (D) 5/81

30. **In a random arrangement of letters of the word INSTITUTION, the probability that the three T's are together is**

(A) 1/55 (B) 2/55

(C) 3/55 (D) 4/55

31. **If** **then** $\sum_{i=1}^{10} x_i$ **is**

(A) 0 (B) 10

(C) 5 (D) –5

$^nC_0, ^nC_1, \ldots, ^nC_n$ $\frac{n(n-1)}{2}$ $\sum_{i=1}^{10} \{ \ldots x_i \ldots = 0$ $\tan \cos \cos \left(\frac{4}{5}\right) + \sin^{-1}\left(\frac{2}{\sqrt{13}}\right)\}$

32. **The set of values of x for which** $\tan^{-1}\frac{x}{\sqrt{1-x^2}} = \sin^{-1}x$ **holds**

(A) $\mathbb{R}$ (B) [–1, 1]

(C) [0, 1] (D) [–1, 0]

33. **The value of** **is**

(A) $\frac{7}{16}$ (B) $\frac{17}{6}$

(C) $\frac{6}{17}$ (D) $\frac{16}{7}$

34. **If** $f(x) = \begin{bmatrix} \cos x & -\sin x & 0 \\ \sin x & \cos x & 0 \\ 0 & 0 & 1 \end{bmatrix}$, **then f(x + y) is equal to**

(A) f(x) + f(y) (B) f(x) – f(y)

(C) f(x) + 2f(y) (D) f(x) f(y)

35. If $A = \begin{bmatrix} 1 & -1 & 1 \\ 1 & 2 & 0 \\ 1 & 3 & 0 \end{bmatrix}$ then the value of $|\text{adj } A|$ is equal to

(A) 5 (B) 0

(C) 1 (D) 3^2

36. Let $P = \begin{bmatrix} \frac{\sqrt{3}}{2} & \frac{1}{2} \\ -\frac{1}{2} & \frac{\sqrt{3}}{2} \end{bmatrix}$, $A = \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$ and $Q = PAP^T$. If $X = P^T Q^{2011} P$ then X is equal to

(A) $\begin{bmatrix} 1 & 2011 \\ 0 & 1 \end{bmatrix}$ (B) $\begin{bmatrix} 4+2011\sqrt{3} & 2033 \\ 2033 & 4-2011\sqrt{3} \end{bmatrix}$

(C) $\frac{1}{4}\begin{bmatrix} 2+\sqrt{3} & 1 \\ -1 & 2-\sqrt{3} \end{bmatrix}$ (D) $\frac{1}{4}\begin{bmatrix} 2011 & 2-\sqrt{3} \\ 2+\sqrt{3} & 2011 \end{bmatrix}$

37. If the system of equations $x + ay + az = 0$, $bx + y + bz = 0$, $cx + cy + z = 0$, (a, b, c non zero and non unity) has a non-trivial solution then the value of

$$\frac{a}{1-a} + \frac{b}{1-b} + \frac{c}{1-c} \text{ is}$$

(A) 1 (B) 0

(C) –1 (D)

38. The determinant

(A) x, y, z are in A.P. (B) x, y, z in G.P.

(C) x, y, z are non-zero (D) xy, yz, zx are in A.P.

39. For $A = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 1 \\ 0 & -2 & 4 \end{bmatrix}$, if $A^{-1} = \left[\frac{1}{6}\left(A^2 + cA + dI\right)\right]$, then the values of c and d are

(A) (–6, –11) (B) (6, 11)

(C) (–6, 11) (D) (6, –11)

40. If $y = (1 + x)(1 + x^2) \dots (1 + x^{2^n})$ then $\frac{dy}{dx}$ at $x = 0$ is

(A) 1 (B) –1

(C) 0 (D) 2^n

41. The derivative of $\tan^{-1}\left(\frac{2x}{1-x^2}\right)$ with respect to $\sin^{-1}\left(\frac{2x}{1-x^2}\right)$ is

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

(C) 0 (D) 1

42. If f is differentiable at x = 1, then

is equal to

(A) $f'(1)$ (B) 0

(C) $f(1) - f'(1)$ (D) $f(1) + f'(1)$

43. The function $[x]^2 - [x^2]$, where [y] is the greatest integer less than or equal to y is discontinuous at

(A) all integers (B) all integers except 0 and 1

(C) all integers except 0 (D) all integers except 1

44. Which one of the following functions is bijective

(A) $f : \mathbb{Z} \to \mathbb{Z}$, $x \to 3x$ (B) $f : \mathbb{Z} \to \mathbb{Z}$, $x \to 5 - x$

(C) $f : \mathbb{Z} \to \mathbb{Z}$, $x \to x - |x| + |x + 1|$ (D) $f : \mathbb{Z} \to \mathbb{Z}$, $x \to \frac{1}{2}x(x + 1)$

45. The equation of a curve is given by $x = e^t \sin t$, $y = e^t \cos t$ the inclination of the tangent to the curve at the point $t = \frac{\pi}{4}$ is

$\lim_{x \to 1} \frac{xf(1) - f(x)}{x - 1}$

(A) $\frac{\pi}{4}$ (B)

(C) (D) 0

46. Let $f(x) = x^3 + 3x^2 - 9x + 2$ then

(A) f(x) has a maximum at x = 1

(B) f(x) has neither maximum nor minimum at x = –3

(C) f(x) has a minimum at x = 1

(D) f(x) has a minimum at x = –3

47. Let x be a real number which exceeds its square by the greatest possible quantity. Then x is equal to

(A) (B) $\frac{1}{4}$

(C) $\frac{3}{4}$ (D) $\frac{1}{8}$

48. **If $f(x) = \int_0^x t \sin t \, dt$, then $f''(x)$ is**

(A) $x \sin x$
(B) $\sin x + x \cos x$
(C) $\cos x + x \sin x$
(D) 0

49. **If $\int \frac{5^{1/x}}{x^2} \, dx = k \, 5^{1/x}$, then the value of k is**

(A) $\log 5$
(B) $-\log 5$
(C) $-\frac{1}{\log 5}$
(D) $\frac{1}{\log 5}$

50. **The area of the region bounded by the curves $y = |x - 3|$, $x = 2$, $x = 4$ and the x-axis is**

(A) 4 square units
(B) 2 square units
(C) 1 square unit
(D) 3 square units

51. **$\lim_{n \to \infty} \frac{2^k + 4^k + ... + (2n)^k}{n^{k+1}}$, $k \neq -1$, is equal to**

(A) 2^k
(B) $\frac{2^k}{k+1}$
(C)
(D)

52. **If $y(t)$ is the solution of , $y(0) = -1$, then $y(1)$ is equal to**

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

53. **The differential equation $\frac{dy}{dx} = \frac{\sqrt{1 - y^2}}{y}$ determines a family of circles with**

(A) Variable radii and a fixed centre at (0, 1)
(B) Variable radii and a fixed centre at (0, –1)
(C) fixed radius 1 and variable centre along the x-axis
(D) fixed radius 1 and variable centre along the y-axis

54. **The value of *l* for which the straight lines**

$$\frac{x+2}{2} = \frac{y}{-3} = \frac{z-1}{4} \text{ and } \frac{x-3}{l} = \frac{y-1}{4} = \frac{z-7}{2} \text{ interesect is}$$

(A) 1
(B) 2
(C) 3
(D) 5

55. **The foot of the prependicular from (0, 2, 3) to the line $\frac{x+3}{5} = \frac{y-1}{2} = \frac{z+4}{3}$ is**

(A) (–2, 3, 4)
(B) (2, –1, 3)
(C) (2, 3, –1)
(D) (3, 2, –1)

56. **If the vectors are not perpendicular to each other and if then**

(A)
(B)
(C)
(D) $\vec{r} = \vec{c} \times \frac{\vec{c} \cdot \vec{a}}{\vec{b} \cdot \vec{a}} \vec{b}$

57. **If $\vec{a} + \vec{b} + \vec{c} = 0$, $|\vec{a}| = 3$, $|\vec{b}| = 5$, $|\vec{c}| = 7$, then the angle between**

(A)
(B)
(C)
(D)

[illegible] $\vec{b} \cdot \vec{a} = 0$

58. **The maximum value of P = 40x + 50y subject to the constraints $3x + y \le 9$, $x + 2y \le 8$, $x \ge 0$, $y \ge 0$ is**

(A) 120
(B) 230
(C) 200
(D) 210

59. **The weighted arithmetic mean of the first n natural numbers whose weights are equal to the corresponding numbers is given by**

(A)
(B) $\frac{1}{2}(2n+1)$
(C) $\frac{1}{3}(2n+1)$
(D) $\frac{1}{6}(2n+1)$

60. **Three persons A, B, C are to speak at a function along with 7 other speakers in a random order. The probability that A speaks before B and B speaks before C at the function is**

(A) $\frac{3}{16}$
(B) $\frac{1}{6}$
(C) $\frac{3}{7}$
(D) $\frac{1}{3}$

ROUGH WORK

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