Question Booklet Series: **A** *Question Booklet Serial No.:* **310800**

CET (UG) – 2022

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

Roll No. ***(In Figure)*** ***(In Words)***

O.M.R. Answer Sheet Serial No.

Signature of Candidate: _____ *Signature of Invigilator:* _____

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 Questions Booklet and also on the OMR Answer Sheet in the space provided and nowhere else.
2. Enter the Question Booklet Serial No. 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. The medium of examination shall be **English** only.
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 answer (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 Booklet. No marks will be deducted in such cases.
8. Darken the bubbles in the OMR Answer Sheet according to the Serial No. of the question 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 log tables is permitted. Borrowing of log tables and any other material is not allowed.
11. For rough work only the blank sheet 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. **20 minutes** extra should be given to the visually handicapped/Person with Disability (PwD) for each paper.
16. A candidate who creates disturbance of any kind or changes his/her seat or is found in possession of any paper possibly of any assistant or found giving or receiving assistant 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.
17. Tele-communication equipment such as Cellular phones, pager, wireless, scanner, camera or any electronic/digital gadget etc., is not permitted inside the examination hall. **Use of calculators is not allowed**.
18. The candidates will not be allowed to leave the Examination Hall/Room before the expiry of the allotted time.

(MAT-A)

1. Find the radian measure corresponding to 25^0.
   (A) $4\pi/3$ (B) $5\pi/4$ (C) $4\pi/9$ (D) $5\pi/36$

2. Find the value of sin(x) if cos(x) = -1/2 and x lies in the third quadrant.
   (A) 1/2 (B) $-\frac{\sqrt{3}}{2}$ (C) $\frac{\sqrt{3}}{2}$ (D) -1/2

3. Find the principal and general solutions of the equation $\tan x = \sqrt{3}$.
   (A) Principal solution: x=$\frac{\pi}{3}, \frac{4\pi}{3}$, General solution: $x = n\pi + \frac{\pi}{3},\ n \in Z$
   (B) Principal solution: x=$\frac{\pi}{3}$, General solution: $x = n\pi + \frac{\pi}{3},\ n \in Z$
   (C) Principal solution: x=$\frac{2\pi}{3}, \frac{4\pi}{3}$, General solution: $x = n\pi + \frac{\pi}{3},\ n \in Z$
   (D) Principal solution: x=$\frac{4\pi}{3}$, General solution: $x = n\pi + \frac{\pi}{3},\ n \in Z$

4. Find the modulus and the argument of the complex number $z = -1 - i\sqrt{3}$.
   (A) Modulus=2, argument= $-\frac{2\pi}{3}$ (B) Modulus=2, argument= $\frac{2\pi}{3}$
   (C) Modulus=1, argument= $-\frac{\pi}{3}$ (D) Modulus=2, argument= $\frac{\pi}{3}$

5. Find real θ such that $(3 + 2i\sin\theta)/(1 - 2i\sin\theta)$ is purely real.
   (A) π only (B) $n\frac{\pi}{2}, n \in Z$ (C) $n\pi, n \in Z$ (D) $\frac{\pi}{2}$

6. How many three digits numbers can be formed using digits from 1 to 9 if no digit is repeated?
   (A) 201 (B) 225 (C) 504 (D) 441

7. Given 5 flags of different colours, how many different types of signals can be generated if each signal requires use of 2 flags, one below the other?
   (A) 25 (B) 20 (C) 16 (D) 24

8. How many cords can be drawn through 21 points on a circle?
   (A) 121 (B) 150 (C) 225 (D) 210

9. Find all pairs of consecutive odd positive integers both of which are smaller than 10 such that their sum is greater than 11.
   (A) (3,5) (B) (5,7) and (7,9) (C) (5,7) (D) (7,9)

10. Find the value of $\sum_{r=0}^{n} 3^r \ {}^nC_r$.
    (A) 4^n (B) 3^n (C) 2^n (D) $4^n + 1$

11. Find the coefficient of x^3 in the expansion of $\left(\frac{2}{x} - \frac{x}{2}\right)^5$.
    (A) 4/9 (B) 3/7 (C) 3/8 (D) 5/8

12. Find the sum of odd integers from 1 to 2001.

(A) 1020100 (B) 2001000 (C) 1002001 (D) 2201101

13. Write the first five terms of the sequence $a_1 = 3,\ a_{n+1} = 3\,a_n + 2\ \forall\ n > 1$.

(A) 3, 11, 35, 111, 213 (B) 3, 11, 35, 112, 323

(C) 3, 6, 33, 111, 323 (D) 3, 11, 35, 107, 323

14. If $\frac{a^n+b^n}{a^{n-1}+b^{n-1}}$ is the arithmetic mean between 'a' and 'b', then find the value of 'n'.

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

15. Find the centre and the radius of the circle $2x^2 + 2y^2 - x = 0$.

(A) Centre=(1,1) and radius=1/4 (B) Centre=(1/4,0) and radius= ¼

(C) Centre=(0,1/4) and radius= 1 (D) Centre=(1,1) and radius=1

16. Find the focus and the length of the latus rectum for the parabola $x^2 = 6y$.

(A) (0, 3/2) and 6 (B) (0, 3) and 4

(C) (0, 2) and 6 (D) (0, 2) and 4

17. Evaluate the limit: $\lim_{x\to 3} \frac{x^4-81}{2x^2-5x-3}$.

(A) 108/7 (B) 108/5 (C) 111/7 (D) Limit does not exist

18. Find the distance between the parallel lines 3x-4y+7=0 and 3x-4y+5=0.

(A) 2 (B) 4/5 (C) 2/5 (D) 9/4

19. Find the distance of the point (3,-5) from the line 3x-4y-26=0.

(A) 3 (B) 4/5 (C) 2/5 (D) 3/5

20. If a matrix has 24 elements, what is the maximum number of possible orders it can have?

(A) 8 (B) 16 (C) 10 (D) 12

21. Find the value of the determinant |A| where matrix A is given as

$$\begin{bmatrix} x+y & x & x \\ 5x+4y & 4x & 2x \\ 10x+8y & 8x & 3x \end{bmatrix}$$

(A) x^3 (B) y^3 (C) $x + y$ (D) xy

22. Find the area of the triangle whose vertices are (1,-1), (2,4) and (-3,5), if these points are not collinear.

(A) 40 square units (B) 13 square units

(C) 25 square units (D) 10 square units

23. If A and B be two non-singular matrices of the same order n, then which of the following statements are not true

I) $(AB)^{-1} = B^{-1}A^{-1}$

II) $(A')^{-1} = (A^{-1})'$

III) $(ABC)^{-1} = C^{-1}B^{-1}A^{-1}$

IV) $(AB)^{-1} = A^{-1}B^{-1}$

(A) II only (B) III only (C) I and II only (D) IV only

24. If $A=\begin{bmatrix}3 & 4\\ 2 & -1\end{bmatrix}$, then find the value of $|A\,(Adj.\ A)|$ where the symbol | B| denotes the determinant of the matrix B.

(A) 8 (B) 11 (C) 2 (D) -11

25. Let R be a relation in the set of natural numbers N defined as $(x, y) \in R \Leftrightarrow x + 2y = 8$. Then express R^{-1} as a set of ordered pair.

(A) $R^{-1} = \{(1,2), (2,3), (3,4)\}$ (B) $R^{-1} = \{(2,3), (4,2), (6,1)\}$

(C) $R^{-1} = \{(3,2), (2,4), (1,6)\}$ (D) $R^{-1} = \{(3,4), (2,1), (5,6)\}$

26. Find the domain and the range of the function $f(x) = x - [x]$.

(A) Domain= All real numbers, Range= (0,1)

(B) Domain= All real numbers, Range= [0,1)

(C) Domain= [0,1], Range= (0,1)

(D) Domain= All real numbers, Range= [0,1]

27. Find the value of $\lim_{x\to 1} \frac{e^x - e}{x-1}$.

(A) 0 (B) e (C) $-e$ (D) 1

28. If P and Q are two sets such that P has 40 elements, P∪Q has 60 elements and P ∩Q has 10 elements, the how many elements does Q have?

(A) 30 (B) 20 (C) 45 (D) 25

29. For what value of k is the following function continuous at x=2?

$$f(x) = \begin{cases} \frac{x^2-4}{x-2}, & x \neq 2 \\ k & x = 2 \end{cases}$$

(A) 2 (B) 3

(C) 4 (D) No such value of k exists

30. If $y = \sqrt{x + \sqrt{x + \sqrt{x + \sqrt{x \ldots\ldots \infty}}}}$, then find the value of $(2y - 1)\frac{dy}{dx}$.

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

31. Find $\frac{dy}{dx}$ if $y = (\sin x)^x$

(A) $(\sin x)^x \ tanx + \cot x$ (B) $(\sin x)^x \log(\sin x)$

(C) $(\sin x)^x \ (\tan x + \log x)$ (D) $(\sin x)^x \ (x \cot x + \log(\sin x))$

32. A particle is moving in a vertical line as per the equation $s = 100\,t - 4.9\,t^2$, where s is in metres and t is in seconds. What is its acceleration at t=1?

(A) $9.8\ m/\sec^2$ (B) $-8\ m/\sec^2$

(C) $-9.8\ m/\sec^2$ (D) $9m\ /\sec^2$

33. At what points on the circle $x^2 + y^2 - 2x - 4y + 1 = 0$, the tangent is parallel to the x-axis.

(A) (1,0) only (B) (1,0) and (1,4) both

(C) (3,2) only (D) There is no such point on the circle

34. Find the least value of 'a' such that the function $x^2 + ax + 1$ is strictly increasing on [1,2].

(A) -4 (B) 4 (C) 2 (D) 3

35. Find the area of the largest rectangle having the perimeter of 200 metre.

(A) 5000 sq. metre (B) 3000 sq. metre

(C) 2500 sq. Metre (D) 1500 sq. metre

36. Find the value of $\int \frac{1-\tan x}{1+\tan x}\,dx$.

(A) $\log\sec\left|\frac{\pi}{4} - x\right| + c$ (B) $\log\sec\left|\frac{\pi}{4} + x\right| + c$

(C) $-\log\sec\left|\frac{\pi}{4} - x\right| + c$ (D) $-\log\sec|\pi/3 - x| + c$

37. If $I_n = \int (\log x)^n\,dx$, then find the value of $I_n + n\,I_{n-1}$.

(A) $x\,(\log x)^n$ (B) $x + (\log x)^n$

(C) $x^n(\log x)^n$ (D) $x^n + (\log x)^n$

38. If $f(2a - x) = f(x)$, then find the value of the integral $\int_0^{2a} f(x)\,dx$.

(A) 0 (B) $\frac{1}{2}\int_0^a f(x)dx$

(C) $\int_0^a f(x)dx$ (D) $2\int_0^a f(x)dx$

39. Find the area of the region bounded by $y = x^2 - 9$ in the 4th quadrant only.

(A) 43/3 (B) 54/3 (C) 40 (D) 35

40. Find the differential equations of all parabolas whose axes are parallel to y-axis.

(A) $\frac{d^3y}{dx^3} = 1$ (B) $\frac{d^3y}{dx^3} = 0$ (C) $\frac{d^3y}{dx^3} + 1 = 0$ (D) $\frac{d^2y}{dx^2} = 0$

41. Find the order and degree of the differential equation and whether the differential equation is linear or non-linear

$$x\frac{dy}{dx} + \frac{1}{\frac{dy}{dx}} = y^2$$

(A) Order=1, degree=1, Non-linear (B) Order=1, degree=2, linear

(C) Order=1, degree=2, Non-linear (D) Order=1, degree=2, linear

42. Find the general solution of the following differential equation $\frac{dy}{dx} = x \log x$.

(A) $y = \frac{x^2}{2} \log x - \frac{1}{4} x^2 + c$ (B) $y = \frac{x^2}{2} \log x + \frac{1}{4} x^2 + c$

(C) $y = x \log x - \frac{1}{4} x^2 + c$ (D) $y = x^3 \log x - \frac{1}{4} x^2 + c$

43. A population grows at the rate of 5% per year. How long does it take for the population to double?

(A) 20 years (B) 2 log(20) years

(C) 20 years (D) 20 log(2) years

44. Find the general solution of the differential equation $\frac{dy}{dx} + \frac{y}{2x} = 3x^2$.

(A) $y = \frac{6}{7} x^{7/2} + c$ (B) $y\sqrt{x} = \frac{6}{7} x^3 + c$

(C) $y\sqrt{x} = \frac{6}{7} x + c$ (D) $y\sqrt{x} = \frac{6}{7} x^{7/2} + c$

45. Find the Cov(x,y) between x,y if $\sum x = 15, \sum y = 36, \sum xy = 110, n = 15$.

(A) 4.53 (B) 4.93 (C) 5.52 (D) 2.99

46. Find the coefficient of correlation $\rho(x, y)$ when Cov(x,y)=16.5, Var(x)=8.25, Var(y)=33.

(A) 1 (B) 0.33 (C) 0.23 (D) 0.11

47. For 5 observations pairs (x,y) of variables X and Y, following results are obtained: $\sum x = 15, \sum y = 18, \sum x^2 = 55, \sum y^2 = 74, \sum xy = 58$. Find the equations of the line of regression of x on y.

(A) $x = \frac{10}{23} y - \frac{33}{23}$ (B) $x = y + \frac{33}{23}$

(C) $x = \frac{10}{23} y + \frac{33}{23}$ (D) $x = \frac{1}{23} y + \frac{3}{23}$

48. In a throw of two coins, find the probability of getting both heads or both tails.

(A) 1/2 (B) 2/3 (C) 1/3 (D) 4/5

49. If P(not A)=0.4, P(A∪B)=0.7 and A and B are given to be independent events, find the value of P(B).

(A) 0.22 (B) 0.45 (C) 0.66 (D) 0.25

50. For a Binomial distribution B(n,p), what is the probability of exactly 'r' successes in 'n' repeated experiments.

(A) ${}^nC_r\, q^r p^r$ (B) ${}^nC_r\, q^{n-r} p^r$

(C) ${}^nC_r\, q^{n+r} p^r$ (D) ${}^nC_r\, q^r p^{n-r}$

51. If $\vec{a}$, $\vec{b}$ are position vectors of the points (1,-1), (-2,m) respectively, then find the value of 'm' for which $\vec{a}$ and $\vec{b}$ are collinear .

(A) 2 (B) 4 (C) -1 (D) -2

52. If $\vec{a}$ and $\vec{b}$ are unit vectors and θ is the angle between then, then the value of $\sin\frac{\theta}{2}$ is given by

(A) $\frac{1}{2}|\vec{a}+\vec{b}|$ (B) $|\vec{a}-\vec{b}|$ (C) $\frac{1}{2}|\vec{a}-\vec{b}|$ (D) $\frac{1}{2}|\vec{a}\,.\,\vec{b}|$

53. Find the value of the λ such that the vectors $2\,\hat{\imath}+\lambda\hat{\jmath}+\hat{k}$ and $\hat{\imath}-2\hat{\jmath}+3\,\hat{k}$ are perpendicular.

(A) 2/3 (B) 4/3 (C) 5/2 (D) ½

54. Find the area of the parallelogram whose adjacent sides are $2\,\hat{\imath}+\hat{\jmath}+3\,\hat{k}$ and $\hat{\imath}-\hat{\jmath}$.

(A) 3 (B) $\sqrt{3}$ (C) 6 (D) $3\sqrt{3}$

55. Find the equation of the plane through the point (1,4,-2) and parallel to the plane 2x-y+3z=0.

(A) 2x-y+3z+4=0 (B) 2x-y+3z+8=0

(C) 2x-y+3z-4=0 (D) 2x-y+3z+10=0

56. Find the angle between the planes $\vec{r}\cdot(2\,\hat{\imath}-\hat{\jmath}+\hat{k})=6$ and $\vec{r}\cdot(\hat{\imath}+\hat{\jmath}+2\,\hat{k})=7$.

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

57. If $\frac{x-1}{k}=\frac{y-3}{1}=\frac{z+6}{-2}$ and $\frac{x-1}{1}=\frac{y-3}{-2}=\frac{z+6}{k}$ are perpendicular, the 'k' is equal to

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

58. Find the value of 'a' for which the function $f(x)=x^2-2ax+6$ is increasing when x >0.

(A) $(-\infty,0)$ (B) $(-\infty,1)$ (C) $(-\infty,0]$ (D) $(-\infty,\pi)$

59. The system of equations 2x+y=4, 3x+2y=2, x+y=-2, has _____.

(A) Infinitely many solution (B) No solution

(C) One solution (D) Only 2 solutions

60. C and D are matrices such that C+D and CD are both defined, then

(A) C and D are such that number of columns of C= number of rows of D.

(B) C and D are square matrices of same order.

(C) C and D are square matrices not necessarily of same order.

(D) C and D can be any matrices.

x-x-x