Question Booklet Series: **A** *Question Booklet Serial No.:* **310969**

CET (UG) – 2021

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 simple 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. Let P, Q and R be three sets such that $P \cup Q = R$ *and* $P \cap Q = \emptyset$. Then $P =$ _____.
   (A) Q (B) R-Q (C) Q-R (D) R

2. In a group of 800 people, 500 can speak Hindi and 320 can speak English. Find how many can speak both Hindi and English?
   (A) 30 (B) 40 (C) 60 (D) 20

3. If $\tan P = \frac{a}{a+1}$ and $\tan Q = \frac{1}{2a+1}$ then find the value of $P + Q$.
   (A) 45^0 (B) 30^0 (C) 60^0 (D) 15^0

4. Find the value of $\frac{\sin 5x - 2\sin 3x + \sin x}{\cos 5x - \cos x}$.
   (A) $\sin 2x$ (B) $\cos 3x$ (C) $\tan x$ (D) $\cot x$

5. If $\left(\frac{1+i}{1-i}\right)^m = 1$, the find the least positive integral value of m.
   (A) 3 (B) 2 (C) 4 (D) 1

6. Find the number of non zero integral solution of the equation $|1 - i|^x = 2^x$.
   (A) 3 (B) 4 (C) 5 (D) No such solution exists

7. In how many ways can 5 girls and 3 boys be seated in a row so that no two boys are together?
   (A) 14400 (B) 1200 (C) 1400 (D) 15000

8. How many numbers greater than 1000000 can be formed by using the digits 1,2,0,2,4,2,4?
   (A) 400 (B) 360 (C) 460 (D) 220

9. Find the number of 3 digits even numbers that can be made using the digits 1,2,3,4,5,6,7, of no digit is repeated?
   (A) 40 (B) 45 (C) 50 (D) 60

10. Find the coefficient of x^5 in $(x + 3)^9$.
    (A) ${}^9C_4$ (B) ${}^9C_4(3)^2$ (C) ${}^9C_4(3)^4$ (D) ${}^9C_4(3)^5$

11. If the coefficients of 5^{th}, 6^{th} and 7^{th} terms in the expansion of $(1 + x)^n$ are in A.P., then find the value of n.
    (A) 7 only (B) 14 only (C) 10 only (D) 7, 14 both

12. Find the sum of the first n terms of the series $1 \times 2 + 2 \times 3 + 3 \times 4 + 4 \times 5 + \cdots$.
    (A) $\frac{n(n^2+1)}{4}$ (B) $\frac{n(n+1)(n+2)}{3}$ (C) $\frac{n(n+3)}{6}$ (D) $\frac{n^2(n^2+1)}{4}$

13. Find the range of r for which the infinite series is convergent: $a + ar + ar^2 + a\,r^3 + \cdots$.
    (A) $|r| < 1$ (B) $|r| \leq 1$ (C) $|r| > 1$ (D) For all values of r

14. Which of the following relations are function?

(i) {(2,1), (5,1), (8,1), (11,1), (14,1), (17,1)}
(ii) {(2,1), (4,2), (6,3), (8,4), (10,5), (12,6), (14,7)}
(iii) {(1,3), (1,5), (2,5)}

(A) (i), (iii) only (B) (ii, (iii)) only (C) (i) and (ii) only (D) (i), (ii), (iii)

15. Find the domain of the function $f(x) = \frac{1}{\sqrt{x+[x]}}$.

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

16. Find the measure of the angle between the lines x+y+7=0 and x-y+1=0.

(A) 30^0 (B) 45^0 (C) 60^0 (D) 90^0

17. Find the value of x for which the points (x,-1), (2,1) and (4,5) are collinear.

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

18. The line perpendicular to the line segment joining the points (1,0) and (2,3) divides it in the ratio 1:n, find the equation of the line

(A) (n+1) x+3 (n+1)y-(n+11)=0 (B) nx+ 3y-11=0
(C) (n+1) x-3ny-11=0 (D) nx+3(n+1)y+10=0

19. Find the value of p so that the three lines 3x+y-2=0, px+2y-3=0 and 2x-y-3=0 may intersect at one point.

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

20. Find the equation of a circle with centre (b,a) and touching x-axis.

(A) $x^2 + y^2 - 2bx + 2ay + b^2 = 0$ (B) $x^2 + y^2 - 2bx - 2ay + b^2 = 0$
(C) $x^2 + y^2 + 2ax + 2by + a^2 = 0$ (D) $x^2 - y^2 - ax - by + a^2 = 0$

21. Find the length of the latus rectum of $3x^2 + 2y^2 = 18$?

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

22. Find the centroid of a triangle, mid points of whose sides are (1,2,-3), (3,0,1) and (-1,1, -1).

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

23. Evaluate $\lim_{x\to 0} \frac{\sin ax}{bx}$.

(A) 0 (B) b/a (C) ab (D) a/b

24. Find the $\lim_{x\to 1} f(x)$ where $f(x) = x^2 - 1, if\ x \leq 1$, and $f(x) = -x - 1, if\ x > 1$.

(A) 0 (B) -1 (C) 1 (D) Limit does not exist

25. Three vertices of a parallelogram PQRS are P(3,-1,2), Q(1,2,-4) and R (-1,1,2). Find the coordinates of the fourth vertex.

(A) (1,2,3) (B) (2,4,-1) (C) (1,-2,8) (D) (3,5,-2)

26. Find the mean deviation about the mean for the data 4,7,8,9,10,12,13,17.

(A) 2 (B) 3 (C) 5 (D) 0

27. The number lock of a suitcase has 4 wheels, each labelled with ten digits i.e. from 0 to 9. The lock opens with a sequence of four digits with no repeats. What is the probability of a person getting the right sequence to open the suitcase?

(A) 1/5040 (B) 2/1500 (C) 1/5540 (D) 3/4501

28. R and S are two events such that P(R)= 0.54, P(S)=0.69 and P(R ∩ S)=0.35. Find P(A ∩ B').

(A) 0.09 (B) 0.19 (C) 0.90 (D) 0.21

29. Consider the relation R defined on the set of real numbers as R={(a,b) : a $\leq b^2$}. For relation R which of the following statements are correct?

(i) R is reflexive
(ii) R is symmetric
(iii) R is transitive
(iv) R is neither reflexive nor symmetric nor transitive

(A) Statement (i) only (B) Statement (ii) only
(C) Statement (iii) only (D) Statement (iv) only

30. Find the principal value of $\tan^{-1}(-\sqrt{3})$.

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

31. Find the value of $\tan^{-1}\left(\frac{x}{y}\right) - \tan^{-1}\left(\frac{x-y}{x+y}\right)$.

(A) $\pi/4$ (B) $\pi/3$ (C) 0 (D) $\pi/2$

32. Which of the given values of x and y make the following pair of matrices are equal

$$\begin{bmatrix} 3x+7 & 5 \\ y+1 & 2-3x \end{bmatrix} = \begin{bmatrix} 0 & y-2 \\ 8 & 4 \end{bmatrix}$$

(A) x=1, y=3 (B) x=-1, y=0 (C) x=2, y=1 (D) Not possible to find

33. If P is a square matrix such that $P^2 = P$, then $(I+P)^3 - 7A$ is equal to

(A) $P + I$ (B) $I - P$ (C) I (D) $2P$

34. The matrix $P'QP$ is symmetric provided _____

(A) P is symmetric (B) P is skew-symmetric
(C) Q is symmetric (D) Q is skew-symmetric

35. If $f(x)$ is an odd function and if $\lim_{x\to 0} f(x)$ exists, then the value of the f $\lim_{x\to 0} f(x)$ is_____.

(A) -1 (B) 0 (C) 1 (D) Limit does not exist

36. Find the value of a if the function defined below is continuous at $x = 2$.

$$f(x) = \begin{cases} 2x-1, & x < 2 \\ a, & x = 2 \\ x+1, & x > 2 \end{cases}$$

(A) 3 (B) 1 (C) 2 (D) No such value exists

37. Find $\frac{dy}{dx}$ for the function $y = \sec^{-1}\left(\frac{x+1}{x-1}\right) + \sin^{-1}\left(\frac{x-1}{x+1}\right)$.

(A) 0 (B) 1 (C) $\tan^{-1} x$ (D) $\cot^{-1} x$

38. Find $\frac{dy}{dx}$ if $x^y = y^x$.

(A) $\frac{y[x \log x - 1]}{x[y \log x - 1]}$ (B) $\frac{x \log y}{y \log x}$ (C) $\frac{\log x - \log y}{x - y}$ (D) $\frac{y[x \log y - y]}{x[y \log x - x]}$

39. A man of height 180cm is moving away from a lamp post at a rate of 1.2 metres per sec. If the height of the lamp post is 4.5 metres, find the rate at which his shadow is lengthening.

(A) 1.2 m/sec (B) 0.8 m/sec (C) 0.5 m/sec (D) 2 m/sec

40. Find the point on the curve $= x^2 - 4x + 3$, the normal at which is parallel to the line whose slope is 1/2.

(A) (0, 3) (B) (2,-1) (C) (1,0) (D) (-1, 8)

41. Show that the function $f(x) = \tan^{-1}(\sin x + \cos x)$ is strictly increasing in the interval_____.

(A) $(0, \pi)$ (B) $(-\pi, 0)$ (C) $(-\pi, \pi)$ (D) $(0, \pi/4)$

42. Find the percentage error in the area of a rectangle when an error of 1% is made in measuring its length and breadth.

(A) 2% (B) 3% (C) 1% (D) 4%

43. Evaluate the integral $\int \frac{x \sin^{-1} x}{\sqrt{1-x^2}}\, dx$.

(A) $\sin^{-1} x + x + c$ (B) $-\sqrt{1-x^2} \sin^{-1} x + x + c$

(C) $\sin^{-1} x + x$ (D) $\sqrt{1-x^2} + \sin^{-1} x + c$

44. Find the value of $\int_0^{\pi} \cos 2x \log(\sin x)\, dx$.

(A) $-\pi/2$ (B) π (C) $\pi/4$ (D) $\pi/2$

45. Find the area of the region bounded by the curve $y^2 = 4ax$ and its latus rectum.

(A) $4a^2$ (B) $8a^2/5$ (C) $8a^2/3$ (D) $5a^2$

46. Find the area bounded by $y = x^2 - 9$, $x = 0$, $x = 2$ and the x-axis.

(A) 23/3 (B) 46/3 (C) 12/5 (D) 13

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

(A) $e^y + e^x = x + c$ (B) $e^y e^x = x^2 + x + c$

(C) $e^{x+y} = x^3 + x + c$ (D) $e^y = e^x + \frac{x^3}{3} + c$

48. Find the general solution of the differential equation $\frac{dy}{dx} + 2y = 4x$.

(A) $y = 2x + xe^x$ (B) $x = y + e^{-x} + c$

(C) $y = (2x - 1) + c\, e^{-2x}$ (D) $y = 2x + 3 + c\, e^{-2x}$

49. Determine the order and degree (if defined) of the differential equation $\left(\frac{dy}{dx}\right)^4 + 3y\frac{d^2y}{dx^2} = 0.$

(A) Order=2, degree=1 (B) Order= 1, degree=4
(C) Order=1, degree=1 (D) Order=2, degree=4

50. Find a vector in the direction of vector $5\hat{\imath} - \hat{\jmath} + 2\hat{k}$ which has magnitude 8 units.

(A) $\frac{5\hat{\imath}-\hat{\jmath}+2\hat{k}}{8}$ (B) $\frac{-5\hat{\imath}+\hat{\jmath}-2\hat{k}}{8}$
(C) $\frac{40}{\sqrt{30}}\hat{\imath} + \frac{8}{\sqrt{30}}\hat{\jmath} + \frac{16}{\sqrt{30}}\hat{k}$ (D) $\frac{40}{\sqrt{30}}\hat{\imath} - \frac{8}{\sqrt{30}}\hat{\jmath} + \frac{16}{\sqrt{30}}\hat{k}$

51. If $\vec{a}$ and $\vec{b}$ are two collinear vectors, then which of the following are incorrect?

(i) $\vec{b} = \lambda\vec{a}$, for some scalar λ

(ii) $\vec{b} = \pm\vec{a}$,

(iii) The respective components of $\vec{a}$ and $\vec{b}$ are proportional.

(iv) Both the vectors $\vec{a}$ and $\vec{b}$ have same direction but different magnitudes.

(A) Statement (i) is incorrect (B) Statement (iv) is incorrect
(C) Statement (i) and (ii) are incorrect (D) Statement (iii) is incorrect

52. Find the direction cosines of the vector $\hat{\imath} + 2\hat{\jmath} + 3\hat{k}$.

(A) $\left(\frac{1}{10}, \frac{2}{10}, \frac{\sqrt{5}}{10}\right)$ (B) $\left(\frac{-1}{10}, \frac{2}{10}, \frac{-\sqrt{5}}{10}\right)$
(C) $\left(\frac{1}{\sqrt{14}}, \frac{2}{\sqrt{14}}, \frac{3}{\sqrt{14}}\right)$ (D) $\left(\frac{-1}{\sqrt{14}}, \frac{2}{\sqrt{14}}, \frac{-3}{\sqrt{14}}\right)$

53. Find the angle between two vectors $\vec{a}$ and $\vec{b}$ with magnitude $\sqrt{3}$ and 2 respectively with $\vec{a}\cdot\vec{b} = \sqrt{6}$.

(A) $\pi/2$ (B) $\pi/5$ (C) $\pi/6$ (D) $\pi/4$

54. Find the projection of the vector $\hat{\imath} - \hat{\jmath}$ on the vector $\hat{\imath} + \hat{\jmath}$.

(A) 1 (B) 2 (C) 0 (D) 0.5

55. Find the Cartesian equation of the line which passes through the point (-2,4,-5) and parallel to the vector vector $3\hat{\imath} + 5\hat{\jmath} + 6\hat{k}$.

(A) $\frac{x+2}{3} = \frac{y-4}{5} = \frac{z+5}{6} = k$ (B) $\frac{x-2}{3} = \frac{y+4}{5} = \frac{z-5}{6} = k$
(C) $x + y + z = -3$ (D) None of the above

56. Find the value of p so that the lines $\frac{1-x}{3} = \frac{7y-14}{2p} = \frac{z-3}{2}$ and $\frac{7-7x}{3p} = \frac{y-5}{1} = \frac{6-z}{5}$ are at right angles.

(A) 12/17 (B) 11/70 (C) 70/11 (D) 25/11

57. If P and Q are square matrices of order 3, such that |P|=-1, |Q|=3, then |3PQ| is equal to

(A) 81 (B) -81 (C) -9 (D) -27

58. If P^T is the transpose of a square matrix P. Then

(A) $|P| \neq |P^T|$ (B) $|P| + |P^T| = 0$

(C) $|P| = |P^T|$only if P is symmetric (D) $|P| = |P^T|$

59. If P and Q are skew –symmetric matrices of order n ($P \neq Q$), then

(A) $P + Q$is skew-symmetric (B) $P + Q$is symmetric

(C) $P + Q$is a diagonal matrix (D) $P + Q$is a zero matrix

60. The area of the parallelogram of which $\hat{\imath}$ and $\hat{\imath} + \hat{\jmath}$ are adjacent sides is

(A) 1 (B) 2 (C) ½ (D) $\sqrt{2}$

x-x-x