MATHEMATICS

1. A line passes through (2, 2) and is perpendicular to the line $3x + y = 3$. Its y-intercept is

(A) 1 (B) $\frac{4}{3}$ (C) $\frac{1}{3}$ (D) $\frac{2}{3}$

2. The distance between the foci of a hyperbola is 16 and its eccentricity is $\sqrt{2}$. Its equation is

(A) $2x^2 - 3y^2 = 7$ (B) $y^2 - x^2 = 32$ (C) $x^2 - y^2 = 32$ (D) $\frac{x^2}{4} - \frac{y^2}{9} = 1$

3. If $\lim_{x \to 0} \frac{\sin(2+x) - \sin(2-x)}{x} = A \cos B$, then the values of A and B respectively are

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

4. If n is even and the middle term in the expansion of $\left(x^2 + \frac{1}{x}\right)^n$ is $924\, x^6$, then n is equal to

(A) 12 (B) 8 (C) 10 (D) 14

5. n^{th} term of the series

$1 + \frac{3}{7} + \frac{5}{7^2} + \frac{1}{7^2} + \ldots$ is

(A) $\frac{2n-1}{7^n}$ (B) $\frac{2n+1}{7^{n-1}}$ (C) $\frac{2n-1}{7^{n-1}}$ (D) $\frac{2n+1}{7^n}$

6. If $p\left(\frac{1}{q} + \frac{1}{r}\right), q\left(\frac{1}{r} + \frac{1}{p}\right), r\left(\frac{1}{p} + \frac{1}{q}\right)$ are in A.P., then p, q, r

(A) are in A.P. (B) are not in G.P.

(C) are not in A.P. (D) are in G.P.

Space For Rough Work

7. Let $f : R \to R$ be defined by $f(x) = 3x^2 - 5$ and $g : R \to R$ by $g(x) = \frac{x}{x^2 + 1}$ then gof is

(A) $\frac{3x^2}{x^4 + 2x^2 - 4}$ (B) $\frac{3x^2}{9x^4 + 30x^2 - 2}$ (C) $\frac{3x^2 - 5}{9x^4 - 30x^2 + 26}$ (D) $\frac{3x^2 - 5}{9x^4 - 6x^2 + 26}$

8. Let the relation R be defined in N by aRb if $3a + 2b = 27$ then R is

(A) $\{(1, 12), (3, 9), (5, 6), (7, 3), (9, 0)\}$

(B) $\{(2, 1), (9, 3), (6, 5), (3, 7)\}$

(C) $\{(1, 12), (3, 9), (5, 6), (7, 3)\}$

(D) $\left\{\left(0, \frac{27}{2}\right), (1, 12), (3, 9), (5, 6), (7, 3)\right\}$

9. Let $f(x) = \sin 2x + \cos 2x$ and $g(x) = x^2 - 1$, then $g(f(x))$ is invertible in the domain

(A) $x \in \left[\frac{-\pi}{2}, \frac{\pi}{2}\right]$ (B) $x \in \left[0, \frac{\pi}{4}\right]$ (C) $x \in \left[\frac{-\pi}{4}, \frac{\pi}{4}\right]$ (D) $x \in \left[\frac{-\pi}{8}, \frac{\pi}{8}\right]$

10. The contrapositive of the statement

"If two lincs do not intersect in the same plane then they are parallel." is

(A) If two lines are not parallel then they do not intersect in the same plane.

(B) If two lines are parallel then they do not intersect in the same plane.

(C) If two lines are not parallel then they intersect in the same plane.

(D) If two lines are parallel then they intersect in the same plane.

11. The mean of 100 observations is 50 and their standard deviation is 5. Then the sum of squares of all observations is

(A) 250000 (B) 255000 (C) 50000 (D) 252500

12. $f : R \to R$ and $g : [0, \infty) \to R$ are defined by $f(x) = x^2$ and $g(x) = \sqrt{x}$. Which one of the following is not true ?

(A) (fog) (2) = 2 (B) (gof) (–2) = 2 (C) (gof) (4) = 4 (D) (fog) (–4) = 4

Space For Rough Work

13. If A and B are two matrices such that $AB = B$ and $BA = A$ then $A^2 + B^2 =$

(A) AB (B) 2 BA (C) A + B (D) 2 AB

14. If $A = \begin{bmatrix} 2-k & 2 \\ 1 & 3-k \end{bmatrix}$ is singular matrix, then the value of $5k - k^2$ is equal to

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

15. The area of a triangle with vertices $(-3, 0)$, $(3, 0)$ and $(0, k)$ is 9 sq. units, the value of k is

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

16. If $\Delta = \begin{vmatrix} 1 & a & a^2 \\ 1 & b & b^2 \\ 1 & c & c^2 \end{vmatrix}$ and $\Delta_1 = \begin{vmatrix} 1 & 1 & 1 \\ bc & ca & ab \\ a & b & c \end{vmatrix}$ then

(A) $\Delta_1 \neq \Delta$ (B) $\Delta_1 = -\Delta$ (C) $\Delta_1 = \Delta$ (D) $\Delta_1 = 3\Delta$

17. If $\sin^{-1}\left(\frac{2a}{1+a^2}\right) + \cos^{-1}\left(\frac{1-a^2}{1+a^2}\right) = \tan^{-1}\left(\frac{2x}{1-x^2}\right)$ where $a, x \in (0, 1)$ then the value of x is

(A) $\frac{2a}{1+a^2}$ (B) $\frac{2a}{1-a^2}$ (C) 0 (D) $\frac{a}{2}$

18. The value of

$$\cot^{-1}\left[\frac{\sqrt{1-\sin x}+\sqrt{1+\sin x}}{\sqrt{1-\sin x}-\sqrt{1+\sin x}}\right] \text{ where } x \in \left(0, \frac{\pi}{4}\right)$$

is

(A) $\pi - \frac{x}{3}$ (B) $\pi - \frac{x}{2}$ (C) $\frac{x}{2}$ (D) $\frac{x}{2} - \pi$

19. If $x\begin{bmatrix} 3 \\ 2 \end{bmatrix} + y\begin{bmatrix} 1 \\ -1 \end{bmatrix} = \begin{bmatrix} 15 \\ 5 \end{bmatrix}$ then the value of x and y are

(A) $x = -4, y = -3$ (B) $x = -4, y = 3$

(C) $x = 4, y = 3$ (D) $x = 4, y = -3$

Space For Rough Work

20. If the function is $f(x) = \frac{1}{x+2}$, then the point of discontinuity of the composite function $y = f(f(x))$ is

(A) $\frac{2}{5}$ (B) $\frac{1}{2}$ (C) $\frac{-5}{2}$ (D) $\frac{5}{2}$

21. If $y = a \sin x + b \cos x$, then $y^2 + \left(\frac{dy}{dx}\right)^2$ is a

(A) function of x and y (B) constant

(C) function of x (D) function of y

22. If $f(x) = 1 + nx + \frac{n(n-1)}{2}x^2 + \frac{n(n-1)(n-2)}{6}x^3 + \ldots\ldots + x^n$ then $f''(1) =$

(A) $n(n-1)2^n$ (B) 2^{n-1} (C) $(n-1)2^{n-1}$ (D) $n(n-1)2^{n-2}$

23. If $A = \begin{bmatrix} 1 & \tan \alpha/2 \\ -\tan \alpha/2 & 1 \end{bmatrix}$ and $AB = I$ then $B =$

(A) $\cos^2 \alpha/2 \cdot I$ (B) $\sin^2 \alpha/2 \cdot A$ (C) $\cos^2 \alpha/2 \cdot A^T$ (D) $\cos^2 \alpha/2 \cdot A$

24. If $u = \sin^{-1}\left(\frac{2x}{1+x^2}\right)$ and $v = \tan^{-1}\left(\frac{2x}{1-x^2}\right)$ then $\frac{du}{dv}$ is

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

25. The function $f(x) = \cot x$ is discontinuous on every point of the set

(A) $\{x = (2n+1)\frac{\pi}{2}; n \in Z\}$ (B) $\{x = \frac{n\pi}{2}; n \in Z\}$

(C) $\{x = n\pi; n \in Z\}$ (D) $\{x = 2n\pi; n \in Z\}$

Space For Rough Work

26. A particle moves along the curve $\frac{x^2}{16}+\frac{y^2}{4}=1$. When the rate of change of abscissa is 4 times that of its ordinate, then the quadrant in which the particle lies is

(A) III or IV (B) II or III (C) I or III (D) II or IV

27. An enemy fighter jet is flying along the curve given by $y = x^2 + 2$. A soldier is placed at (3, 2) wants to shoot down the jet when it is nearest to him. Then the nearest distance is

(A) 2 units (B) $\sqrt{5}$ units (C) $\sqrt{3}$ units (D) $\sqrt{6}$ units

28. $\int_2^8 \frac{5^{\sqrt{10-x}}}{5^{\sqrt{x}}+5^{\sqrt{10-x}}}\,dx =$

(A) 4 (B) 3 (C) 5 (D) 6

29. $\int \sqrt{\text{cosec } x - \sin x}\,dx =$

(A) $2\sqrt{\sin x}+C$ (B) $\frac{2}{\sqrt{\sin x}}+C$ (C) $\sqrt{\sin x}+C$ (D) $\frac{\sqrt{\sin x}}{2}+C$

30. If $f(x)$ and $g(x)$ are two functions with $g(x) = x - \frac{1}{x}$ and $fog\,(x) = x^3 - \frac{1}{x^3}$ then $f'(x) =$

(A) $x^2-\frac{1}{x^2}$ (B) $1-\frac{1}{x^2}$ (C) $3x^2+3$ (D) $3x^2+\frac{3}{x^4}$

31. A circular plate of radius 5 cm is heated. Due to expansion, its radius increases at the rate of 0.05 cm/sec. The rate at which its area is increasing when the radius is 5.2 cm is

(A) 5.05 π cm^2/sec (B) 0.52 π cm^2/sec

(C) 5.2 π cm^2/sec (D) 27.4 π cm^2/sec

32. The distance 's' in meters travelled by a particle in 't' seconds is given by $s = \frac{2t^3}{3} - 18t + \frac{5}{3}$.

The acceleration when the particle comes to rest is

(A) 12 m^2/sec. (B) 18 m^2/sec. (C) 3 m^2/sec. (D) 10 m^2/sec.

Space For Rough Work

33. $\int_0^{\pi} \frac{x \tan x}{\sec x \cdot \operatorname{cosec} x} dx =$

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

34. $\int \sqrt{5 - 2x + x^2}\, dx =$

(A) $\frac{x-1}{2}\sqrt{5 + 2x + x^2} + 2 \log \left| (x-1) + \sqrt{5 + 2x + x^2} \right| + C$

(B) $\frac{x-1}{2}\sqrt{5 - 2x + x^2} + 2 \log \left| (x-1) + \sqrt{5 - 2x + x^2} \right| + C$

(C) $\frac{x-1}{2}\sqrt{5 - 2x + x^2} + 2 \log \left| (x+1) + \sqrt{x^2 + 2x + 5} \right| + C$

(D) $\frac{x}{2}\sqrt{5 - 2x + x^2} + 4 \log \left| (x+1) + \sqrt{x^2 - 2x + 5} \right| + C$

35. $\int \frac{1}{1 + 3\sin^2 x + 8\cos^2 x} dx =$

(A) $\frac{1}{6}\tan^{-1}\left(\frac{2\tan x}{3}\right) + C$ (B) $6\tan^{-1}\left(\frac{2\tan x}{3}\right) + C$

(C) $\frac{1}{6}\tan^{-1}(2\tan x) + C$ (D) $\tan^{-1}\left(\frac{2\tan x}{3}\right) + C$

36. $\int_{-2}^{0} (x^3 + 3x^2 + 3x + 3 + (x+1)\cos(x+1))\, dx =$

(A) 4 (B) 1 (C) 0 (D) 3

Space For Rough Work

$\frac{x^4}{4} + \frac{3x^3}{3} + \frac{3x^2}{2} + 3x(-\sin(x+1)$

37. The degree of the differential equation

$$1+\left(\frac{dy}{dx}\right)^2+\left(\frac{d^2y}{dx^2}\right)^2=\sqrt[3]{\frac{d^2y}{dx^2}+1} \text{ is}$$

(A) 1 (B) 2 (C) 6 (D) 3

38. If $\left|\vec{a}+\vec{b}\right|=\left|\vec{a}-\vec{b}\right|$ then

(A) $\vec{a}$ and $\vec{b}$ are coincident.

(B) Inclined to each other at 60°.

(C) $\vec{a}$ and $\vec{b}$ are perpendicular.

(D) $\vec{a}$ and $\vec{b}$ are parallel.

39. The component of $\hat{i}$ in the direction of the vector $\hat{i}+\hat{j}+2\hat{k}$ is

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

40. In the interval $(0, \pi/2)$, area lying between the curves $y = \tan x$ and $y = \cot x$ and the X-axis is

(A) 4 log 2 sq. units

(B) log 2 sq. units

(C) 3 log 2 sq. units

(D) 2 log 2 sq. units

41. The area of the region bounded by the line $y = x + 1$, and the lines $x = 3$ and $x = 5$ is

(A) $\frac{11}{2}$ sq. units

(B) 7 sq. units

(C) 10 sq. units

(D) $\frac{7}{2}$ sq. units

42. If a curve passes through the point (1, 1) and at any point (x, y) on the curve, the product of the slope of its tangent and x co-ordinate of the point is equal to the y co-ordinate of the point, then the curve also passes through the point

(A) $(-1, 2)$ (B) $(\sqrt{3}, 0)$ (C) (2, 2) (D) (3, 0)

Space For Rough Work

43. The length of perpendicular drawn from the point $(3, -1, 11)$ to the line $\frac{x}{2} = \frac{y-2}{3} = \frac{z-3}{4}$ is

(A) $\sqrt{33}$ (B) $\sqrt{53}$ (C) $\sqrt{66}$ (D) $\sqrt{29}$

44. The equation of the plane through the points $(2, 1, 0)$, $(3, 2, -2)$ and $(3, 1, 7)$ is

(A) $6x - 3y + 2z - 7 = 0$ (B) $7x - 9y - z - 5 = 0$

(C) $3x - 2y + 6z - 27 = 0$ (D) $2x - 3y + 4z - 27 = 0$

45. The point of intersection of the line $x + 1 = \frac{y+3}{3} = \frac{-z+2}{2}$ with the plane $3x + 4y + 5z = 10$ is

(A) $(2, 6, -4)$ (B) $(2, 6, 4)$ (C) $(-2, 6, -4)$ (D) $(2, -6, -4)$

46. If $(2, 3, -1)$ is the foot of the perpendicular from $(4, 2, 1)$ to a plane, then the equation of the plane is

(A) $2x - y + 2z = 0$ (B) $2x + y + 2z - 5 = 0$

(C) $2x - y + 2z + 1 = 0$ (D) $2x + y + 2z - 1 = 0$

47. $\left|\vec{a} \times \vec{b}\right|^2 + \left|\vec{a} \cdot \vec{b}\right|^2 = 144$ and $\left|\vec{a}\right| = 4$ then $\left|\vec{b}\right|$ is equal to

(A) 8 (B) 4 (C) 12 (D) 3

48. If $\vec{a} + 2\vec{b} + 3\vec{c} = \vec{0}$ and

$$\left(\vec{a} \times \vec{b}\right) + \left(\vec{b} \times \vec{c}\right) + \left(\vec{c} \times \vec{a}\right) = \lambda\left(\vec{b} \times \vec{c}\right)$$

then the value of λ is equal to

(A) 4 (B) 6 (C) 2 (D) 3

49. If a line makes an angle of $\frac{\pi}{3}$ with each X and Y axis then the acute angle made by Z-axis is

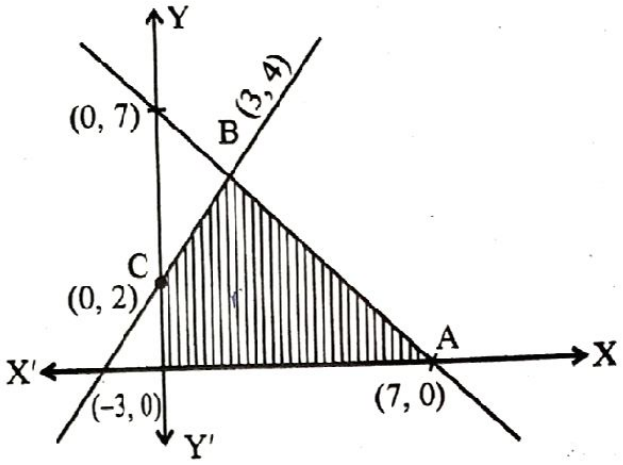
(A) $\frac{\pi}{2}$ (B) $\frac{\pi}{4}$ (C) $\frac{\pi}{6}$ (D) $\frac{\pi}{3}$

Space For Rough Work

50. Let A = {x, y, z, u} and B = {a, b}. A function f : A → B is selected randomly. The probability that the function is an onto function is

(A) $\frac{5}{8}$ (B) $\frac{1}{35}$ (C) $\frac{7}{8}$ (D) $\frac{1}{8}$

51. The shaded region in the figure given is the solution of which of the inequations ?



(A) $x + y \geq 7, 2x - 3y + 6 \geq 0, x \geq 0, y \geq 0$

(B) $x + y \leq 7, 2x - 3y + 6 \leq 0, x \geq 0, y \geq 0$

(C) $x + y \leq 7, 2x - 3y + 6 \geq 0, x \geq 0, y \geq 0$

(D) $x + y \geq 7, 2x - 3y + 6 \leq 0, x \geq 0, y \geq 0$

52. If A and B are events such that $P(A) = \frac{1}{4}$, $P(A/B) = \frac{1}{2}$ and $P(B/A) = \frac{2}{3}$ then P(B) is

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

53. A bag contains 2n + 1 coins. It is known that n of these coins have head on both sides whereas the other n + 1 coins are fair. One coin is selected at random and tossed. If the probability that toss results in heads is $\frac{31}{42}$, then the value of n is

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

Space For Rough Work

54. The value of $\begin{vmatrix} \sin^2 14° & \sin^2 66° & \tan 135° \\ \sin^2 66° & \tan 135° & \sin^2 14° \\ \tan 135° & \sin^2 14° & \sin^2 66° \end{vmatrix}$ is

(A) 1 (B) 2 (C) –1 (D) 0

55. The modulus of the complex number $\frac{(1+i)^2(1+3i)}{(2-6i)(2-2i)}$ is

(A) $\frac{1}{\sqrt{2}}$ (B) $\frac{\sqrt{2}}{4}$ (C) $\frac{4}{\sqrt{2}}$ (D) $\frac{2}{\sqrt{2}}$

56. Given that a, b and x are real numbers and $a < b$, $x < 0$ then

(A) $\frac{a}{x} < \frac{b}{x}$ (B) $\frac{a}{x} \leq \frac{b}{x}$ (C) $\frac{a}{x} > \frac{b}{x}$ (D) $\frac{a}{x} \geq \frac{b}{x}$

57. Ten chairs are numbered as 1 to 10. Three women and two men wish to occupy one chair each. First the women choose the chairs marked 1 to 6, then the men choose the chairs from the remaining. The number of possible ways is

(A) ${}^6C_3 \times {}^4P_2$ (B) ${}^6P_3 \times {}^4C_2$ (C) ${}^6C_3 \times {}^4C_2$ (D) ${}^6P_3 \times {}^4P_2$

58. Which of the following is an empty set ?

(A) $\{x : x^2 - 9 = 0, x \in R\}$ (B) $\{x : x^2 = x + 2, x \in R\}$

(C) $\{x : x^2 - 1 = 0, x \in R\}$ (D) $\{x : x^2 + 1 = 0, x \in R\}$

59. If $f(x) = ax + b$, where a and b are integers, $f(-1) = -5$ and $f(3) = 3$ then a and b are respectively

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

60. The value of $e^{\log_{10} \tan 1° + \log_{10} \tan 2° + \log_{10} \tan 3° + \ldots + \log_{10} \tan 89°}$ is

(A) $\frac{1}{e}$ (B) 1 (C) 0 (D) 3

Space For Rough Work

1M0520K23 (DAY-1, SECOND SESSION)

SUBJECT CODE	TIME	QUESTION BOOKLET	
		VERSION CODE	SERIAL NUMBER
M	2.30 pm to 3.50 pm	B-3	

Total Duration	Maximum Time for Answering	Maximum Marks	Total No. of Questions	Mention Your CET Number					
80 Minutes	70 Minutes	60	60	23UGE					

DOs:

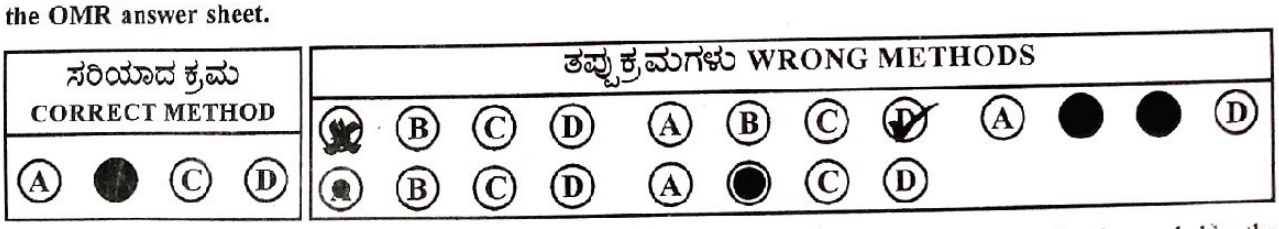
1. This question booklet is issued to you by the room invigilator **after 2.30 pm.**
2. Check whether the CET Number has been entered and shaded in the respective circles on the OMR answer sheet.
3. The version code of this question booklet should be entered on the OMR answer sheet and the respective circles should also be shaded completely.
4. The Version Code and Serial Number of this question booklet should also be entered on the Nominal Roll without any mistakes.
5. Compulsorily sign at the bottom portion of the OMR answer sheet in the space provided.

DONTs:

1. **THE TIMING AND MARKS PRINTED ON THE OMR ANSWER SHEET SHOULD NOT BE DAMAGED / MUTILATED / SPOILED.**
2. The 3rd **Bell rings at 2.40 pm, till then;**
   - Do not remove the seal present on the right hand side of this question booklet.
   - Do not look inside this question booklet or start answering on the OMR answer sheet.

IMPORTANT INSTRUCTIONS TO CANDIDATES

1. In case of usage of SIGNS AND SYMBOLS in the questions, the regular texbook connotation should be considered unless stated otherwise.
2. This question booklet contains **60** questions and each question will have one statement and four different options/ responses & out of which you have to choose one correct answer.
3. After the 3rd **Bell rings at 2.40 pm,** remove the paper seal 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.
4. Completely **darken / shade** the relevant circle with **a blue or black ink ballpoint pen against the question number on the OMR answer sheet.**



5. Please note that even a minute unintended ink dot on the OMR answer sheet will also be recognized and recorded by the scanner. Therefore, avoid multiple markings of any kind on the OMR answer sheet.
6. Use the space provided on each page of the question booklet for Rough Work. Do not use the OMR answer sheet for the same.
7. **Last Bell will ring at 3.50 pm,** stop writing on the OMR answer sheet.
8. Hand over the **OMR answer sheet** to the room invigilator as it is.
9. After separating the top sheet (Office copy), the invigilator will return the bottom sheet replica (Candidate's copy) to you.

NOTE : In case of any discrepancy between English and Kannada Versions, the English version will be taken as final.