MHT-CET

Subjects : Mathematics
Full Test-01

Question Booklet Version	MH-CET - 2024 Roll No.	Question Booklet Sr. No.
15 (Write this number on your Answer Sheet)		**M110823** (Write this number on your Answer Sheet)
	Answer Sheet No.	

Day and Date :

Duration : 90 minutes

Total Marks : 100

This is to certify that, the entries of MH-CET Roll No. and Answer Sheet No. have been correctly written and verified.

Candidate's Signature Invigilator's Signature

Instructions to Candidates

1. This question booklet contains 50 Objective Type Question (Multiple Choice Questions (MCQ)) of Mathematics (50).
2. This question paper and OMR (Optical Mark Reader) Answer Sheet is issued separately at the start of the examination.
3. Choice and sequence for attempting questions will be as per the convenience of the candidate.
4. Candidate should carefully read the instructions printed on the Question Booklet and Answer Sheet and make the correct entries on the Answer Sheet. As Answer Sheets are designed to suit the OPTICAL MARK READER (OMR) SYSTEM , special care should be taken to mark the entries correctly. Special care should be taken to fill QUESTION BOOKLET VERSION, SERIAL No. and MH-CET Roll No. accurately. The correctness of entries has to be cross-checked by the invigilators. **The candidate must sign on the Answer Sheet and Question Booklet**
5. Read each question carefully
6. Determine the one correct answer from out of the four available options given for each question.
7. Fill the appropriate circle completely like this ●, for answering a particular question. Mark with Black ink ball point pen only.
8. **Each question with correct response shall be awarded two (2) mark. There shall be no negative marking. No mark shall be granted for marking two or more answers of same question, scratching or overwriting.**
9. Use of whitener or any other material to erase/hide the circle once filled is not permitted.
10. Avoid overwriting and/or striking of answer once marked.
11. Rough work should be done only on the blank space provided on the Question Booklet. **Rough work should not be done on the Answer Sheet.**
12. Immediately after the prescribed examination time is over, the Question Booklet and Answer sheet is to be returned to the Invigilator. Confirm that both the Candidate and invigilator have signed on question booklet and answer sheet
13. No candidate is allowed to leave the examination hall till the end of examination.

SPACE FOR ROUGH WORK

Q.1 The area of a triangle ABC is equal to $(a^2 + b^2 - c^2)$, where a, b and c are the sides of the triangle. The value of tan C equals

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

Q.2 Number of points on the straight line which joins $(-4, 11)$ to $(16, -1)$ whose co-ordinates are positive integer

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

Q.3 AB is any chord of the circle $x^2 + y^2 - 6x - 8y - 11 = 0$, which subtend 90° at (1, 2). If locus of mid-point of AB is circle $x^2 + y^2 - 2ax - 2by - c = 0$, then value of $(a + b + c)$ is

(A) 5 (B) 8 (C) 11 (D) 17

Q.4 Number of solutions of the equation $2\sin x + \cos 2x = 1$ in $[0, 2\pi]$, is

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

Q.5 Let the maximum area of the triangle that can be inscribed in the ellipse $\frac{x^2}{a^2} + \frac{y^2}{4} = 1, a > 2$, having one of its vertices at one end of the major axis of the ellipse and one of its sides parallel to the y-axis, be $6\sqrt{3}$. Then the eccentricity of the ellipse is

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

Q.6 The radius of a right circular cylinder increases at the rate of 0.1 cm/min, and the height decreases at the rate of 0.2 cm/min. The rate of change of the volume of the cylinder, in cm^3/min, when the radius is 2 cm and the height is 3 cm is.

(A) -2π (B) $-\frac{8\pi}{5}$ (C) $-\frac{3\pi}{5}$ (D) $\frac{2\pi}{5}$

Q.7 A bag contains $(2n + 1)$ coins. It is known that n of these coins have head on both the sides, whereas the remaining $(n + 1)$ coins are fair. Acoin is picked up at random from the bag and tossed.

If the probability that the toss results in a head is $\frac{31}{42}$, then the value of n, is

(A) 10 (B) 20 (C) 100 (D) 8

SPACE FOR ROUGH WORK

Q.8 $\sin\left(3\sin^{-1}\frac{2}{3}\right)$ is equal to

(A) $\frac{22}{7}$ (B) $\frac{22}{27}$ (C) $\frac{12}{27}$ (D) $\frac{17}{27}$

Q.9 The equation of the plane passing through the point (– 1, 3, 2) and perpendicular to each of the planes $x + 2y + 3z = 5$ and $3x + 3y + z = 0$ is $ax + by + cz + 25 = 0$, then the value of $(a + b + c)$, is

(A) 2 (B) 4 (C) 12 (D) 18

Q.10 The complex number z satisfies $z + |z| = 2 + 8i$. The value of $|z|$ is

(A) 10 (B) 13 (C) 17 (D) 23

Q.11 The derivative of $f(x) = x|x|$ is

(A) 2x (B) –2x (C) $2x^2$ (D) $2|x|$

Q.12 If $f(x) = \cos^{-1}\left[\frac{1-(\log x)^2}{1+(\log x)^2}\right]$, then the value of $f'(e)$ is equal to

(A) 1 (B) 1/e (C) 2/e (D) $\frac{2}{e^2}$

Q.13 Total number of ways of selecting two numbers from the set $\{1, 2, 3, 4, ... , 90\}$ so that their sum is divisible by 3, is

(A) 535 (B) 945 (C) 1335 (D) 2025

Q.14 If $|\vec{a}| = 3, |\vec{b}| = 4, |\vec{c}| = 5$ and $\vec{a} + \vec{b} + \vec{c} = 0$, then the angle between $\vec{a}$ and $\vec{b}$ is

(A) 0 (B) $\frac{\pi}{6}$ (C) $\frac{\pi}{3}$ (D) $\frac{\pi}{2}$

Q.15 Number of integers in the range of the function $f(x) = \cos^4 x + 3\sin^2 x$ will be

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

SPACE FOR ROUGH WORK

Q.16 Let $\log_b(2\sin^2 2\theta) = \frac{5}{4}$ where $\theta \in \left(0, \frac{\pi}{2}\right)$ and $\frac{\sin^2\theta}{2+\cos^2\theta} = \frac{1}{5}$. If $b = 2^q$ where q is rational, then the value of q is equal to

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

Q.17 The value of $\lim\limits_{x\to 0} \frac{\sin^4(3\sqrt{x})}{1-\cos x}$, is

(A) 324 (B) 243 (C) 162 (D) 81

Q.18 The value of p and q for which the function $f(x) = \begin{cases} \frac{\sin(p+1)x + \sin x}{x}, & x < 0 \\ q, & x = 0 \\ \frac{\sqrt{x+x^2} - \sqrt{x}}{x^{3/2}}, & x > 0 \end{cases}$ is continuous

for all x in R, is

(A) $p = \frac{5}{2}, q = \frac{1}{2}$ (B) $p = \frac{-3}{2}, q = \frac{1}{2}$ (C) $p = \frac{1}{2}, q = \frac{3}{2}$ (D) $p = \frac{1}{2}, q = \frac{-3}{2}$

Q.19 Consider the following statements

P : Sumanisbrilliant

Q : Suman is rich

R : Suman is honest.

The negation of the statement " Suman is brilliant and dishonestifandonlyifSumanisrich"canbeexpressedas :

(A) $\sim P \wedge (Q \leftrightarrow \sim R)$ (B) $(Q \leftrightarrow (P \wedge \sim R))$

(C) $\sim Q \leftrightarrow \sim P \wedge R$ (D) $(\sim P \vee R) \leftrightarrow Q$

Q.20 The distance of the plane passing through the point P(1, 1, 1) and perpendicular to the line $\frac{x-1}{3} = \frac{y-1}{0} = \frac{z-1}{4}$ fromtheorigin is

(A) 3/4 (B) 4/3 (C) 7/5 (D) 1

SPACE FOR ROUGH WORK

Q.21 If $\begin{bmatrix} 2 & -3 \\ 4 & 0 \end{bmatrix} - \begin{bmatrix} a & c \\ b & d \end{bmatrix} = \begin{bmatrix} 1 & 4 \\ 2 & -5 \end{bmatrix}$, then (a, b, c, d) =

(A) (1, 6, 2, 5) (B) (1, 2, 7, 5) (C) (1, 2, –7, 5) (D) (–1, –2, 7, –5)

Q.22 General solution of equation $\sin x - \cos^2 x + \frac{5}{4} = 0$ is given by (where $n \in I$)

(A) $x = n\pi + (-1)^{n+1}\left(\frac{\pi}{6}\right)$ (B) $x = n\pi + (-1)^n\left(\frac{\pi}{6}\right)$

(C) $x = n\pi + (-1)^n\left(\frac{\pi}{3}\right)$ (D) $x = n\pi - (-1)^n\left(\frac{\pi}{3}\right)$

Q.23 The volume of the parallelopiped constructed on the diagonals of the faces of the given rectangular parallelopiped is m times the volumes of the given parallelopiped. Then m is equal to :

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

Q.24 Aline $\frac{x+2}{1} = \frac{y-3}{2} = \frac{z-k}{3}$ cuts the y-z plane and the x-y plane at Aand B respectively.

If $\angle AOB = \frac{\pi}{2}$, (where O is the origin) then value of 2K, is

(A) 4 (B) 7

(C) 8 (D) 9

Q.25 If $\int \sin 5x \cos 3x dx = -\frac{\cos 8x}{16} + A$, then A =

(A) $\frac{\sin 2x}{16}$ + constant (B) $-\frac{\cos 2x}{4}$ + constant

(C) Constant (D) sin 4x + constant

SPACE FOR ROUGH WORK

Q.26 Function $f(x) = x^4 - \frac{x^3}{3}$ is

(A) Increasing for $x > \frac{1}{4}$ and decreasing for $x < \frac{1}{4}$

(B) Increasing for every value of x

(C) Dereasing for every value of x

(D) None of these

Q.27 If sum of all possible values of $x \in (0, 2\pi)$ satisfying the equation

$2 \cos x \cdot \text{cosec}\, x - 4 \cos x - \text{cosec}\, x = -2$, is $\frac{k\pi}{4}$, then k is equal to

(A) 9 (B) 12 (C) 16 (D) 32

Q.28 Let A_n be the area of region bounded by a curve $y = x^3(1 - x^2)^n$, $0 \le x \le 1$ and the x-axis, then the value of $A_1 + A_2$ is equal to

(A) 1/2 (B) 1/4 (C) 1/8 (D) 1

Q.29 If the slope of one line of the pair of lines represented by $ax^2 + 10xy + y^2 = 0$ is four times the slope of the other line, then a is equal to

(A) 1 (B) 2 (C) 4 (D) 16

Q.30 Given $|p| = 2$; $|q| = 3$ and $p \cdot q = 0$. If $V = (p \times (p \times (p \times (p \times q))))$ then the vector V is

(A) collinear with p (B) $V = 16\vec{p}$ (C) $V = 48\vec{q}$ (D) $V = 16\vec{q}$

Q.31 $\frac{d}{dx} \sin^{-1}(3x - 4x^3) =$

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

SPACE FOR ROUGH WORK

Q.32 If $\vec{a}$ and $\vec{b}$ are two orthogonal vectors of equal magnitude such that $\left|3\vec{a}+4\vec{b}\right|+\left|4\vec{a}-3\vec{b}\right|=20$, then the value of $\left|(\vec{a}\times\vec{b})\times\vec{a}\right|$ is equal to

(A) 16 (B) 8 (C) 4 (D) 2

Q.33 Equation of tangent to the curve $y=\sqrt{9-2x^2}$ at the point where ordinate and abscissa are equal, is

(A) $2x-y+\sqrt{3}=0$ (B) $2x-y-\sqrt{3}=0$ (C) $2x+y+3\sqrt{3}=0$ (D) $2x+y-3\sqrt{3}=0$

Q.34 Let $L_1=\frac{x+3}{1}=\frac{y-1}{-2}=\frac{z+2}{1}$ and $L_2=\frac{x-1}{2}=\frac{y-2}{-1}=\frac{z-3}{3}$, then the shortest distance between L_1 and L_2 is equal to

(A) 0 (B) $\frac{6}{\sqrt{35}}$ (C) $\frac{8}{\sqrt{35}}$ (D) $\frac{4}{\sqrt{35}}$

Q.35 $\int\frac{\text{cosec}\theta-\cot\theta}{\text{cosec}\theta+\cot\theta}d\theta$ is equal to (c is constant of integration)

(A) $2\,\text{cosec}\,\theta-2\cot\theta-\theta+c$ (B) $2\,\text{cosec}\,\theta-2\cot\theta+\theta+c$
(C) $2\,\text{cosec}\,\theta+2\cot\theta-\theta+c$ (D) None of these

Q.36 The maximum value of $10x+5y$ under the constraints $3x+y\le 15$, $x+2y\le 8$, $x, y\ge 0$ is

(A) 20 (B) 50 (C) 53 (D) 70

Q.37 If p, q, r are simple propositions, then the truth value of $(\sim p\vee q)\wedge\sim r\Rightarrow p$ is

(A) true if truth values of p, q, r are T, F, T respectively
(B) false if truth values of p, q, r are T, F, T respectively
(C) false if truth values of p, q, r are T, F, F respectively
(D) true if truth values of p, q, r are F, T, F respectively

Q.38 The angle between the vectors $\vec{a}+\vec{b}$ and $\vec{a}-\vec{b}$, when $\vec{a}=(1,1,4)$ and $\vec{b}=(1,-1,4)$ is

(A) 90° (B) 45° (C) 30° (D) 15°

SPACE FOR ROUGH WORK

Q.39 The integral $\int e^{2\ln(x^2+1)}dx$ is equal to (C is constant of integration)

(A) $\frac{1}{5}x^5 + \frac{3}{2}x^3 + x + C$ (B) $5x^5 + 3x^3 + x + C$

(C) $\frac{1}{5}x^5 + \frac{2}{3}x^3 + x + C$ (D) $2x + C$

Q.40 Let $f(x) = \begin{cases} x^3 + x^2 - 10x & -1 \le x < 0 \\ \sin x & 0 \le x < \frac{\pi}{2} \\ 1 + \cos x & \frac{\pi}{2} \le x \le \pi \end{cases}$

then for f(x) which of the following is not TRUE?

(A) absolute maximum value at $x = -1$ (B) local minimum at $x = \frac{\pi}{2}$

(C) absolute minimum value at $x = 0, \pi$ (D) local maximum at $x = \frac{\pi}{2}$

Q.41 The general solution of $x^2 \frac{dy}{dx} = 2$ is (c is constant of integration)

(A) $y = c + \frac{2}{x}$ (B) $y = c - \frac{2}{x}$ (C) $y = 2cx$ (D) $y = c - \frac{3}{x^2}$

Q.42 $\int \frac{3e^x + 5e^{-x}}{4e^x - 5e^{-x}} dx = Ax + B\, ln\, |4e^{2x} - 5| + C$, then

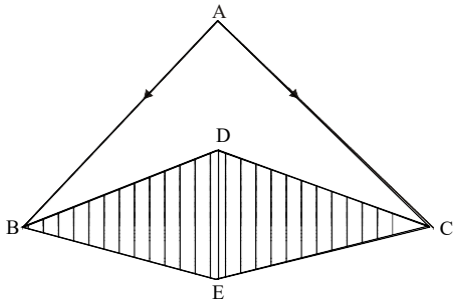
(A) A = –1, B = –7/8; C = const. of integration
(B) A = 1, B = 7/8; C = const. of integration
(C) A = –1/8, B = 7/8 ; C = const. of integration
(D) A = –1, B = 7/8 ; C = const. of integration

SPACE FOR ROUGH WORK

Q.43 The value of the definite integral $\int_{-1}^{1} \frac{dx}{(1+e^x)(1+x^2)}$ is

(A) $\pi/2$ (B) $\pi/4$ (C) $\pi/8$ (D) $\pi/16$

Q.44 Let $\overrightarrow{AB} = 3\hat{i} - \hat{j}$, $\overrightarrow{AC} = 2\hat{i} + 3\hat{j}$ and $\overrightarrow{DE} = 4\hat{i} - 2\hat{j}$.
The area of the shaded region in the adjacent figure, is



(A) 5 (B) 6 (C) 7 (D) 8

Q.45 Let I be the purchase value of an equipment and V(t) be the value after it has been used for t years. The value V(t) depreciates at a rate given by differential equation $\frac{dV(t)}{dt} = -k(T-t)$, where $k > 0$ is a constant and T is the total life in years of the equipment. Then the scrap value V(T) of the equipment is

(A) $I - \frac{kT^2}{2}$ (B) $I - \frac{k(T-t)^2}{2}$ (C) e^{-kT} (D) $T^2 - \frac{I}{k}$

Q.46 A random variable X has the probability distribution:

X:	1	2	3	4	5	6	7	8
P(X):	0.15	0.23	0.12	0.10	0.20	0.08	0.07	0.05

For the events E = {X is prime number} and F = {X < 4}, the probability $P(E \cup F)$ is-
(A) 0.35 (B) 0.77
(C) 0.87 (D) 0.50

SPACE FOR ROUGH WORK

Q.47 If the function $P(X = x) = kx, x = 1, 2, 3, 4, 5 = 0$, otherwise is a probability mass function (p.m.f.), then k is equal to

(A) $\frac{1}{14}$ (B) $\frac{1}{15}$ (C) $\frac{1}{16}$ (D) $\frac{1}{17}$

Q.48 If a fair coin is tossed 10 times, find the probability of getting exactly six heads.

(A) $\frac{105}{512}$ (B) $\frac{53}{64}$ (C) $\frac{193}{512}$ (5) $\frac{54}{64}$

Q.49 If Mean value theorem holds good for the function

$f(x) = \frac{x-1}{x}$ on the interval [1, 3] then the value of 'c' is

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

Q.50 If the curve satisfying the equation $(x^2 + y^2)dy = xy\,dx$ and passing through points (1, 1) and $\left(k, \sqrt{e}\right)$, then the value of k^2/e is equal to

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

SPACE FOR ROUGH WORK