MHT CET 2017 Paper I (Mathematics) May 11 Question Paper

Conducted by the State Common Entrance Test Cell, Maharashtra

Time Allowed: 90 Minutes **Total Questions: 50** **Maximum Marks: 100**

General Instructions

(i) This **Paper I - Mathematics** question paper is from **MHT CET 2017**.

(ii) This paper contains **50 objective questions** in Mathematics. Each question offers **four choices**; select the single best response.

(iii) The time allowed is **90 minutes**, for a total of **100 marks**.

(iv) Each correct response earns **2 marks**. There is **no negative marking**.

(v) Mark responses with a **black ink ball point pen** on the OMR answer sheet.

(vi) Use blank space in the question booklet for rough work. Do not use the answer sheet for rough work.

1. The number of principal solutions of $\tan 2\theta = 1$ is

(A) one (B) two

(C) three (D) four

2. The object function $z = 4x_1 + 5x_2$, subject to $2x_1 + x_2 \geq 7,\ \ 2x_1 + 3x_2 \leq 15,\ \ x_2 \leq 3,\ \ x_1, x_2 \geq 0$ has minimum value at the point

(A) on X-axis (B) on Y-axis

(C) at the origin (D) on the line parallel to X-axis

3. If z_1 and z_2 are z-coordinates of the points of trisection of the segment joining the points A(2,1,4), B(-1,3,6), then $z_1 + z_2 =$

(A) 1 (B) 4

(C) 5 (D) 10

4. The maximum value of $f(x) = \dfrac{\log x}{x}$ $(x \neq 0,\ x \neq 1)$ is

(A) e (B) $\dfrac{1}{e}$

(C) e^2 (D) $\dfrac{1}{e^2}$

5. $\int_0^1 x \tan^{-1} x\, dx =$

(A) $\pi/4 + 1/2$ (B) $\pi/4 - 1/2$

(C) $1/2 - \pi/4$ (D) $-\pi/4 - 1/2$

6. The statement pattern $(\neg p \wedge q)$ is logically equivalent to

(A) $(p \vee q) \vee \neg p$ (B) $(p \vee q) \wedge \neg p$

(C) $(p \wedge q) \to p$ (D) $(p \vee q) \to p$

7. If $g(x)$ is the inverse function of $f(x)$ and $f'(x) = \dfrac{1}{1+x^4}$, then $g'(x)$ is

(A) $1 + [g(x)]^4$ (B) $1 - [g(x)]^4$

(C) $1 + [f(x)]^4$ (D) $\dfrac{1}{1 + [g(x)]^4}$

8. The inverse of the matrix $\begin{bmatrix} 1 & 0 & 0 \\ 3 & 3 & 0 \\ 5 & 2 & -1 \end{bmatrix}$ is

(A) $-\dfrac{1}{3}\begin{bmatrix} -3 & 0 & 0 \\ 3 & 1 & 0 \\ 9 & 2 & -3 \end{bmatrix}$ (B) $-\dfrac{1}{3}\begin{bmatrix} -3 & 0 & 0 \\ 3 & -1 & 0 \\ -9 & -2 & 3 \end{bmatrix}$

(C) $-\dfrac{1}{3}\begin{bmatrix} 3 & 0 & 0 \\ 3 & -1 & 0 \\ -9 & -2 & 3 \end{bmatrix}$ (D) $-\dfrac{1}{3}\begin{bmatrix} -3 & 0 & 0 \\ -3 & -1 & 0 \\ -9 & -2 & 3 \end{bmatrix}$

9. If $\int \dfrac{1}{\sqrt{9 - 16x^2}} dx = \alpha \sin^{-1}(\beta x) + c$, then $\alpha + 1/\beta =$

(A) 1 (B) $\dfrac{7}{12}$

(C) $\dfrac{19}{12}$ (D) $\dfrac{9}{12}$

10. O(0,0), A(1,2), B(3,4) are the vertices of triangle OAB. The joint equation of the altitude and median drawn from O is

(A) $x^2 + 7xy - y^2 = 0$ (B) $x^2 + 7xy + y^2 = 0$

(C) $3x^2 - xy - 2y^2 = 0$ (D) $3x^2 + xy - 2y^2 = 0$

11. If the function $f(x) = \begin{cases} [\tan(\pi/4 + x)]^{1/x}, & x \neq 0 \\ K, & x = 0 \end{cases}$ continuous at $x = 0$, then $K =$?

(A) e (B) e^{-1}

(C) e^2 (D) e^{-2}

12. For a invertible matrix A if $A(\text{adj } A) = \begin{bmatrix} 10 & 0 \\ 0 & 10 \end{bmatrix}$, then $|A| =$

(A) 100 (B) -100

(C) 10 (D) -10

13. The solution of the differential equation $\dfrac{dy}{dx} = \tan\dfrac{y}{x} + \dfrac{y}{x}$ is

(A) $\cos(y/x) = cx$ (B) $\sin(y/x) = cx$

(C) $\cos(y/x) = cy$ (D) $\sin(y/x) = cy$

14. In triangle ABC, if $\sin^2 A + \sin^2 B = \sin^2 C$ and $l(AB) = 10$, then the maximum value of the area of triangle ABC is

(A) 50 (B) $10\sqrt{2}$

(C) 25 (D) $25\sqrt{2}$

15. If $x = f(t)$ and $y = g(t)$ are differentiable functions of t, then $\frac{d^2y}{dx^2}$ is

(A) $\frac{f'(t)g''(t) - g'(t)f''(t)}{[f'(t)]^3}$

(B) $\frac{f'(t)g''(t) - g'(t)f''(t)}{[f'(t)]^2}$

(C) $\frac{g'(t)f''(t) - f'(t)g''(t)}{[f'(t)]^3}$

(D) $\frac{g'(t)f''(t) + f'(t)g''(t)}{[f'(t)]^3}$

16. The equation of line equally inclined to coordinate axes and passing through (-3,2,-5) is

(A) $\frac{x+3}{1} = \frac{y-2}{1} = \frac{z+5}{1}$

(B) $\frac{x+3}{-1} = \frac{y-2}{1} = \frac{5+z}{-1}$

(C) $\frac{x+3}{-1} = \frac{y-2}{1} = \frac{z+5}{1}$

(D) $\frac{x+3}{-1} = \frac{2-y}{1} = \frac{z+5}{-1}$

17. If $\int_0^{\pi/2} \log\cos x\, dx = \frac{\pi}{2}\log(1/2)$, then $\int_0^{\pi/2} \log\sec x\, dx =$

(A) $\frac{\pi}{2}\log(1/2)$ (B) $1 - \frac{\pi}{2}\log(1/2)$

(C) $1 + \frac{\pi}{2}\log(1/2)$ (D) $\frac{\pi}{2}\log 2$

18. A boy tosses fair coin 3 times. If he gets $2X$ for X heads, then his expected gain equals to

(A) 1 (B) 3/2

(C) 3 (D) 4

19. Which of the following statement pattern is a tautology?

(A) $p \vee (q \to p)$ (B) $\neg q \to \neg p$

(C) $(q \to p) \vee (\neg p \leftrightarrow q)$ (D) $p \wedge \neg p$

20. If the angle between the planes $\vec{r}\cdot(m\hat{i} - \hat{j} + 2\hat{k}) + 3 = 0$ and $\vec{r}\cdot(2\hat{i} - m\hat{j} - \hat{k}) - 5 = 0$ is $\pi/3$, then $m =$

(A) 2 (B) ± 3

(C) 3 (D) -2

21. If the origin and the points P(2,3,4), Q(1,2,3) and R(x,y,z) are coplanar, then

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

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

22. If lines represented by equation $px^2 - qy^2 = 0$ are distinct, then

(A) $pq > 0$ (B) $pq < 0$

(C) $pq = 0$ (D) $p + q = 0$

23. Let PQRS be a quadrilateral. If M and N are the mid-points of the sides PQ and RS respectively, then $\overrightarrow{PS} + \overrightarrow{QR} =$

(A) $3\overrightarrow{MN}$ (B) $4\overrightarrow{MN}$

(C) $2\overrightarrow{MN}$ (D) $2\overrightarrow{NM}$

24. If slopes of lines represented by $kx^2 + 5xy + y^2 = 0$ differ by 1, then $k =$

(A) 2 (B) 3

(C) 6 (D) 8

25. If vector $\vec{r}$ with dc's l, m, n is equally inclined to the coordinate axes, then the total number of such vectors is

(A) 4 (B) 6

(C) 8 (D) 2

26. If

$$\int \frac{1}{(x^2+4)(x^2+9)}dx = A\tan^{-1}(x/2) + B$$

$\tan^{-1}(x/3) + C$

, then $A - B =$

(A) $\frac{1}{6}$ (B) $\frac{1}{30}$

(C) $-\frac{1}{30}$ (D) $-\frac{1}{6}$

27. If α and β are roots of the equation $x^2 + 5|x| - 6 = 0$, then the value of $|\tan^{-1}\alpha - \tan^{-1}\beta|$ is

(A) $\pi/2$ (B) 0

(C) π (D) $\pi/4$

28. If $x = a(t - 1/t)$, $y = a(t + 1/t)$, where t is the parameter, then $\frac{dy}{dx} =$?

(A) $\frac{y}{x}$ (B) $-\frac{x}{y}$

(C) $\frac{x}{y}$ (D) $-\frac{y}{x}$

29. The point on the curve $y = \sqrt{x-1}$, where the tangent is perpendicular to the line $2x + y - 5 = 0$ is

(A) $(2, -1)$ (B) $(10, 3)$

(C) $(2, 1)$ (D) $(5, -2)$

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30. If

$$\int \sqrt{(x-5)/(x-7)}\, dx = A\sqrt{x^2-12x+35} + \log|x-6+\sqrt{x^2-12x+35}\,| + C$$

, then $A =$

(A) -1 (B) $1/2$

(C) $-1/2$ (D) 1

31. At random variable $X \sim B(n,p)$, if values of mean and variance of X are 18 and 12 respectively, then total number of possible values of X are

(A) 54 (B) 55

(C) 12 (D) 18

32. The area of the region bounded by the lines $y = 2x+1$, $y = 3x+1$ and $x = 4$ is

(A) 16 sq unit (B) $\frac{121}{3}$ sq unit

(C) $\frac{121}{6}$ sq unit (D) 8 sq unit

33. A box contains 6 pens, 2 of which are defective. Two pens are taken randomly from the box. If r.v. X: number of defective pens obtained, then standard deviation of X=

(A) $\pm\frac{4}{3\sqrt{5}}$ (B) $\frac{8}{3}$

(C) $\frac{16}{45}$ (D) $\frac{4}{3\sqrt{5}}$

34. If the volume of spherical ball is increasing at the rate of $4\pi\ \text{cm}^3/\text{s}$, then the rate of change of its surface area when the volume is $288\pi\ \text{cm}^3$, is

(A) $\frac{4}{3}\pi\ \text{cm}^2/\text{s}$ (B) $\frac{2}{3}\pi\ \text{cm}^2/\text{s}$

(C) $4\pi\ \text{cm}^2/\text{s}$ (D) $2\pi\ \text{cm}^2/\text{s}$

35. If $f(x) = \begin{cases} \log(\sec^2 x)^{\cot^2 x}, & x \neq 0 \\ K, & x = 0 \end{cases}$ is continuous at $x = 0$, then K is

(A) e^{-1} (B) 1

(C) e (D) 0

36. If c denotes the contradiction, then dual of the compound statement $\neg p \wedge (q \vee c)$ is

(A) $\neg p \vee (q \wedge t)$ (B) $\neg p \wedge (q \vee t)$

(C) $p \vee (\neg q \vee t)$ (D) $\neg p \vee (q \wedge c)$

37. The differential equation of all parabolas whose axis is Y-axis, is

(A) $x\frac{d^2y}{dx^2} - \frac{dy}{dx} = 0$ (B) $x\frac{d^2y}{dx^2} + \frac{dy}{dx} = 0$

(C) $\frac{d^2y}{dx^2} - y = 0$ (D) $\frac{d^2y}{dx^2} - \frac{dy}{dx} = 0$

38. $\int_0^3 [x]\, dx =$....., where [x] is greatest integer function.

(A) 3 (B) 0

(C) 2 (D) 1

39. The objective function of LPP defined over the convex set attains it optimum value at

(A) atleast two of the corner points (B) all the corner points

(C) atleast one of the corner points (D) None of the corner points

40. If the inverse of the matrix $\begin{bmatrix} \alpha & 14 & -1 \\ 2 & 3 & 1 \\ 6 & 2 & 3 \end{bmatrix}$ does not exist, then the value of α is

(A) 1 (B) -1

(C) 0 (D) -2

41. If $f(x) = \begin{cases} x, & x \leq 0 \\ 0, & x > 0 \end{cases}$, then f(x) at $x = 0$ is

(A) continuous but not differentiable (B) not continuous but differentiable

(C) continuous and differentiable (D) not continuous and not differentiable

42. The equation of plane through (-1,1,2), whose normal makes equal acute angles with coordinate axes is

(A) $\vec{r} \cdot (\hat{i} + \hat{j} + \hat{k}) = 2$

(B) $\vec{r} \cdot (\hat{i} + \hat{j} + \hat{k}) = 6$

(C) $\vec{r} \cdot (3\hat{i} - 3\hat{j} + 3\hat{k}) = 2$

(D) $\vec{r} \cdot (\hat{i} - \hat{j} + \hat{k}) = 3$

43. Probability that a person will develop immunity after vaccinations is 0.8. if 8 people are given the vaccine, then probability that all develop immunity is =

(A) $(0.2)^8$ (B) $(0.8)^8$

(C) 1 (D) ${}^8C_6(0.2)^6(0.8)^2$

44. If the distance of points $2\hat{i}+3\hat{j}+\lambda\hat{k}$ from the plane $\vec{r}\cdot(3\hat{i}+2\hat{j}+6\hat{k})=13$ is 5 units, then $\lambda=$

(A) $6,-\frac{17}{3}$ (B) $6,\frac{17}{3}$

(C) $-6,-\frac{17}{3}$ (D) $-6,\frac{17}{3}$

45. The value of $\cos^{-1}(\cot(\pi/2))+\cos^{-1}(\sin(2\pi/3))$ is

(A) $\frac{2\pi}{3}$ (B) $\frac{\pi}{3}$

(C) $\frac{\pi}{2}$ (D) π

46. The particular solution of the differential equation $x\,dy+2y\,dx=0$, when $x=2$, $y=1$ is

(A) $xy=4$ (B) $x^2y=4$

(C) $xy^2=4$ (D) $x^2y^2=4$

47. Triangle ABC has vertices at A=(2,3,5), B=(-1,3,2) and $C=(\lambda,5,\mu)$. If the median through A is equally inclined to the axes, then the values of λ and μ respectively are

(A) $10,7$ (B) $9,10$

(C) $7,9$ (D) $7,10$

48. For the following distribution function $F(x)$ of a r.v. x:

x	1	2	3	4	5	6
$F(x)$	0.2	0.37	0.48	0.62	0.85	1

$P(3<x\leq 5)=$

(A) 0.48 (B) 0.37

(C) 0.27 (D) 1.47

49. The lines $\frac{x-1}{2}=\frac{y+1}{2}=\frac{z-1}{4}$ and $\frac{x-3}{1}=\frac{y-k}{2}=\frac{z}{1}$ intersect each other at point

(A) $(-2,-4,5)$ (B) $(-2,-4,-5)$

(C) $(2,4,-5)$ (D) $(2,-4,-5)$

50. $\int\frac{\sec^8 x}{\csc x}dx=$

(A) $\frac{\sec^8 x}{8}+c$ (B) $\frac{\sec^7 x}{7}+c$

(C) $\frac{\sec^6 x}{6}+c$ (D) $\frac{\sec^9 x}{9}+c$

- End of Question Paper -