MHT CET 2018 Paper I (Mathematics) May 10 Question Paper

Conducted by the Directorate of Technical Education, Maharashtra

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

General Instructions

(i) This **Paper I - Mathematics** question paper is from **MHT CET 2018**.

(ii) This paper contains **50 objective questions** in Mathematics.

(iii) Each question offers **four choices**; select the single best response.

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

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

1. If $\int_0^K \frac{dx}{2+18x^2} = \frac{\pi}{24}$, then the value of K is

(A) 3 (B) 4

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

2. The cartesian co-ordinates of the point on the parabola $y^2 = -16x$, whose parameter is $\frac{1}{2}$, are

(A) (-2,4) (B) (4,-1)

(C) (-1,-4) (D) (-1,4)

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

(A) $\sec x + \log|\sec x + \tan x| + c$

(B) $\sec x \cdot \tan x + c$

(C) $\sec x + \log|\operatorname{cosec} x - \cot x| + c$

(D) $\sec x + \log|\sec x - \tan x| + c$

4. If $\log_{10}\left(\frac{x^3-y^3}{x^3+y^3}\right) = 2$ then $\frac{dy}{dx} =$

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

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

5. If $f : \mathbb{R} - \{2\} \to \mathbb{R}$ is a function defined by $f(x) = \frac{x^2-4}{x-2}$, then its range is

(A) $\mathbb{R}$ (B) $\mathbb{R} - \{2\}$

(C) $\mathbb{R} - \{4\}$ (D) $\mathbb{R} - \{-2, 2\}$

6. If $f(x) = x^2 + \alpha$ for $x > 0$, $= 2\sqrt{x^2+1} + \beta$ for $x < 0$, is continuous at x=0 and $f(1/2) = 2$ then $\alpha^2 + \beta^2$ is

(A) 3 (B) $\frac{8}{25}$

(C) $\frac{25}{8}$ (D) $\frac{1}{3}$

7. If $y = (\tan^{-1} x)^2$ then $(x^2+1)^2 \frac{d^2y}{dx^2} + 2x(x^2+1)\frac{dy}{dx} =$

(A) 4 (B) 2

(C) 1 (D) 0

8. The line $5x + y - 1 = 0$ coincides with one of the lines given by $5x^2 + xy - kx - 2y + 2 = 0$ then the value of k is

(A) -11 (B) 31

(C) 11 (D) -31

9. If $A = \begin{bmatrix} 1 & 2 & 3 \\ -1 & 1 & 2 \\ 1 & 2 & 4 \end{bmatrix}$ then $(A^2 - 5A)A^{-1} =$

(A) $\begin{bmatrix} 4 & 2 & 3 \\ -1 & 4 & 2 \\ 1 & 2 & 1 \end{bmatrix}$ (B) $\begin{bmatrix} -4 & 2 & 3 \\ -1 & -4 & 2 \\ 1 & 2 & -1 \end{bmatrix}$

(C) $\begin{bmatrix} -4 & -1 & 1 \\ 2 & -4 & 2 \\ 3 & 2 & -1 \end{bmatrix}$ (D) $\begin{bmatrix} -1 & -2 & 1 \\ 4 & -2 & -3 \\ 1 & 4 & -2 \end{bmatrix}$

10. The equation of line passing through (3,-1,2) and perpendicular to the lines $\vec{r} = (\hat{i} + \hat{j} - \hat{k}) + \lambda(2\hat{i} - 2\hat{j} + \hat{k})$ and $\vec{r} = (2\hat{i} + \hat{j} - 3\hat{k}) + \mu(\hat{i} - 2\hat{j} + 2\hat{k})$ is

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

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

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

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

11. Letters in the word HULULULU are re-arranged. The Probability of all three L being together is

(A) $\frac{3}{20}$ (B) $\frac{2}{5}$

(C) $\frac{3}{28}$ (D) $\frac{5}{23}$

12. The sum of the first 10 terms of the series 9+99+999+..., is

(A) $\frac{9}{8}(9^{10} - 1)$ (B) $\frac{100}{9}(10^9 - 1)$

(C) $10^9 - 1$ (D) $\frac{100}{9}(10^{10} - 1)$

13. If A, B, C are the angles of $\triangle ABC$ then $\cot A \cdot \cot B + \cot B \cdot \cot C + \cot C \cdot \cot A =$

(A) 0 (B) 1

(C) 2 (D) -1

14. If $\int \frac{dx}{\sqrt{16-9x^2}} = A\sin^{-1}(Bx) + C$ then $A + B =$

(A) $\frac{9}{4}$ (B) $\frac{19}{4}$

(C) $\frac{3}{4}$ (D) $\frac{13}{12}$

15. $\int e^x \left[\frac{2+\sin 2x}{1+\cos 2x}\right] dx =$

(A) $e^x \tan x + c$ (B) $e^x \sec x + c$

(C) $2e^x \tan x + c$ (D) $e^x \tan 2x + c$

16. A coin is tossed three times. If X denotes the absolute difference between the number of heads and the number of tails then $P(X = 1) =$

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

(C) $\frac{1}{6}$ (D) $\frac{3}{4}$

17. If $2\sin(\theta + \pi/3) = \cos(\theta - \pi/6)$, then $\tan\theta =$

(A) $\sqrt{3}$ (B) $-1/\sqrt{3}$

(C) $1/\sqrt{3}$ (D) $-\sqrt{3}$

18. The area of the region bounded by $x^2 = 4y$, $y = 1$, $y = 4$ and the y-axis lying in the first quadrant is __ square units.

(A) $\frac{22}{3}$ (B) $\frac{28}{3}$

(C) 30 (D) $\frac{21}{4}$

19. If $f(x) = \frac{e^{x^2} - \cos x}{x^2}$, for $x \neq 0$ is continuous at x=0, then value of f(0) is

(A) $\frac{2}{3}$ (B) $\frac{5}{2}$

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

20. The maximum value of $2x + y$ subject to $3x + 5y \leq 26$ and $5x + 3y \leq 30$, $x \geq 0$, $y \geq 0$ is

(A) 12 (B) 11.5

(C) 10 (D) 17.33

21. If $\vec{a}, \vec{b}, \vec{c}$ are mutually perpendicular vectors having magnitudes 1, 2, 3 respectively, then $[\vec{a} + \vec{b} + \vec{c} \;\; \vec{b} - \vec{a} \;\; \vec{c}] =$

(A) 0 (B) 6

(C) 12 (D) 18

22. If points $P(4, 5, x)$, $Q(3, y, 4)$ and $R(5, 8, 0)$ are collinear, then the value of $x + y$ is

(A) -4 (B) 3

(C) 5 (D) 4

23. If the slope of one the lines given by $ax^2 + 2hxy + by^2 = 0$ is two times the other then

(A) $8h^2 = 9ab$ (B) $8h^2 = 9ab^2$

(C) 8h=9ab (D) $8h = 9ab^2$

24. The equation of the line passing through the point (-3,1) and bisecting the angle between co-ordinate axes is

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

(C) $x - y + 4 = 0$ (D) $2x + y + 5 = 0$

25. The negation of the statement: "Getting above 95% marks is necessary condition for Hema to get the admission in good college".

(A) Hema gets above 95% marks but she does not get the admission in good college

(B) Hema does not get above 95% marks and she gets admission in good college

(C) If Hema does not get above 95% marks then she will not get the admission in good college

(D) Hema does not get above 95% marks or she gets the admission in good college

26. $\cos 1^\circ . \cos 2^\circ . \cos 3^\circ ... \cos 179^\circ =$

(A) 0 (B) 1

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

27. If planes $x - cy - bz = 0$, $cx - y + az = 0$ and $bx + ay - z = 0$ pass through a straight line then $a^2 + b^2 + c^2 =$

(A) $1 - abc$ (B) $abc - 1$

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

28. The point of intersection of line represented by $x^2 - y^2 + 3y - 2 = 0$ is

(A) (1,0) (B) (0,2)

(C) (-1/2,3/2) (D) (1/2,1/2)

29. A die is rolled. If X denotes the number of positive divisors of the outcome then the range of the random variable X is

(A) $\{1, 2, 3\}$ (B) $\{1, 2, 3, 4\}$

(C) $\{1, 2, 3, 4, 5, 6\}$ (D) $\{1, 3, 5\}$

30. A die is thrown four times. The probability of getting perfect square in at least one throw is

(A) $\frac{16}{81}$ (B) $\frac{65}{81}$

(C) $\frac{23}{81}$ (D) $\frac{58}{81}$

31. $\int_0^{\pi/4} x \cdot \sec^2 x \, dx =$

(A) $\pi/4 + \log\sqrt{2}$ (B) $\pi/4 - \log\sqrt{2}$

(C) $1 + \log\sqrt{2}$ (D) $1 - \frac{1}{2}\log 2$

32. In $\triangle$ABC, with usual notations, if a, b, c are in A.P. Then $a\cos^2(C/2) + c\cos^2(A/2) =$

(A) $\frac{3a}{2}$ (B) $\frac{3c}{2}$

(C) $\frac{3b}{2}$ (D) $\frac{3abc}{2}$

33. If $x = e^{\theta}(\sin\theta - \cos\theta)$, $y = e^{\theta}(\sin\theta + \cos\theta)$ then $\frac{dy}{dx}$ at $\theta = \pi/4$ is

(A) 1 (B) 0

(C) $1/\sqrt{2}$ (D) $\sqrt{2}$

34. The number of solutions of $\sin x + \sin 3x + \sin 5x = 0$ in the interval $[\pi/2, 3\pi/2]$ is

(A) 2 (B) 3

(C) 4 (D) 5

35. If $\tan^{-1} 2x + \tan^{-1} 3x = \pi/4$, then x=

(A) -1 (B) $\frac{1}{3}$

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

36. Matrix $A = \begin{bmatrix} 1 & 2 & 3 \\ 1 & 1 & 5 \\ 2 & 4 & 7 \end{bmatrix}$ then the value of $a_{31}A_{31} + a_{32}A_{32} + a_{33}A_{33}$ is

(A) 1 (B) 13

(C) -1 (D) -13

37. The contrapositive of the statement: "If the weather is fine then my friends will come and we go for a picnic."

(A) The weather is fine but my friends will not come or we do not go for a picnic

(B) If my friends do not come or we do not go for picnic then weather will not be fine

(C) If the weather is not fine then my friends will not come or we do not go a picnic

(D) The weather is not fine but friends will come and we go for a picnic

38. If $f(x) = \frac{x}{x^2+1}$ is increasing function then the value of x lies in

(A) R (B) $(-\infty, -1)$

(C) $(1, \infty)$ (D) (-1,1)

39. If $X = \{4^n - 3n - 1 : n \in N\}$ and $Y = \{9n - 1 : n \in N\}$, then $X \cap Y =$

(A) X (B) Y

(C) ϕ (D) {0}

40. The statement pattern $P \wedge (\sim p \wedge q)$ is

(A) a tautology (B) a contradiction

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

41. If the line $y = 4x - 5$ touches to the curve $y^2 = ax^3 + b$ at the point (2,3) then $7a + 2b =$

(A) 0 (B) 1

(C) -1 (D) 2

42. The sides of a rectangle are given by x=$\pm$a and y=$\pm$b. The equation of the circle passing through the vertices of the rectangle is

(A) $x^2 + y^2 = a^2$

(B) $x^2 + y^2 = a^2 + b^2$

(C) $x^2 + y^2 = a^2 - b^2$

(D) $(x-a)^2 + (y-b)^2 = a^2 + b^2$

43. The minimum value of the function $f(x) = x\log x$ is

(A) $-\frac{1}{e}$ (B) $-e$

(C) $\frac{1}{e}$ (D) e

44. If $X \sim B(n,p)$ with n=10, p=0.4 then $E(X^2) =$

(A) 4 (B) 2.4

(C) 3.6 (D) 18.4

45. The general solution of differential equation $\frac{dx}{dy} = \cos(x+y)$ is

(A) $\tan((x+y)/2) = y + c$

(B) $\tan((x+y)/2) = x + c$

(C) $\cot((x+y)/2) = y + c$

(D) $\cot((x+y)/2) = x + c$

46. If planes $\vec{r} \cdot (p\hat{i} - \hat{j} + 2\hat{k}) + 3 = 0$ and $\vec{r} \cdot (2\hat{i} - p\hat{j} - \hat{k}) - 5 = 0$ include angle $\pi/3$ then the value of p is

(A) 1,-3 (B) -1,-3

(C) -3 (D) 3

47. The order of the differential equation of all parabolas, whose latus rectum is 4a and axis parallel to the x-axis, is

(A) one (B) four

(C) three (D) two

48. If lines $\frac{x-1}{2} = \frac{y+1}{3} = \frac{z-1}{4}$ and $x - 3 = \frac{y-k}{2} = z$ intersect then the value of k is

(A) $\frac{9}{2}$ (B) $\frac{1}{2}$

(C) $\frac{5}{2}$ (D) $\frac{7}{2}$

49. If a line makes angles 120° and 60° with the positive directions of X and Z axes respectively then the angle made by the line with positive Y-axis is

(A) 150° (B) 60°

(C) 135° (D) 120°

50. L and M are two points with position vectors $2\vec{a} - \vec{b}$ and $\vec{a} + 2\vec{b}$ respectively. The position vector of the point N which divides the line segment LM in the ratio 2:1 externally is

(A) $3\vec{b}$ (B) $4\vec{b}$

(C) $5\vec{b}$ (D) $3\vec{a} + 4\vec{b}$

- End of Question Paper -