MHT CET 2023 Question Paper Shift 1 12th May(Maths)

1. If the matrix A = [1 2 ; -5 1] and A^{-1} = xA + yI when I is a unit matrix of order 2, then the value of 2x + 3y is

(A) 8/11

(B) 4/11

(C) -8/11

(D) -4/11

2. $\int (x^2 + 1) / x(x^2 - 1)\, dx$ =

(A) log $x(x^2 - 1)$ + c

(B) log $((x^2 - 1) / x)$ + c

(C) log $(x^2 - 1)$ + c

(D) log $((x^2 + 1) / x)$ + c

3. Let $\bar{A}$ be a vector parallel to line of intersect of planes P_1 and P_2 through origin, P_1 is parallel to the vectors $2\hat{j} + 3\hat{k}$ and $4\hat{j} - 3\hat{k}$ and P_2 is parallel to $\hat{j} - \hat{k}$ and $3\hat{i} + 3\hat{j}$, then the angle between $\bar{A}$ and $2\hat{i} + \hat{j} - 2\hat{k}$ is

(A) π/3

(B) π/2

(C) π/6

(D) 3π/4

4. Let PQR be a right angled isosceles triangle, right angled at P(2,1). If the equation of the line QR is 2x + y = 3 then the equation representing the pair of lines PQ and PR is

(A) $3x^2 - 3y^2 + 8xy + 20x + 10y + 25 = 0$

(B) $3x^2 - 3y^2 + 8xy - 20x - 10y + 25 = 0$

(C) $3x^2 - 3y^2 + 8xy + 10x + 15y + 20 = 0$

(D) $3x^2 - 3y^2 - 8xy - 10x - 15y - 20 = 0$

5. The derivative of f(tan x) w.r.t. g(sec x) at $x = \pi/4$ where $f'(1) = 2$ and $g'(\sqrt{2}) = 4$ is

(A) $1/\sqrt{2}$

(B) $\sqrt{2}$

(C) 1

(D) 0

6. If l is the perpendicular distance of a point P on the circle $x^2 + y^2 + 2x + 2y - 3 = 0$, from the line $2x + y + 13 = 0$, then maximum possible value of l is

(A) $2\sqrt{5}$

(B) $3\sqrt{5}$

(C) $4\sqrt{5}$

(D) $\sqrt{5}$

7. The integral $\int (\sin^2x \cos^2x) / (\sin^5x + \cos^3x \sin^2x + \sin^3x \cos^2x + \cos^5x)^2 dx$ is

(A) $1 / 3(1 + \tan^3x) + c$

(B) $-1 / 3(1 + \tan^3x) + c$

(C) $1 / (1 + \cot^3x) + c$

(D) $-1 / (1 + \cos^3x) + c$

8. If $dy/dx = y + 3$ and $y(0) = 2$, then $y(\log 2) =$

(A) 5

(B) 7

(C) 13

(D) -2

9. The solution set of $8\cos^2\theta + 14\cos\theta + 5 = 0$ in the interval $[0, 2\pi]$, is

(A) $\{\pi/3, 2\pi/3\}$

(B) $\{\pi/3, 4\pi/3\}$

(C) $\{2\pi/3, 4\pi/3\}$

(D) $\{2\pi/3, 5\pi/3\}$

10. If the line $(1 - x)/3 = (7y - 14)/2p = (z - 3)/2$ and $(7 - 7x)/3p = (y - 5)/1 = (6 - z)/5$ are at right angles, then p =

(A) 70/11

(B) 11/70

(C) -70/11

(D) -11/70

11. If T_n denotes the number of triangles which can be formed using the vertices of regular polygon of n sides and $T_{n+1} - T_n = 21$ then n =

(A) 5

(B) 7

(C) 6

(D) 4

12. If $g(x) = 1 + \sqrt{x}$ and $f(g(x)) = 3 + 2\sqrt{x} + x$, then f(f(x)) is

(A) $x^2 + 4x + 6$

(B) $x^4 + x^2 + 6$

(C) $x^2 + x + 6$

(D) $x^4 + 4x^2 + 6$

13. The function $f(x) = \sin^4 x + \cos^4 x$ is increasing in

(A) $0 < x < \pi/8$

(B) $\pi/4 < x < \pi/2$

(C) $3\pi/8 < x < 5\pi/8$

(D) $5\pi/8 < x < 3\pi/4$

14. If the variance of the numbers -1, 0, 1, k is 5, where $k > 0$, then k is equal to

(A) $2\sqrt{(10/3)}$

(B) $2\sqrt{6}$

(C) $4\sqrt{(5/3)}$

(D) $\sqrt{6}$

15. $\lim_{x \to 0} (\cos 7x^\circ - \cos 2x^\circ) / x^2$ is

(A) $-45/2\ \pi^2$

(B) $-45/2\ \pi$

(C) $-\pi^2 / 1440$

(D) $-\pi^2 / 2880$

16. If $\tan\theta = (\sin\alpha - \cos\alpha) / (\sin\alpha + \cos\alpha)$, $0 \le \alpha \le \pi/2$ then the value of $\cos 2\theta$ is

(A) $\cos 2\alpha$

(B) $\sin\alpha$

(C) $\cos\alpha$

(D) $\sin 2\alpha$

17. The contrapositive of "If x and y are integers such that xy is odd, then both x and y are odd" is

(A) If both x and y are odd integers, then xy is odd.

(B) If both x and y are even integers, then xy is even.

(C) If x or y is an odd integer, then xy is odd.

(D) If both x and y are not odd integers, then the product xy is not odd.

18. The decay rate of radio active material at any time t is proportional to its mass at that time. The mass is 27 grams when t = 0. After three hours it was found that 8 grams are left. Then the substance left after one more hour is

(A) 27/8 grams

(B) 16/9 grams

(C) 16/3 grams

(D) 2 grams

19. If x = -1 and x = 2 are extreme points of $f(x) = \alpha \log x + \beta x^2 + x$ where α and β are constants, then the value of $\alpha^2 + 2\beta$ is

(A) -3

(B) 3

(C) 3/2

(D) 5

20. $\bar{u}$, $\bar{v}$, $\bar{w}$ are three vectors such that $|\bar{u}| = 1$, $|\bar{v}| = 2$, $|\bar{w}| = 3$. If the projection of $\bar{v}$ along $\bar{u}$ is equal to projection of $\bar{w}$ along $\bar{u}$ and $\bar{v}$, $\bar{w}$ are perpendicular to each other, then $|\bar{u} - \bar{v} + \bar{w}|$ =

(A) 4

(B) $\sqrt{7}$

(C) $\sqrt{14}$

(D) 2

21. $\int_0^4 |2x - 5| \, dx$ =

(A) 13/2

(B) 15/2

(C) 17/4

(D) 17/2

22. The approximate value of sin(60° 0' 10") is (given that √3 = 1.732, 1' = 0.0175^c)

(A) 0.08660243

(B) 0.0008660243

(C) 0.8660243

(D) 0.008660243

23. The p.m.f of random variate X is P(X) = { 2x / n(n+1), x=1,2,...,n ; 0, otherwise }. Then E(X) =

(A) (n + 1) / 3

(B) (2n + 1) / 3

(C) (n + 2) / 3

(D) (2n - 1) / 3

24. If the area of the triangle with vertices (1, 2, 0), (1, 0, 2) and (0, x, 1) is √6 square units, then the value of x is

(A) 1

(B) 2

(C) 3

(D) 4

25. The differential equation $\cos(x + y)\, dy = dx$ has the general solution given by

(A) $y = \sin(x + y) + c$

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

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

(D) $y = 1/2 \tan(x + y) + c$

26. An experiment succeeds twice as often as it fails. Then the probability, that in the next 6 trials there will be atleast 4 successes, is

(A) 1/729

(B) 496/729

(C) 233/729

(D) 491/729

27. A plane is parallel to two lines whose direction ratios are 1, 0, -1 and -1, 1, 0 and it contains the point (1, 1, 1). If it cuts the co-ordinate axes at A, B, C then the volume of the tetrahedron OABC (in cubic units) is

(A) 9/4

(B) 9/2

(C) 9

(D) 27

28. The area of the region bounded by the curves $y = e^x$, $y = \log x$ and lines $x = 1$, $x = 2$ is

(A) $(e - 1)^2$ sq. units

(B) $(e^2 - e + 1)$ sq. units

(C) $(e^2 - e + 1 - 2 \log 2)$ sq. units

(D) $(e^2 + e - 2 \log 2)$ sq. units

29. $y = (1 + x)(1 + x^2)(1 + x^4)...(1 + x^{2n})$ then the value of dy/dx at x = 0 is

(A) 0

(B) -1

(C) 1

(D) 2

30. A and B are independent events with P(A) = 1/4 and $P(A \cup B) = 2P(B) - P(A)$, then P(B) is

(A) 1/4

(B) 3/5

(C) 2/3

(D) 2/5

31. If a > 0 and $z = (1 + i)^2 / (a + i)$ has magnitude $2/\sqrt{5}$ ($i = \sqrt{-1}$) then $\bar{z}$ is equal to

(A) -2/5 + 4/5 i

(B) 2/5 + 4/5 i

(C) -2/5 - 4/5 i

(D) 2/5 - 4/5 i

32. The angle between the tangents to the curves $y = 2x^2$ and $x = 2y^2$ at (1, 1) is

(A) $\tan^{-1}(15/8)$

(B) $\tan^{-1}(7/8)$

(C) $\tan^{-1}(3/4)$

(D) $\tan^{-1}(1/4)$

33. If $x = \text{cosec}(\tan^{-1}(\cos(\cot^{-1}(\sec(\sin^{-1}a)))))$ for $a \in [0, 1]$ then

(A) $x^2 - a^2 = 3$

(B) $x^2 + a^2 = 3$

(C) $x^2 - a^2 = 2$

(D) $x^2 + a^2 = 2$

34. The distance of the point P(-2, 4, -5) from the line $(x + 3)/3 = (y - 4)/5 = (z + 8)/6$ is

(A) $\sqrt{37} / 10$

(B) $\sqrt{(37 / 10)}$

(C) $37 / \sqrt{10}$

(D) $37 / 10$

35. The value of $\sin(\cot^{-1}x)$ is

(A) $1 / \sqrt{(1 + x^2)}$

(B) $\sqrt{(1 + x^2)}$

(C) $1 / (x\sqrt{(1 + x^2)})$

(D) $x\sqrt{(1 + x^2)}$

36. The values of a and b, such that the function Q(x) is continuous for $0 \leq x \leq \pi$, are:

(A) $-\pi/12, \pi/6$

(B) $-\pi/6, -\pi/12$

(C) $\pi/6, \pi/12$

(D) $\pi/6, -\pi/12$

37. Sides $\overline{AB} = 2\hat{i} + 10\hat{j} + 11\hat{k}$ and $\overline{AD} = -\hat{i} + 2\hat{j} + 2\hat{k}$ of a parallelogram are given. AD is rotated by angle α to AD'. If AD' ⊥ AB, then cos α =

(A) 8/9

(B) √17 / 9

(C) 1/9

(D) 4√5 / 9

38. ∫ cosec x / cos²(1 + log tan(x/2)) dx =

(A) tan(1 + log(tan(x/2))) + c

(B) tan(1 + log(tan x)) + c

(C) tan(log(tan(x/2))) + c

(D) tan(tan(x/2)) + c

39. Co-ordinates of points on 2x - y = 5 at distance 1 from 3x + 4y = 5 are

(A) (30/11, -5/11), (20/11, 15/11)

(B) (30/11, 5/11), (20/11, -15/11)

(C) (-30/11, 5/11), (-20/11, 15/11)

(D) (-30/11, 5/11), (-20/11, -15/11)

40. The centroid of tetrahedron with vertices at A(-1,2,3) B(3,-2,1) C(2,1,3) and D(-1,-2,4) is

(A) (3/4, -1/4, 11/4)

(B) (5/4, -3/4, 7/4)

(C) (-3/4, -1/4, 11/4)

(D) (-5/4, -3/4, -7/4)

41. If log(x + y) = 2xy, then dy/dx at x = 0 is

(A) 1

(B) -1

(C) 2

(D) -2

42. Two cards are drawn with replacement from 52 cards. The probability distribution of Jacks is:

(A)

$X = x$	0	1	2
$P(X = x)$	$\frac{144}{169}$	$\frac{24}{169}$	$\frac{1}{169}$

(B)

$X = x$	0	1	2
$P(X = x)$	$\frac{1}{169}$	$\frac{144}{169}$	$\frac{24}{169}$

(C)

$X = x$	0	1	2
$P(X = x)$	$\frac{24}{169}$	$\frac{1}{169}$	$\frac{144}{169}$

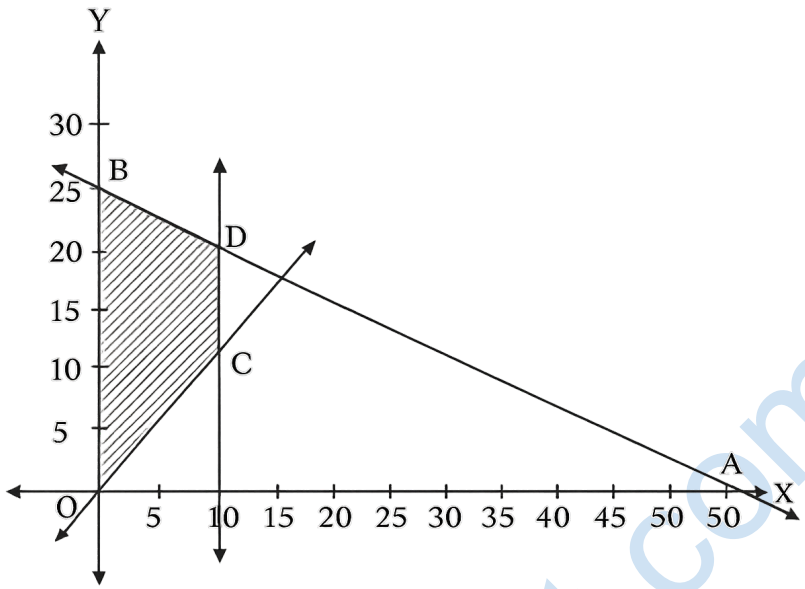
(D)

$X = x$	0	1	2
$P(X = x)$	$\frac{144}{169}$	$\frac{1}{169}$	$\frac{24}{169}$

(D)

$X = x$	$\frac{44}{169}$	$\frac{1}{169}$	$\frac{24}{169}$

43. For the feasible region OCDBO, the maximum value of z = 3x + 4y is



(A) 70

(B) 100

(C) 110

(D) 130

44. If sum of two sides is x, product is y, and $x^2 - c^2 = y$ (c is third side), circumradius is

(A) c/3

(B) $c/\sqrt{3}$

(C) 3/2 y

(D) $y/\sqrt{3}$

45. If $\int \cos^{(3/5)}x \cdot \sin^3 x \, dx = -1/m \cos^m x + 1/n \cos^n x + c$, then (m, n) =

(A) (18/5, 8/5)

(B) (-8/5, 18/5)

(C) (8/5, 18/5)

(D) (-18/5, -8/5)

46. If $|\bar{a}|=2$, $|\bar{b}|=4$, $|\bar{c}|=1$, $|\bar{b}\times\bar{c}|=\sqrt{15}$ and $\bar{b} = 2\bar{c} + \lambda\bar{a}$, then λ =

(A) 2

(B) $2\sqrt{2}$

(C) 1

(D) 4

47. A 5m ladder rests against a wall. Top slides at 10cm/s. Angle between ladder and floor decreases at rate (rad/s) when lower end is 4m from wall:

(A) -0.1

(B) -0.025

(C) 0.1

(D) 0.025

48. Equation of plane through (-1, 1, 2) whose normal makes equal acute angles with axes:

(A) x + y + z - 3 = 0

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

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

(D) x - y + z - 3 = 0

49. Inverse of "If surface area increases, then pressure decreases":

(A) If surface area does not increase, then pressure does not decrease.

(B) If pressure decreases, then surface area increases.

(C) If pressure does not decrease, then surface area does not increase.

(D) If surface area does not increase, then pressure decreases.

50. If general solution of $\cos^2\theta - 2\sin\theta + 1/4 = 0$ is $\theta = n\pi/A + (-1)^n \pi/B$, then A + B =

(A) 7

(B) 6

(C) 1

(D) -7