Class-XIITh
MATHEMATICS

MOCK EXAM

Serial Number- 1

Time- 3 hrs

Maximum Marks- 80

Exam Date_____

सरदार पटेल
Academy & Research Centre

85954-93500; 8010-668877

2514, Hudson Lane, GTB Nagar, Delhi-09

General Instructions:
1. This Question Paper has 5 Sections A-E.
2. Section **A** has 20 MCQs carrying 1 mark each
3. Section **B** has 5 questions carrying 02 marks each.
4. Section **C** has 6 questions carrying 03 marks each.
5. Section **D** has 4 questions carrying 05 marks each.
6. Section **E** has 3 case based integrated units of assessment (04 marks each) with sub parts of the values of 1, 1 and 2 marks each respectively.
7. All Questions are compulsory
8. Draw neat figures wherever required. Take π =22/7 wherever required if not stated.

SECTION A

1. Which of the following function from Z to Z is bijective?
(a) f (x) = x^3 (b) f (x) = x + 2 (c) f (x) = 2x + 1 (d) f (x) = x^2 + 1

2. The area of the quadrilateral ABCD, where A(0,4,1), B (2, 3, –1), C(4, 5, 0) and D (2, 6, 2), is equal to
(a) 9 sq. units (b) 18 sq. units (c) 27 sq. units (d) 81 sq. units

3. The area of the region bounded by the curve y = $\sqrt{16 - x^2}$ and x-axis is
(a) 8 sq units (b) 20π sq units (c) 16π sq units (d) 256π sq units

4. The equation $\tan^{-1} x + \cot^{-1} x = \tan^{-1}\left(\frac{1}{\sqrt{3}}\right)$ has
(a) no solution (b) unique solution
(c) infinite number of solutions (d) two solutions

5. Let the f : R → R be defined by f (x) = 2x + cos$x$, then f :
(a) has a minimum at x = π (b) has a maximum, at x = 0
(c) is a decreasing function (d) is an increasing function

6.If f and g are continuous functions in [0, 1] satisfying f (x) = f (a – x) and g(x) + g (a – x) = a, then $\int_0^a$ f (x) g(x) dx is equal to
(a) $\frac{a}{2}$ (b) $\frac{a}{2}\int_0^a$ f (x) dx (c) $\int_0^a$ f (x) dx (d) $a\int_0^a$ f (x) dx

7. If $\cos^{-1}$ α + $\cos^{-1}$ β + $\cos^{-1}$ γ = 3π, then α (β + γ) + β (γ + α) + γ (α + β) equals (a) 0
(b) 1 (c) 6 (d) 12

8. The area of a triangle with vertices (–3, 0), (3, 0) and (0, k) is 9 sq. units. The value of k will be
(a) 9 (b) 3 (c) – 9 (d) 6

9. The degree of the differential equation $\left(1 + \frac{dy}{dx}\right)^3 = \left(\frac{d^2y}{dx^2}\right)^2$ is
(a) 1 (b) 2 (c) 3 (d) 4

10. Which of the following functions is decreasing on $\left(0, \frac{\pi}{2}\right)$
(a) sin 2x (b) tan x (c) cos x (d) cos 3x

11. The coordinates of the foot of the perpendicular drawn from the point (2, 5, 7) on the x-axis are given by

(a) (2, 0, 0) (b) (0, 5, 0) (c) (0, 0, 7) (d) (0, 5, 7)

12. Corner points of the feasible region determined by the system of linear constraints are (0, 3), (1, 1) and (3, 0). Let Z = px + qy, where p, q > 0. Condition on p and q so that the minimum of Z occurs at (3, 0) and (1, 1) is

(a) p = 2q (b) p = $\frac{q}{2}$ (c) p = 3q (d) p = q

13. If A = $\begin{bmatrix} 2 & \lambda & -3 \\ 0 & 2 & 5 \\ 1 & 1 & 3 \end{bmatrix}$, then A^{-1} exists if

(a) $\lambda = 2$ (b) $\lambda \neq 2$ (c) $\lambda \neq -2$ (d) None of these

14. The domain of the function $\cos^{-1}(2x - 1)$ is

(a) [0, 1] (b) [–1, 1] (c) (–1, 1) (d) [0, π]

15. If two events are independent, then

(a) they must be mutually exclusive

(b) the sum of their probabilities must be equal to 1

(c) (a) and (b) both are correct

(d) None of the above is correct

16. The function f (x) = $x|x|$ is

(a) continuous everywhere but not differentiable at x = 0

(b) continuous and differentiable everywhere

(c) not continuous at x = 0

(d) none of these.

17. Set A has 3 elements and the set B has 4 elements .Then the number of injective mappings that can be defined from A to B is

(a) 144 (b) 12 (c) 24 (d) 64

18. For any two matrices A and B, we have

(a) AB = BA (b) AB ≠ BA (c) AB = O (d) None of these

DIRECTION: In the question number 19 and 20, a statement of **Assertion (A)** is followed by a statement of **Reason (R)**. Choose the correct option

(a)Assertion and Reason both are correct statements and Reason is the correct explanation of Assertion.

(b) Assertion and Reason both are correct statements but Reason is not the correct explanation of Assertion.

(c) Assertion is correct statement but Reason is wrong statement.

(d) Assertion is wrong statement but Reason is correct statement.

19.Assertion : A function f : X → Y is defined to be invertible, if there exists a function g : Y → X such that g o f = I_X and f o g = I_Y . The function g is called the inverse of f and is denoted by f^{-1} .

Reason : A function f : X → Y is invertible if and only if f is a bijective function.

20.Assertion : Let R be the feasible region (convex polygon) for an LPP and let Z = ax + by be the objective function. When Z has an optimal value (maximum or minimum), where x and y are subject to constraints described by linear inequalities, this optimal value must occur at a corner point (vertex) of the feasible region.

Reason (R): Let R be the feasible region for a LPP and let Z = ax + by be the objective function. If R is bounded, then the objective function Z has both a maximum and a minimum value on R and each of these occur at a corner point of R.

SECTION B

21. Construct a matrix A = $[a_{ij}]_{3\times3}$ whose elements a_{ij} are given by $a_{ij} = e^{2ix} \sin jx$

22. Two dice are thrown together. Let A be the event 'getting 6 on the first die' and B be the event 'getting 2 on the second die'. Are the events A and B independent?

23. Using vectors, find the value of k such that the points (k, – 10, 3), (1, –1, 3) and (3, 5, 3) are collinear.

24. Find the direction cosines of the line passing through the points P (2, 3, 5) and Q (–1, 2, 4).

25. Let A = {a, b, c} and the relation R be defined on A as follows: R = {(a, a), (b, c), (a, b)}. Then, write minimum number of ordered pairs to be added in R to make R reflexive and transitive.

SECTION C

26. Find $\int x^2 \tan^{-1} x \, dx$.

27. Find the angle between the lines whose direction cosines are given by the equations: $3l + m + 5n = 0$ and $6mn – 2nl + 5lm = 0$.

28. Find the area of a minor segment of the circle $x^2 + y^2 = a^2$ cut off by the line $x = \frac{a}{2}$.

29. Using matrix method, solve the system of equations $y + 2z = 7$, $x – y = 3$, $2x + 3y + 4z = 17$.

30. Two men A and B start with velocities *v* m/sec at the same time from the junction of two roads inclined at 45° to each other. If they travel by different roads, find the rate at which they are being seperated.

31. A firm has to transport 1200 packages using large vans which can carry 200 packages each and small vans which can take 80 packages each. The cost for engaging each large van is Rs 400 and each small van is Rs 200. Not more than Rs 3000 is to be spent on the job and the number of large vans can not exceed the number of small vans. Formulate this problem as a LPP given that the objective is to minimise cost.What will be the minimum cost?

SECTION D

32. Find the general solution of $(1 + \tan y)(dx – dy) + 2x dy = 0$.

33. Show that, $2\tan^{-1}\left\{\tan\frac{\alpha}{2}.\tan\left(\frac{\pi}{4}-\frac{\beta}{2}\right)\right\} = \tan^{-1}\frac{\sin\alpha\cos\beta}{\cos\alpha+\sin\beta}$.

34. Differentiate, $\tan^{-1}\left(\frac{\sqrt{1-x^2}}{x}\right)$ with respect to $\cos^{-1}\left(2x\sqrt{1-x^2}\right)$, where $x \in \left(\frac{1}{\sqrt{2}}, 1\right)$

35. Show that, $\int_0^{\frac{\pi}{2}} \frac{\sin^2 x}{\sin x+\cos x}\,dx = \frac{1}{\sqrt{2}}\log_e\left(\sqrt{2}+1\right)$.

SECTION E

Case study based questions are compulsory.

36. A shopkeeper sells three types of flower seeds A_1, A_2 and A_3.They are sold as a mixture where the proportions are 4**:**4**:**2 respectively. The germination rates of the three types of seeds are 45**%**, 60**%** and 35**%**. Calculate the probability

1) of a randomly chosen seed to germinate

2) that it will not germinate given that the seed is of type A_3,

3) that it is of the type A_2 given that a randomly chosen seed does not germinate.

37. Two schools P and Q want to award their selected students on the values of Tolerance, Kindness, and Leadership. The school P wants to award Rs x each, Rs y each and Rs z each for the three respective values to 3, 2 and 1 students respectively with total award money of Rs. 2200.School Q wants to spend Rs 3100 to award its 4, 1 and 3 students on the respective values (by giving the same award money to the three values as school P). If the total amount of award for one prize on each value is Rs1200, using matrices, find the following:

1)What is award money for Tolerance?
(a)350 (b)300 (c)500 (d)400

2)What is the award money for Leadership?
(a)300 (b)280 (c)450 (d)500

3)What is the award money for Kindness?
(a)500 (b)400 (c)300 (d)550

38. A man has an expensive square shape piece of golden board of size 24 cm is to be made into a box without top by cutting from each corner and folding the flaps to form a box.

1)Volume of open box formed by folding up the flap:
(a) $4(x^3 - 24x^2 + 144x)$ (b) $4(x^3 - 34x^2 + 244x)$
(c) $x^3 - 24x^2 + 144x$ (d) $4x^3 - 24x^2 + 144x$

2) What should be the side of the square piece to be cut from each corner of the board to behold the maximum volume?
(a)14 cm (b)12 cm (c)4 cm (d) 5 cm

3) What should be the maximum volume of open box?
(a)1034 cm^3 (b)1024 cm^3 (c)1204 cm^3 (d)4021 cm^3

Academy & Research Centre