

Class - 12TH

MATHEMATICS

MOCK EXAMS

Serial Number: 04

Time: 3 Hours

Maximum Marks: 80

Exam Date: _____



CLASS 12TH
MATHEMATICS

EXAM ID 0644

PAPER - 4

DURATION 3 HOURS

MM. 80

General Instructions:

Read the following instructions carefully and follow them:

1. This question paper contains 38 questions.
2. This Question Paper is divided into 5 Sections A, B, C, D and E.
3. In Section A, Questions no. 1-18 are multiple choice questions of 1 mark each.
4. In Section B, Questions no. 21-25 are very short answer (VSA) type questions, carrying 02 marks each.
5. In Section C, Questions no. 26-31 are short answer (SA) type questions, carrying 03 marks each.
6. In Section D, Questions no. 32-35 are long answer (LA) type questions, carrying 05 marks each.
7. In Section E, Questions no. 36-38 are case study-based questions carrying 4 marks each with sub-parts of the values of 1, 1 and 2 marks each respectively.
8. All Questions are compulsory. However, an internal choice in 2 Questions of Section B, 2 Questions of Section C and 2 Questions of Section D has been provided. An internal choice has been provided in all the 2 marks questions of Section E.
9. Use of calculators is not allowed.

SECTION – A (1 MARKS EACH)

1. Let $A = \{1, 2, 3\}$ and let $R = \{(1,1), (2, 2), (3, 3), (1, 2), (2,1), (2, 3), (3, 2)\}$. Then, R is
 - a. reflexive and symmetric but not transitive
 - b. an equivalence relation
 - c. symmetric and transitive but not reflexive
 - d. reflexive and transitive but not symmetric
2. The value of $\sin^{-1}\left(\cos \frac{\pi}{9}\right)$ is
 - a. $\frac{5\pi}{9}$
 - b. $\frac{7\pi}{18}$
 - c. $\frac{-5\pi}{9}$
 - d. $\frac{\pi}{9}$
3. For which value of x , are the determinants $\begin{vmatrix} 2x & -3 \\ 5 & x \end{vmatrix}$ and $\begin{vmatrix} 10 & 1 \\ -3 & 2 \end{vmatrix}$ equal?
 - a. ± 2
 - b. 2
 - c. ± 3
 - d. -3
4. The function $f(x) = |\cos x|$ is
 - a. everywhere continuous but not differentiable at $(2n+1)\frac{\pi}{2}, n \in \mathbb{Z}$
 - b. either continuous or differentiable at $(2n+1)\frac{\pi}{2}, n \in \mathbb{Z}$
 - c. neither continuous nor differentiable at $(2n+1)\frac{\pi}{2}, n \in \mathbb{Z}$
 - d. everywhere continuous and differentiable
5. If a vector makes an angle of $\frac{\pi}{4}$ with the positive directions of both x -axis and y -axis, then the angle which it makes with positive z -axis is:
 - a. 0
 - b. $\frac{3\pi}{4}$
 - c. $\frac{\pi}{2}$
 - d. $\frac{\pi}{4}$
6. Consider the following statements in respect of the differential equation $\frac{d^2y}{dx^2} + \cos\left(\frac{dy}{dx}\right) = 0$
 - i. The degree of the differential equation is not defined.
 - ii. The order of the differential equation is 2.Which of the above statement(s) is/are correct?
 - a. Neither (i) nor (ii)
 - b. Both (i) and (ii)
 - c. Only (ii)
 - d. Only (i)
7. The graph of the inequality $2x + 3y > 6$ is
 - a. whole XOY – plane excluding the points on the line $2x + 3y = 6$.
 - b. half plane that neither contains the origin nor the points of the line $2x + 3y = 6$.
 - c. entire XOY plane.
 - d. half plane that contains the origin.
8. Magnitude of the vector $\vec{a} = 2\hat{i} - 7\hat{j} - 3\hat{k}$ is
 - a. $\sqrt{61}$
 - b. $\sqrt{65}$
 - c. $\sqrt{62}$
 - d. $\sqrt{63}$

9. $\int \frac{dx}{(2-3x)} = ?$
 a. $-3\log|2-3x| + C$ b. $\log|2+3x| + C$ c. $-\log|2-3x| + C$ d. $-\frac{1}{3}\log|2-3x| + C$
10. The order of matrix $A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & -1 \end{bmatrix}$ is _____.
 a. 2×3 b. 3×3 c. 2×2 d. 3×2
11. The point at which the maximum value of $x + y$, subject to the constraints $x + 2y \leq 70, 2x + y \leq 95, x, y \geq 0$ is obtained, is
 a. (30, 25) b. (20, 35) c. (35, 20) d. (40, 15)
12. For what value of λ , the projection of vector $\hat{i} + \lambda\hat{j}$ on vector $\hat{i} - \hat{j}$ is $\sqrt{2}$?
 a. 0 b. -1 c. 1 d. 3
13. $\begin{vmatrix} \cos 70^\circ & \sin 20^\circ \\ \sin 70^\circ & \cos 20^\circ \end{vmatrix} = ?$
 a. $\sin 50^\circ$ b. 0 c. $\cos 50^\circ$ d. 1
14. A bag contains 5 red and 3 blue balls. If 3 balls are drawn at random without replacement the probability that exactly two of the three balls were red, the first ball being red, is
 a. $\frac{4}{7}$ b. $\frac{5}{28}$ c. $\frac{15}{28}$ d. $\frac{1}{3}$
15. General solution of $y \log y \, dx - x \, dy = 0$
 a. $y = e^{cx}$ b. $y^2 = e^{cx}$ c. $y = e^{cx} + e^{-cx}$ d. $y = e^{-cx}$
16. Let L denote the set of all straight lines in a plane. Let a relation R be defined by lRm if and only if l is perpendicular to $m \forall l, m \in L$.
 a. reflexive b. symmetric c. Asymmetric d. transitive
17. For what value of k may the function $f(x) = \begin{cases} k(3x^2 - 5x), & x \leq 0 \\ \cos x, & x > 0 \end{cases}$ become continuous?
 a. 1 b. $-\frac{1}{2}$ c. 0 d. No value
18. The straight line $\frac{x-3}{3} = \frac{y-2}{1} = \frac{z-1}{0}$ is
 a. perpendicular to z-axis b. parallel to x-axis c. parallel to y-axis d. parallel to z-axis
19. **Assertion (A):** The rate of change of area of a circle with respect to its radius r when $r = 6$ cm is $12\pi \text{ cm}^2/\text{cm}$.
Reason (R): Rate of change of area of a circle with respect to its radius r is $\frac{dA}{dr}$, where A is the area of the circle.
 a. Both A and R are true and R is the correct explanation of A.
 b. Both A and R are true but R is not the correct explanation of A.
 c. A is true but R is false.
 d. A is false but R is true.
20. The value of λ for which the two vectors $2\hat{i} - \hat{j} + 2\hat{k}$ and $3\hat{i} + \lambda\hat{j} + \hat{k}$ are perpendicular is
 a. 8 b. 4 c. 6 d. 2

SECTION – B (2 MARKS EACH)

21. If $A = \begin{bmatrix} p & 2 \\ 2 & p \end{bmatrix}$ and $|A^3| = 125$, then find the values of p .

OR

Using determinant show that the (5, 5), (-5, 1) and (10, 7) points are collinear.

22. Evaluate: $\int e^x \frac{(2-x)}{(1-x)^2} dx$.

23. Find the absolute maximum and minimum values of a function f given by $f(x) = 2x^3 - 15x^2 + 36x + 1$ on the interval $[1, 5]$.

OR

Prove that the function $f(x) = \tan x - 4x$ is strictly decreasing on $(-\frac{\pi}{3}, \frac{\pi}{3})$.

24. If A and B are two independent events such that $P(A \cup B) = 0.60$ and $P(A) = 0.2$, find $P(B)$.
25. Show that: $\frac{d}{dx}(|x|) = \frac{x}{|x|}, x \neq 0$.

SECTION – C (3 MARKS EACH)

26. $\int \frac{x^2(x^4+4)}{x^2+4} dx.$

27. A bag contains 7 red, 5 white and 8 black balls. If four balls are drawn one by one with replacement, what is the probability that all are white?

28. Find $\int \frac{\cos \theta}{(4+\sin^2 \theta)(5-4 \cos^2 \theta)} d\theta.$

OR

Evaluate: $\int_0^{\pi/6} (2 + 3x^2) \cos 3x dx$

29. Solve the differential equation: $(y^2 - 2xy)dx = (x^2 - 2xy)dy.$

OR

Solve the initial value problem: $xe^{y/x} - y \sin\left(\frac{y}{x}\right) + x \frac{dy}{dx} \sin\left(\frac{y}{x}\right) = 0, y(1) = 0.$

30. Solve the Linear Programming Problem graphically:

Maximize $Z = 50x + 30y$ Subject to

$2x + y \leq 18$

$3x + 2y \leq 34$

$x, y \geq 0$

OR

Solve the following LPP graphically:

Minimize $Z = 3x + 5y$

Subject to

$x + y \geq 3$

$x - 2y \leq 2$

$x, y \geq 0$

31. If $x = a \left(\cos t + \log \tan \frac{t}{2} \right), y = a \sin t$, then evaluate $\frac{d^2y}{dx^2}$ at $t = \frac{\pi}{3}.$

SECTION – D (5 MARKS EACH)

32. Using integration, find the area of the triangle formed by positive X-axis and tangent and normal to the circle $x^2 + y^2 = 4$ at $(1, \sqrt{3}).$

33. Let $A = \{1, 2, 3\}$ and $R = \{(a, b) : a, b \in A \text{ and } |a^2 - b^2| \leq 5\}.$ Write R as set of ordered pairs. Mention whether R is

i. reflexive

ii. symmetric

iii. transitive

Give reason in each case.

OR

Show that the function $f: R_0 \rightarrow R_0$ defined as $f(x) = \frac{1}{x'}$ is one-one onto, where R_0 is the set non-zero real numbers. Is the result true, if the domain R_0 is replaced by N with co-domain being same as R_0 ?

34. Solve the system of equations

$\frac{2}{x} + \frac{3}{y} + \frac{10}{z} = 4$

$\frac{4}{x} - \frac{6}{y} + \frac{5}{z} = 1$

$\frac{6}{x} + \frac{9}{y} - \frac{20}{z} = 2$

35. Find the image of the point $(0, 2, 3)$ in the line $\frac{x+3}{5} = \frac{y-1}{2} = \frac{z+4}{3}.$

OR

By computing the shortest distance determine whether the pairs of lines intersect or not:

$\vec{r} = (\hat{i} - \hat{j}) + \lambda(2\hat{i} + \hat{k})$ and $\vec{r} = (2\hat{i} - \hat{j}) + \mu(\hat{i} + \hat{j} - \hat{k})$

SECTION – E (4 MARKS EACH)

36. Read the following text carefully and answer the questions that follow:

To hire a marketing manager, it's important to find a way to properly assess candidates who can bring radical changes and has leadership experience.

Ajay, Ramesh and Ravi attend the interview for the post of a marketing manager. Ajay, Ramesh and Ravi chances of being selected as the manager of a firm are in the ratio 4 : 1 : 2 respectively. The respective probabilities for them to introduce a radical change in marketing strategy are 0.3, 0.8, and 0.5. If the change does take place.



- i. Find the probability that it is due to the appointment of Ajay (A). (1)
- ii. Find the probability that it is due to the appointment of Ramesh (B). (1)
- iii. Find the probability that it is due to the appointment of Ravi (C). (2)

OR

Find the probability that it is due to the appointment of Ramesh or Ravi. (2)

37. Read the following text carefully and answer the questions that follow:

A motor cycle race was organized in a town, where the maximum speed limit was set by the organizers. No participant are allowed to cross the specified speed limit, but Two motorcycles A and B are running at the speed more than allowed speed on the road along the lines $\vec{r} = \lambda(\hat{i} + 2\hat{j} - \hat{k})$ and $\vec{r} = 3\hat{i} + 3\hat{j} + \mu(2\hat{i} + \hat{j} + \hat{k})$, respectively.



- i. Find the Cartesian equation of the line along which motorcycle A is running. (1)
- ii. Find the shortest distance between the lines. (1)
- iii. If the direction cosines of a lines are $\frac{k}{3}, \frac{k}{3}, \frac{k}{3}$, then find the value of k. (2)

OR

The point where the line joining the points (0, 5, 4) and (1, 3, 6) meets XY - plane. (2)

38. Read the following text carefully and answer the questions that follow:

Dinesh is having a jewelry shop at Green Park, normally he does not sit on the shop as he remains busy in political meetings. The manager Lisa takes care of jewelry shop where she sells earrings and necklaces. She gains profit of ₹30 on pair of earrings & ₹40 on neckless. It takes 30 minutes to make a pair of earrings and 1 hour to make a necklace, and there are 10 hours a week to make jewelry. In addition, there are only enough materials to make 15 total of jewelry items per week.



- i. Formulate the above information mathematically. (1)
- ii. Graphically represent the given data. (1)
- iii. To obtain maximum profit how many pair of earring and neckleses should be sold? (2)

OR

What would be the profit if 5 pairs of earrings and 5 necklaces are made? (2)