Class XII | Session 2026-27
Subject - Mathematics
Sample Question Paper - Set 4

General Instructions:

1. This Question paper contains 38 questions. All questions are compulsory.
2. This Question paper is divided into five Sections - A, B, C, D and E.
3. In Section A, Questions no. 1 to 18 are multiple choice questions (MCQs) and Questions no. 19 and 20 are Assertion-Reason based questions of 1 mark each.
4. In Section B, Questions no. 21 to 25 are Very Short Answer (VSA)-type questions, carrying 2 marks each.
5. In Section C, Questions no. 26 to 31 are Short Answer (SA)-type questions, carrying 3 marks each.
6. In Section D, Questions no. 32 to 35 are Long Answer (LA)-type questions, carrying 5 marks each.
7. In Section E, Questions no. 36 to 38 are Case study-based questions, carrying 4 marks each.
8. There is no overall choice. However, an internal choice has been provided in 2 questions in Section B, 3 questions in Section C, 2 questions in Section D and one subpart each in 2 questions of Section E.
9. Use of calculators is not allowed.

Section A

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 **[1]**

   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 $\sin^{-1}(\cos\frac{\pi}{9})$ is **[1]**

   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? **[1]**

   a) ± 2
   b) 2
   c) ± 3
   d) -3

4. The function f(x) = |cos x| is **[1]**

   a) everywhere continuous but not differentiable at $(2n + 1)\frac{\pi}{2}$, $n \in Z$
   b) either continuous or differentiable at $(2n + 1)\frac{\pi}{2}$, $n \in Z$
   c) neither continuous nor differentiable at $(2n + 1)\frac{\pi}{2}$, $n \in Z$
   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 **[1]**

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 $\frac{d^2y}{dx^2} + \cos\left(\frac{dy}{dx}\right) = 0$ **[1]**

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 **[1]**

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 **[1]**

a) $\sqrt{61}$ b) $\sqrt{65}$

c) $\sqrt{62}$ d) $\sqrt{63}$

9. $\int \frac{dx}{(2-3x)} = ?$ **[1]**

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 _____. **[1]**

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 **[1]**

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 $\sqrt{2}$? **[1]**

a) 0 b) -1

c) 1 d) 3

13. $\begin{vmatrix} \cos 70^\circ & \sin 20^\circ \\ \sin 70^\circ & \cos 20^\circ \end{vmatrix}$ = ? **[1]**

a) sin 50° b) 0

c) cos 50° d) 1

14. A bag contains 5 red and 3 blue balls. If 3 balls are drawn at random without replacement the the probability that exactly two of the three balls were red, the first ball being red, is **[1]**

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 **[1]**

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. Then R is **[1]**

a) reflexive b) symmetric

c) Asymmetric d) transitive

17. For what value of k may the function f(x) = $\begin{cases} k\left(3x^2 - 5x\right), & x \leq 0 \\ \cos x, & x > 0 \end{cases}$ become continuous? **[1]**

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 **[1]**

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 12π cm^2/cm. **[1]**
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 **[1]**

a) 8 b) 4

c) 6 d) 2

Section B

21. Evaluate: $\tan^{-1}\sqrt{3} - \sec^{-1}(-2)$. **[2]**

OR

Write the interval for the principal value of function and draw its graph: $\tan^{-1} x$.

22. Find all the points of discontinuity of the greatest integer function defined by f(x) = [x], where [x] denotes the greatest integer less than or equal to x. **[2]**

23. Find the intervals in which $f(x) = (x + 2)e^{-x}$ is increasing or decreasing. **[2]**

OR

If $x^{30}y^{20} = (x + y)^{50}$, prove that $\frac{dy}{dx} = \frac{y}{x}$.

24. Evaluate: $\int e^x (\cot x - \text{cosec}^2 x)\, dx$ **[2]**

25. If A = $\begin{bmatrix} \cos x & -\sin x \\ \sin x & \cos x \end{bmatrix}$, find AA^T **[2]**

Section C

26. Using integration, find the area of the region bounded by the lines x - y = 0, 3x - y = 0 and x + y = 12. **[3]**

27. A girl walks 4 km towards west, then she walks 3 km in a direction 30^0 east of north and stops. Determine the girl's displacement from her initial point of departure. **[3]**

28. Evaluate the definite integral $\int_0^{\pi} \frac{1}{1+\sin x} dx$ **[3]**

OR

Evaluate: $\int \frac{1}{5-4\cos x} dx$

29. Find the general solution of the differential equation: $(x^2 + 1)\frac{dy}{dx}$ - 2xy = $(x^2 + 1)(x^2 + 2)$ **[3]**

OR

Solve the differential equation: $\left[x\sqrt{x^2+y^2} - y^2\right]$ dx + xy dy = 0

30. Solve the Linear Programming Problem graphically: **[3]**

Maximize Z = x + y Subject to

- 2x + y $\leq$ 1

x $\leq$ 2

x + y $\leq$ 3

x ,y $\geq$ 0

OR

Determine graphically the minimum value of the objective function Z = -50x + 20y subject to the constraints:

2x - y $\geq$ - 5

3x + y $\geq$ 3

2x - 3y $\leq$ 12

x $\geq$ 0, y $\geq$ 0

31. Show that the function f(x) defined by f(x) = $\begin{cases} \frac{\sin x}{x} + \cos x, & x > 0 \\ 2, & x = 0 \\ \frac{4(1-\sqrt{1-x})}{x}, & x < 0 \end{cases}$ is continuous at x = 0. **[3]**

Section D

32. Evaluate: $\int \frac{(x^2+1)(x^2+2)}{(x^2+3)(x^2+4)} dx$. **[5]**

33. Let A = R - {3}, B = R - {1}. If $f : A \to B$ be defined by $f(x) = \frac{x-2}{x-3}$ $\forall x \in A$. Then, show that f is bijective. **[5]**

OR

Let A = {1, 2, 3, ...9} and R be the relation in A$\times$A defined by (a, b) R (c, d) if a + d = b + c for (a, b), (c, d) in A $\times$A. Prove that R is an equivalence relation and also obtain the equivalence class [(2, 5)].

34. If $A = \begin{bmatrix} 1 & 2 & 0 \\ -2 & -1 & -2 \\ 0 & -1 & 1 \end{bmatrix}$, then find the value of A^{-1}. **[5]**

Using A^{-1}, solve the system of linear equations:

x - 2y = 10,

2x - y - z = 8,

-2y +z = 7

35. Show that the lines $\frac{x-1}{3} = \frac{y+1}{2} = \frac{z-1}{5}$ and $\frac{x-2}{2} = \frac{y-1}{3} = \frac{z+1}{-2}$ intersect and find their point of intersection. **[5]**

OR

Find the length shortest distance between the lines: $\frac{x-3}{3} = \frac{y-8}{-1} = z - 3$ and $\frac{x+3}{-3} = \frac{y+7}{2} = \frac{z-6}{4}$

Section E

36. **Read the following text carefully and answer the questions that follow:** **[4]**

Akash and Prakash appeared for first round of an interview for two vacancies. The probability of Nisha's

selection is $\frac{1}{3}$ and that of Ayushi's selection is $\frac{1}{2}$.

i. Find the probability that both of them are selected. (1)

ii. The probability that none of them is selected. (1)

iii. Find the probability that only one of them is selected.(2)

OR

Find the probability that atleast one of them is selected. (2)

37. **Read the following text carefully and answer the questions that follow:** **[4]**

A trust fund has ₹ 35000 that must be invested in two different types of bonds, say X and Y. The first bond pays 10% interest p.a. which will be given to an old age home and second one pays 8% interest p.a. which will be given to WWA (Women Welfare Association).

Let A be a 1×2 matrix and B be a 2×1 matrix, representing the investment and interest rate on each bond respectively.

Based on the above information, answer the following questions.

i. If ₹ 15000 is invested in bond X, then what is the matrix representation of A and B? (1)

ii. If ₹ 15,000 is invested in bond X, how can we determine the total amount of interest received on both bonds? (1)

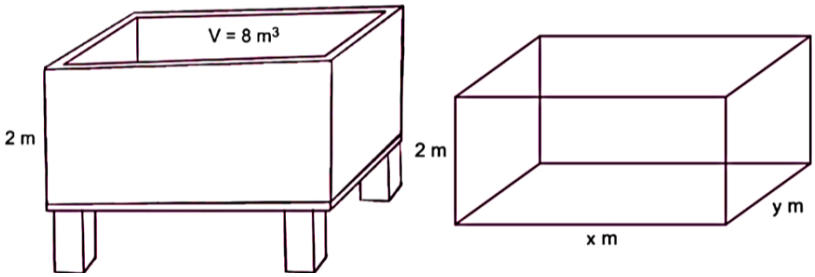
iii. How much is the investment in two bonds if the trust fund obtains an annual total interest of ₹3200? (2)

OR

What is the amount of investment in bond Y if the interest given to the old age home is ₹500? (2)

38. **Read the following text carefully and answer the questions that follow:** **[4]**

On the request of villagers, a construction agency designs a tank with the help of an architect. Tank consists of a rectangular base with rectangular sides, open at the top so that its depth is 2 m and volume is 8 m^3 as shown below. The construction of the tank costs ₹70 per sq. metre for the base and ₹45 per square metre for sides.



i. Express making cost C in terms of length of rectangle base. (1)

ii. If x and y represent the length and breadth of its rectangular base, then find the relation between the variables. (1)

iii. Find the value of **x** so that the cost of construction is minimum. (2)

OR

Verify by second derivative test that cost is minimum at a critical point. (2)