

Class XII | Session 2026-27
Subject - Mathematics
Sample Question Paper - Set 3

General Instructions:

1. This Question paper contains - five sections A, B, C, D and E. Each section is compulsory. However, there are internal choices in some questions.
2. Section A has 18 MCQ's and 02 Assertion-Reason based questions of 1 mark each.
3. Section B has 5 Very Short Answer (VSA)-type questions of 2 marks each.
4. Section C has 6 Short Answer (SA)-type questions of 3 marks each.
5. Section D has 4 Long Answer (LA)-type questions of 5 marks each.
6. Section E has 3 source based/case based/passage based/integrated units of assessment (4 marks each) with sub parts.

Section A

1. If $A' = \begin{bmatrix} -2 & 3 \\ 1 & 2 \end{bmatrix}$ and $B = \begin{bmatrix} -1 & 0 \\ 1 & 2 \end{bmatrix}$, then $(A + 2B)'$ is [1]

a) $\begin{bmatrix} 1 & -4 \\ 6 & 5 \end{bmatrix}$

b) $\begin{bmatrix} -4 & 5 \\ 1 & 6 \end{bmatrix}$

c) $\begin{bmatrix} -4 & 6 \\ 1 & 5 \end{bmatrix}$

d) $\begin{bmatrix} -4 & 1 \\ 5 & 6 \end{bmatrix}$

2. Matrices A and B are inverses of each other only when [1]

a) $AB = BA = O$

b) $AB = O, BA = I$

c) $AB = BA$

d) $AB = BA = I$

3. The value of the determinant $\begin{vmatrix} 2 & 7 & 1 \\ 1 & 1 & 1 \\ 10 & 8 & 1 \end{vmatrix}$ is: [1]

5. If the points A(-1, 3, 2), B(-4, 2, -2) and C(5, 5, λ) are collinear then the value of λ is [1]

a) -47

b) -49

c) -51

d) -79

4. If $y = 2^x$ then $\frac{dy}{dx} = ?$ [1]

a) $x(2^{x-1})$

b) $2^x (\log 2)$

c) $\frac{2^x}{(\log 2)}$

d) $3^x (\log 3)$

a) 10

b) 7

c) 5

d) 8

6. The degree of the differential equation $x^2 \frac{d^2y}{dx^2} = \left(x \frac{dy}{dx} - y\right)^3$ is [1]
- a) 2 b) 1
c) 3 d) 6
7. The corner points of the feasible region for a Linear Programming problem are P(0, 5), Q(1, 5), R(4, 2) and S(12, 0). The minimum value of the objective function $Z = 2x + 5y$ is at the point. [1]
- a) R b) Q
c) S d) P
8. The principal value of the expression $\cos^{-1} [\cos (-680^\circ)]$ is [1]
- a) $\frac{\pi}{9}$ b) $\frac{2\pi}{9}$
c) $\frac{-2\pi}{9}$ d) $\frac{34\pi}{9}$
9. $\int_{-\pi}^{\pi} \sin^5 x dx = ?$ [1]
- a) 2π b) $\frac{3\pi}{4}$
c) 0 d) $\frac{5\pi}{16}$
10. If $\begin{bmatrix} 2x+y & 4x \\ 5x-7 & 4x \end{bmatrix} = \begin{bmatrix} 7 & 7y-13 \\ y & x+6 \end{bmatrix}$, then the value of x, y is [1]
- a) $x = 3, y = 1$ b) $x = 2, y = 3$
c) $x = 2, y = 4$ d) $x = 3, y = 3$
11. If the constraints in a linear programming problem are changed [1]
- a) the problem is to be re-evaluated b) solution is not defined
c) the objective function has to be modified d) the change in constraints is ignored
12. Let $\vec{a}, \vec{b}, \vec{c}$ be three unit vectors such that $|\vec{a} + \vec{b} + \vec{c}| = 1$ and $\vec{a}$ is perpendicular to $\vec{b}$. If $\vec{c}$ makes angle α and β with $\vec{a}$ and $\vec{b}$ respectively, then $\cos \alpha + \cos \beta =$ [1]
- a) $-\frac{3}{2}$ b) 1
c) -1 d) $\frac{3}{2}$
13. If $P = \begin{bmatrix} 1 & \alpha & 3 \\ 1 & 3 & 3 \\ 2 & 4 & 4 \end{bmatrix}$ is the adjoint of a 3×3 matrix A and $|A| = 4$, then α is equal to [1]
- a) 11 b) 4
c) 5 d) 13
14. The letters of the word ORIENTAL are arranged in all possible ways. The chance that the consonants and vowels occur alternately is [1]
- a) $\frac{3}{35}$ b) $\frac{1}{35}$
c) $\frac{2}{35}$ d) $\frac{1}{70}$
15. If $x = a \cos \theta + b \sin \theta$, $y = a \sin \theta - b \cos \theta$, then which one of the following is true? [1]
- a) $y^2 \frac{d^2y}{dx^2} - x \frac{dy}{dx} + y = 0$ b) $y^2 \frac{d^2y}{dx^2} - x \frac{dy}{dx} - y = 0$

$$c) y^2 \frac{d^2 y}{dx^2} + x \frac{dy}{dx} - y = 0$$

$$d) y^2 \frac{d^2 y}{dx^2} + x \frac{dy}{dx} + y = 0$$

16. Which one of the following is the unit vector perpendicular to both $\vec{a} = -\hat{i} + \hat{j} + \hat{k}$ and $\vec{b} = \hat{i} - \hat{j} + \hat{k}$? [1]

a) $\frac{\hat{j} + \hat{k}}{\sqrt{2}}$

b) $\pm \frac{\hat{i} + \hat{j}}{\sqrt{2}}$

c) $\frac{\hat{i} - \hat{j}}{\sqrt{2}}$

d) $\hat{k}$

17. Let $f(x) = x - |x|$ then $f(x)$ is [1]

a) differentiable $\forall x \in \mathbb{R}$

b) continuous $\forall x \in \mathbb{R}$ and not differentiable at $x = 0$

c) discontinuous at $x = 0$

d) neither continuous nor differentiable at $x = 0$

18. If a line makes angles $\alpha, \beta, \gamma, \delta$ with four diagonals of a cube then $\cos^2 \alpha + \cos^2 \beta + \cos^2 \gamma + \cos^2 \delta$ is equal to [1]

a) $\frac{2}{3}$

b) $\frac{4}{3}$

c) $\frac{8}{3}$

d) $\frac{1}{3}$

19. **Assertion (A):** If x is real, then the minimum value of $x^2 - 8x + 17$ is 1. [1]

Reason (R): If $f''(x) > 0$ at a critical point, then the value of the function at the critical point will be the minimum value of the function.

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. **Assertion (A):** The modulus function $f : \mathbb{R} \rightarrow \mathbb{R}$ given by $f(x) = |x|$ is neither one-one nor onto. [1]

Reason (R): The signum function $f : \mathbb{R} \rightarrow \mathbb{R}$ given by $f(x) = \begin{cases} 1, & x > 0 \\ 0, & x = 0 \\ -1, & x < 0 \end{cases}$ is bijective.

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.

Section B

21. $\sin^{-1} \left(\frac{-1}{2} \right)$ [2]

OR

Find the value of $\cos^{-1} \frac{1}{2} + 2 \sin^{-1} \frac{1}{2}$.

22. Show that the function given by $f(x) = \sin x$ is decreasing in $\left(\frac{\pi}{2}, \pi \right)$ [2]

23. A particle moves along the curve $y = \left(\frac{2}{3} \right) x^3 + 1$. Find the points on the curve at which the y-coordinate is changing twice as fast as the x-coordinate. [2]

OR

The total revenue in Rs received from the sale of x units of the product is given by $R(x) = 13x^2 + 26x + 15$. find Marginal Revenue when 17 unit are produce.

24. Evaluate: $\int e^x \cdot \left\{ \frac{2 + \sin 2x}{1 + \cos 2x} \right\} dx$. [2]

25. If $A = \begin{bmatrix} 1 & 1 & -2 \\ 2 & 1 & -3 \\ 5 & 4 & -9 \end{bmatrix}$ find $|A|$. [2]

Section C

26. Evaluate: $\int \frac{3 \sin x + 2 \cos x}{3 \cos x + 2 \sin x} dx$ [3]
27. The contents of three bags I, II and III are as follows: [3]

Bag I : 1 white, 2 black and 3 red balls,

Bag II : 2 white, 1 black and 1 red ball;

Bag III : 4 white, 5 black and 3 red balls.

A bag is chosen at random and two balls are drawn. What is the probability that the balls are white and red?

28. Evaluate $\int \frac{2x}{(x^2+1)(x^2+3)} dx$. [3]

OR

Evaluate: $\int_0^{\pi/2} \frac{1}{1+\cot x} dx$

29. $(x^2 + y^2) dy = xy dx$. If $y(1) = 1$ and $y(x_0) = e$, then find the value of x_0 . [3]

OR

Show that the differential equation $(y^2 - x^2)dy = 3xydx$ is homogeneous and solve it.

30. If $\vec{a} + \vec{b} + \vec{c} = \vec{0}$, prove that $(\vec{a} \times \vec{b}) = (\vec{b} \times \vec{c}) = (\vec{c} \times \vec{a})$. [3]

OR

Using vectors, find the area of the $\triangle ABC$, whose vertices are A (1, 2, 3), B(2, -1, 4) and C(4, 5, -1).

31. If $x\sqrt{1+y} + y\sqrt{1+x} = 0$ and $x \neq y$, prove that $\frac{dy}{dx} = -\frac{1}{(x+1)^2}$. [3]

Section D

32. Find the area enclosed by the parabola $4y = 3x^2$ and the line $2y = 3x + 12$. [5]

33. Let R be a relation on $N \times N$, defined by $(a, b) R (c, d) \Leftrightarrow a + d = b + c$ for all $(a, b), (c, d) \in N \times N$. Show that R is an equivalence relation. [5]

OR

Show that the function $f: R \rightarrow \{x \in R : -1 < x < 1\}$ defined by $f(x) = \frac{x}{1+|x|}$, $x \in R$ is one-one and onto function.

34. Express the matrix $A = \begin{bmatrix} 1 & 3 & 5 \\ -6 & 8 & 3 \\ -4 & 6 & 5 \end{bmatrix}$ as the sum of a symmetric and a skew-symmetric matrix. [5]

35. AB is the diameter of a circle and C is any point on the circle. Show that the area of $\triangle ABC$ is maximum, when it is an isosceles triangle. [5]

OR

Show that the height of a closed right circular cylinder of given surface and maximum volume is equal to diameter of base.

Section E

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

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.



- Find the probability that it is due to the appointment of Ajay (A). (1)
- Find the probability that it is due to the appointment of Ramesh (B). (1)
- 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:**

[4]

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.



- Find the Cartesian equation of the line along which motorcycle A is running. (1)
- Find the shortest distance between the lines. (1)
- 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:**

[4]

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.



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

OR