Class XII | Session 2026-27
Subject - Mathematics
Sample Question Paper - Set 9

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. $x\begin{bmatrix}2\\3\end{bmatrix}+y\begin{bmatrix}-1\\1\end{bmatrix}=\begin{bmatrix}10\\5\end{bmatrix}$, then the value of x is **[1]**

a) 0 b) 7

c) 3 d) 10

2. If A $=\begin{bmatrix}\text{a} & 0 & 0\\0 & \text{a} & 0\\0 & 0 & a\end{bmatrix}$, then det (adj A) equals **[1]**

a) a^{27} b) a^2

c) a^6 d) a^9

3. The system of equations, x + y + z = 1, 3x + 6y + z = 8, αx + 2y + 3z = 1 has a unique solution for **[1]**

a) α not equal to 0 b) all rational α

c) all real α d) all integral α

4. If f(x) = x^n, then the value of f(1) - $\frac{f'(1)}{1!}+\frac{f''(1)}{2!}-\frac{f'''(1)}{3!}\ldots+\frac{(-1)^n f^n(1)}{n!}$ is **[1]**

a) 1 b) 0

c) 2^n d) 2

[1]

5. The direction ratios of the line perpendicular to the lines $\frac{x-7}{2}=\frac{y+17}{-3}=\frac{z-6}{1}$ and $\frac{x+5}{1}=\frac{y+3}{2}=\frac{z-4}{-2}$ are proportional to

a) 4, 5, 7
b) 4, -5, 7
c) -4, 5, 7
d) 4, -5, -7

6. Solution of $\left(x^2 - y^2\right)\ dx + 2xy\,dy = 0$ is **[1]**

a) $x^2+y^3=Cx$
b) $x^2-y^2=Cx$
c) $x^2+y^2=Cx$
d) $x^3+y^2=Cx$

7. The feasible region for an LPP is always a **[1]**

a) type of polygon
b) convex polygon
c) concave polygon
d) Straight line

8. If β is perpendicular to both α and γ, where $\alpha = \hat{k}$ and $\gamma = \gamma = 2\hat{i}+3\hat{j}+4\hat{k}$, then what is β equal to? **[1]**

a) $3\hat{i}+2\hat{j}$
b) $-3\hat{i}+2\hat{j}$
c) $-2\hat{i}+3\hat{j}$
d) $2\hat{i}-3\hat{j}$

9. $\int_0^1 \frac{d}{dx}\left\{\sin^{-1}\left(\frac{2x}{1+x^2}\right)\right\}dx$ is equal to **[1]**

a) $\frac{\pi}{2}$
b) 0
c) π
d) $\frac{\pi}{4}$

10. If A + B = $\begin{bmatrix}1 & 0\\ 1 & 1\end{bmatrix}$ and A – 2 B = $\begin{bmatrix}-1 & 1\\ 1 & -1\end{bmatrix}$, then A = ? **[1]**

a) $\frac{1}{3}\begin{bmatrix}2 & 1\\ 1 & 2\end{bmatrix}$
b) $\frac{1}{3}\begin{bmatrix}1 & 1\\ 3 & 1\end{bmatrix}$
c) $\begin{bmatrix}1 & 1\\ 2 & 1\end{bmatrix}$
d) $\frac{1}{2}\begin{bmatrix}2 & 1\\ 1 & 2\end{bmatrix}$

11. The point which does not lie in the half plane 2x + 3y - 12 $\leq$ 0 is **[1]**

a) (2,1)
b) (2, 3)
c) (1, 2)
d) (-3, 2)

12. For any vector α, what is $(\alpha\cdot\hat{\mathbf{i}})\hat{\mathbf{i}}+(\alpha\cdot\hat{\mathbf{j}})\hat{\mathbf{j}}+(\alpha\cdot\hat{\mathbf{k}})\hat{\mathbf{k}}$ equal to? **[1]**

a) -α
b) α
c) 0
d) 3α

13. The sum of products of elements of any row with the cofactors of corresponding elements is equal to **[1]**

a) $a_{11}A_{11} + a_{12}A_{12} + a_{13}A_{13}$
b) $a_{11}A_{11} + a_{12}A_{12} + a_{21}A_{13}$
c) $a_{11}A_{11} + a_{12}A_{13} + a_{13}A_{12}$
d) $a_{12}A_{21} + a_{12}A_{21} + a_{21}A_{13}$

14. If $P(A)=\frac{3}{10}, P(B)=\frac{2}{5}$ and $P(A\cup B)=\frac{3}{5}$, then $P(B/A)+P(A/B)$ equals **[1]**

a) $\frac{7}{12}$
b) $\frac{5}{12}$
c) $\frac{1}{3}$
d) $\frac{1}{4}$

15. The general solution of a differential equation of the type $\frac{dx}{dy}+\mathrm{P}_1x=\mathrm{Q}_1$ is **[1]**

a) $xe^{\int \mathrm{P}_1 dy} = \int \left(\mathrm{Q}_1 e^{\int \mathrm{P}_1 dy}\right) dy + \mathrm{C}$

b) $ye^{\int \mathrm{P}_1 dy} = \int \left(\mathrm{Q}_1 e^{\int \mathrm{P}_1 dy}\right) dy + \mathrm{C}$

c) $xe^{\int P^1 dx} = \int \left(Q_1 e^{\int P_1 dx}\right) dx + C$

d) $y \cdot e^{\int_P dx} = \int \left(Q_1 e^{\int P_1 dx}\right) dx + C$

16. If $\vec{a} \cdot \hat{i} = \vec{a} \cdot (\hat{i} + \hat{j}) = \vec{a} \cdot (\hat{i} + \hat{j} + \hat{k}) = 1$, then $\vec{a}$ is **[1]**

a) $\hat{k}$

b) $\hat{j}$

c) $\hat{i} + \hat{j} + \hat{k}$

d) $\hat{i}$

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

a) 1

b) $-\frac{1}{2}$

c) 0

d) No value

18. If a line makes an angle of 30^o with the positive direction of x-axis, 120^o with the positive direction of y-axis, then the angle which it makes with the positive direction of z-axis is: **[1]**

a) 0^o

b) 120^o

c) 90^o

d) 60^o

19. **Assertion (A):** The average rate of change of the function y = 15 - x^2 between x = 2 and x = 3 is -5. **[1]**

Reason (R): Average rate of change δ_y = $y_{\text{at } x = 3}$ - $y_{\text{at } x = 2}$.

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):** Let A = {1, 5, 8, 9}, B = {4, 6} and f = {(1, 4), (5, 6), (8, 4), (9, 6)}, then f is a bijective function. **[1]**

Reason (R): Let A = {1, 5, 8, 9}, B = {4, 6} and f = {(1, 4), (5, 6), (8, 4), (9, 6)}, then f is a surjective 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.

Section B

21. Write the interval for the principal value of function and draw its graph: $\cot^{-1}$ x. **[2]**

OR

Find the value of $\tan^{-1}\left(-\frac{1}{\sqrt{3}}\right) + \cot^{-1}\left(\frac{1}{\sqrt{3}}\right) + \tan^{-1}\left[\sin\left(\frac{-\pi}{2}\right)\right]$.

22. Show that f(x) = x^3 - 15x^2 + 75x - 50 is increasing on R. **[2]**

23. The volume of a sphere is increasing at the rate of 3 cubic centimeter per second. Find the rate of increase of its surface area, when the radius is 2 cm. **[2]**

OR

Is the function $cos3x$ decreasing on $\left(0, \frac{\pi}{2}\right)$?

24. Evaluate: $\int x^2 \cos x dx$. **[2]**

25. Find the maximum and minimum value, f(x) = |x + 2| - 1 **[2]**

Section C

26. Find $\int \frac{5x-2}{1+2x+3x^2} dx$. **[3]**

27. Probabilities of solving a specific problem independently by A and Bare $\frac{1}{2}$ and $\frac{1}{3}$ respectively. If both try to **[3]**

solve problem independently, then find the probability that

i. problem is solved.

ii. exactly one of them solves the problem.

28. If f(2a - x) = -f(x), prove that $\int_0^{2a} f(x)dx = 0$ **[3]**

OR

Evaluate: $\int e^{\sin x} \sin 2x\, dx$

29. Find the particular solution of the differential equation $x\frac{dy}{dx} + y + \frac{1}{1+x^2}$ = 0, given that y(1) = 0. **[3]**

OR

Find the general solution of the differential equation: $\left(1-x^2\right)\frac{dy}{dx} + xy = ax$

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

Minimize Z = 3 x_1 + $5x_2$

Subject to

$x_1 + 3x_2 \geq 3$

$x_1 + x_2 \geq 2$

$x_1, x_2 \geq 0$

OR

Solve the Linear Programming Problem graphically:

Minimize Z = l8x + 10y

Subject to

4x + y > 20

2x + 3 y > 30

x, y > 0

31. Find all points of discontinuity of f where f is defined as follows,f(x) = $\begin{cases} |x| + 3, x \leq -3 \\ -2x, -3 < x < 3 \\ 6x + 2, x \geq 3 \end{cases}$ **[3]**

Section D

32. Find the area of the smaller region bounded by the ellipse $\frac{x^2}{9} + \frac{y^2}{4} = 1$ and the line $\frac{x}{3} + \frac{y}{2} = 1$. **[5]**

33. If A = {1, 2, 3, 4}, define relations on A which have properties of being: **[5]**

a. reflexive, transitive but not symmetric

b. symmetric but neither reflexive nor transitive

c. reflexive, symmetric and transitive.

OR

Let A = [-1, 1]. Then, discuss whether the following functions defined on A are one-one, onto or bijective:

i. $f(x) = \frac{x}{2}$

ii. g(x) = |x|

iii. h(x) = x|x|

iv. k(x) = x^2

34. Solve the system of the following equations: (Using matrices): **[5]**

$\frac{2}{x} + \frac{3}{y} + \frac{10}{z} = 4; \frac{4}{x} - \frac{6}{y} + \frac{5}{z} = 1; \frac{6}{x} + \frac{9}{y} - \frac{20}{z} = 2;$

35. Find the vector equation of the line passing through (1, 2, 3) and parallel to each of the planes **[5]**

$\vec{r} \cdot (\hat{i} - \hat{j} + 2\hat{k}) = 5$ and $\vec{r} \cdot (3\hat{i} + \hat{j} + \hat{k}) = 6$. Also find the point of intersection of the line thus obtained with the plane $\vec{r}\cdot(2\hat{i}+\hat{j}+\hat{k})=4$.

OR

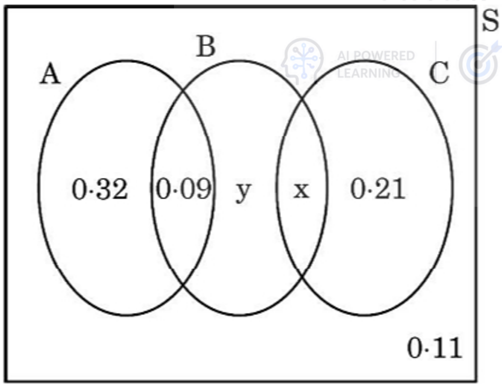
Find the shortest distance between the given lines. $\vec{r}=(6\hat{i}+3\hat{k})+\lambda(2\hat{i}-\hat{j}+4\hat{k})$, $\vec{r}=(-9\hat{i}+\hat{j}-10\hat{k})$ $+\mu(4\hat{i}+\hat{j}+6\hat{k})$

Section E

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

There are different types of Yoga which involve the usage of different poses of Yoga Asanas, Meditation and Pranayam as shown in the figure below:

The Venn diagram below represents the probabilities of three different types of Yoga, A, B and C performed by the people of a society. Further, it is given that probability of a member performing type C Yoga is 0.44.



i. Find the value of x. (1)

ii. Find the value of y. (1)

iii. Find $P\left(\frac{C}{B}\right)$. (2)

OR

Find the probability that a randomly selected person of the society does Yoga of type A or B but not C. (2)

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

If two vectors are represented by the two sides of a triangle taken in order, then their sum is represented by the third side of the triangle taken in opposite order and this is known as triangle law of vector addition.

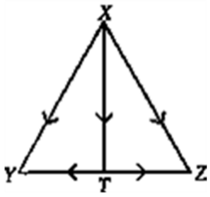
i. If $\vec{p}, \vec{q}, \vec{r}$ are the vectors represented by the sides of a triangle taken in order, then find $\vec{q}+\vec{r}$. (1)

ii. If ABCD is a parallelogram and AC and BD are its diagonals, then find the value of $\overrightarrow{AC}+\overrightarrow{BD}$. (1)

iii. If ABCD is a parallelogram, where $\overrightarrow{AB}$ = $2\vec{a}$ and $\overrightarrow{BC}$ = $2\vec{b}$, then find the value of $\overrightarrow{AC}-\overrightarrow{BD}$. (2)

OR

If T is the mid point of side YZ of $\triangle$XYZ, then what is the value of $\overrightarrow{XY}+\overrightarrow{XZ}$. (2)



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

In a street two lamp posts are 600 feet apart. The light intensity at a distance d from the first (stronger) lamp post is $\frac{1000}{d^2}$, the light intensity at distance d from the second (weaker) lamp post is $\frac{125}{d^2}$ (in both cases the light intensity is inversely proportional to the square of the distance to the light source). The combined light intensity is the sum of the two light intensities coming from both lamp posts.

i. If l(x) denotes the combined light intensity, then find the value of x so that I(x) is minimum. (1)

ii. Find the darkest spot between the two lights. (1)

iii. If you are in between the lamp posts, at distance x feet from the stronger light, then write the combined light intensity coming from both lamp posts as function of x. (2)

OR

Find the minimum combined light intensity? (2)