Class XII | Session 2026-27

Subject - Mathematics

Sample Question Paper - Set 6

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 B $\begin{vmatrix} 1 & -2 \\ 1 & 4 \end{vmatrix} = \begin{vmatrix} 6 & 0 \\ 0 & 6 \end{vmatrix}$ then matrix B is **[1]**

   a) I

   b) $\begin{vmatrix} 4 & 2 \\ -1 & 1 \end{vmatrix}$

   c) $\begin{vmatrix} 0 & 0 \\ 0 & 0 \end{vmatrix}$

   d) $\begin{vmatrix} 4 & 2 \\ 1 & 1 \end{vmatrix}$

2. If $A = \begin{bmatrix} 2 & 3 \\ 5 & -2 \end{bmatrix}$ be such that $A^{-1} = kA$, then k equals **[1]**

   a) 19

   b) -1/19

   c) 1/19

   d) -19

3. A square matrix A is called singular if det. A is **[1]**

   a) 0

   b) Negative

   c) Positive

   d) Non–zero

4. If $y = \frac{\log x}{x}$, then $\frac{d^2y}{dx^2} =$ **[1]**

   a) $\frac{2\log x - 3}{x^4}$

   b) $\frac{2\log x + 3}{x^3}$

   c) $\frac{3 - 2\log x}{x^3}$

   d) $\frac{2\log x - 3}{x^3}$

5. If lines $\frac{2x-2}{2k} = \frac{4-y}{3} = \frac{z+2}{-1}$ and $\frac{x-5}{1} = \frac{y}{k} = \frac{z+6}{4}$ are at right angles, then the value of k is **[1]**

   a) -2

   b) 4

   c) 0

   d) 2

6. The general solution of the differential equation $\frac{dy}{dx}$ + y cot x = cosec x, is **[1]**

a) y sin x = x + C

b) y + x (sin x + cos x) = C

c) x + y sin x = C

d) x + y cos x = C

7. Minimize Z = 5x + 10 y subject to x + 2y ≤ 120, x + y ≥ 60, x – 2y ≥ 0, x, y ≥ 0 **[1]**

a) Minimum Z = 300 at (60, 0)

b) Minimum Z = 330 at (60, 0)

c) Minimum Z = 310 at (60, 0)

d) Minimum Z = 320 at (60, 0)

8. The value of $\cos^{-1}\left(\cos\frac{3\pi}{2}\right)$ is equal to **[1]**

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

b) $\frac{7\pi}{2}$

c) $\frac{5\pi}{2}$

d) $\frac{3\pi}{2}$

9. $\int\frac{3x^2}{\sqrt{9-16x^6}}dx=?$ **[1]**

a) $2\sin^{-1}\left(\frac{3x^3}{4}\right)+C$

b) $4\sin^{-1}\left(\frac{x^3}{4}\right)+C$

c) $\frac{1}{4}\sin^{-1}\left(\frac{4x^3}{3}\right)+C$

d) $\frac{1}{4}\sin^{-1}\left(\frac{x^3}{3}\right)+C$

10. If $A=\begin{bmatrix}2&3\\1&2\end{bmatrix}$, $B=\begin{bmatrix}1&3&2\\4&3&1\end{bmatrix}$, $C=\begin{bmatrix}1\\2\end{bmatrix}$ and $D=\begin{bmatrix}4&6&8\\5&7&9\end{bmatrix}$, then which of the following is defined? **[1]**

a) A + B

b) C + D

c) B + D

d) B + C

11. A feasible region of a system of linear inequalities is said to be ..., if it can be enclosed within a circle. **[1]**

a) In squared form

b) bounded

c) unbounded

d) in circled form

12. What is the angle which the vector $(\hat{i}+\hat{j}+\sqrt{2}\hat{k})$ makes with the z- axis? **[1]**

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

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

c) $\frac{2\pi}{3}$

d) $\frac{\pi}{6}$

13. Let A and B be two invertible matrices of order 3 × 3. If det (ABA') = 8 and det (AB^{-1}) = 8, then det ($BA^{-1}B'$) is equal to **[1]**

a) 1

b) $\frac{1}{16}$

c) 16

d) $\frac{1}{4}$

14. Three dice are thrown simultaneously. The probability of obtaining a total score of 5 is **[1]**

a) $\frac{1}{36}$

b) $\frac{5}{216}$

c) $\frac{1}{6}$

d) $\frac{1}{49}$

15. The solution of the differential equation $x\frac{dy}{dx}=y+x\tan\frac{y}{x}$, is **[1]**

a) $\sin\frac{y}{x}=cx$

b) $\sin\frac{x}{y}=x+C$

c) $\sin\frac{x}{y}=Cy$

d) $\sin\frac{y}{x}=Cy$

16. The value of $\hat{i}\cdot(\hat{j}\times\hat{k})+\hat{j}\cdot(\hat{i}\times\hat{k})+\hat{k}\cdot(\hat{i}\times\hat{j})$ is **[1]**

a) 1

b) 3

c) 0 d) -1

17. Let f(x) = $\begin{cases} e^{1/x}, x<0 \\ x, x \geqslant 0 \end{cases}$, then $\underset{x \to 0}{Lt} \ f(x)$ **[1]**

a) does exist

b) is equal to non – zero real number

c) is equal to 0

d) does not exist

18. If (a_1, b_1, c_1) and (a_2, b_2, c_2) be the direction ratios of two parallel lines then **[1]**

a) $a_1 = a_2$, $b_1 = b_2$, $c_1 = c_2$

b) $a_1^2 + b_1^2 + c_1^2 = a_2^2 + b_2^2 + c_2^2$

c) $a_1a_2 + b_1b_2 + c_1c_2 = 0$

d) $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$

19. **Assertion (A):** The function f(x) = x^2 - 4x + 6 is strictly increasing in the interval (2, ∞). **[1]**

Reason (R): The function f(x) = x^2 - 4x + 6 is strictly decreasing in the interval ($-\infty$, 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):** The function f : R $\to$ R given by f(x) = x^3 is injective. **[1]**

Reason (R): The function f : X $\to$ Y is injective, if f(x) = f(y) $\Rightarrow$ x = y for all x, y $\in$ X.

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. Find the domain of f(x) = $\sin^{-1}(-x^2)$. **[2]**

OR

Which is greater, tan 1 or $\tan^{-1} 1$?

22. A stone is dropped into a quiet lake and waves move in circles at the speed of 5 cm/s. At the instant when the radius of the circular wave is 8 cm, how fast is the enclosed area increasing? **[2]**

23. Water is running into an inverted cone at the rate of π cubic metres per minute. The height of the cone is 10 metres, and the radius of its base is 5 m. How fast the water level is rising when the water stands 7.5 m below the base. **[2]**

OR

Prove that the function f given by f(x) = x^2 - x + 1 is neither strictly increasing nor strictly decreasing on (-1, 1).

24. Evaluate: $\int \tan^3 x \sec^2 x \, dx$ **[2]**

25. A matrix A of order 3 $\times$ 3 is such that |A| = 4. Find the value of |2A|. **[2]**

Section C

26. Find $\int \frac{x^2+1}{x^2-5x+6} dx$ **[3]**

27. An urn contains 10 white and 3 black balls. Another urn contains 3 white and 5 black balls. Two are drawn from first urn and put into the second urn and then a ball is drawn from the latter. Find the probability that it is a white ball. **[3]**

28. Prove that **[3]**

$\int\limits_{0}^{\frac{\pi}{2}} \frac{\sin^2 x}{\sin x+\cos x} dx = \frac{1}{\sqrt{2}}\log(\sqrt{2}+1)$.

OR

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

29. Find a particular solution of the differential equation (x - y) (dx + dy) = dx - dy, given that y = -1, when x = 0. **[3]**

OR

Solve the differential equation $x \log|x| \frac{dy}{dx} + y = \frac{2}{x} \log|x|$.

30. If $\vec{a} = 3\hat{i} - \hat{j}$ and $\vec{b} = 2\hat{i} + \hat{j} - 3\hat{k}$, then express $\vec{b}$ in the form $\vec{b} = \vec{b}_1 + \vec{b}_2$, where $\vec{b}_1 \| \vec{a}$ and $\vec{b}_2 \perp \vec{a}$. **[3]**

OR

If $\vec{a}, \vec{b}, \vec{c}$ are vectors such that $\vec{a} \cdot \vec{b} = \vec{a} \cdot \vec{c}, \vec{a} \times \vec{b} = \vec{a} \times \vec{c}, \vec{a} \neq \vec{0}$, then show that $\vec{b} = \vec{c}$.

31. If x = sin t, y = sin pt, prove that $\left(1-x^2\right) \frac{d^2y}{dx^2} - x\frac{dy}{dx} + p^2y = 0$. **[3]**

Section D

32. Find the area bounded by the curves y = x and y = x^3 **[5]**

33. Show that the relation R in the set A = {1, 2, 3, 4, 5} given by R = {(a, b) : |a – b| is divisible by 2} is an equivalence relation. Write all the equivalence classes of R. **[5]**

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. Find X and Y, if $2x + 3y = \begin{bmatrix} 2 & 3 \\ 4 & 0 \end{bmatrix}$ and $3x + 2y = \begin{bmatrix} 2 & -2 \\ -1 & 5 \end{bmatrix}$ **[5]**

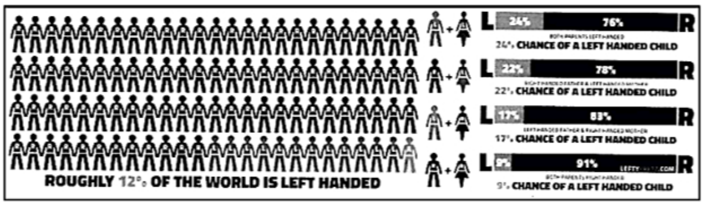
35. A wire of length 28m is to be cut into two pieces. One of the pieces is to be made into a square and the other into a circle. What should be the length of the two pieces so that the combined areas of the square and the circle is minimum? **[5]**

OR

If length of three sides of a trapezium other than base are equal to 10cm, then find the area of the trapezium when it is maximum.

Section E

36. Recent studies suggest that roughly 12% of the world population is left handed. **[4]**



Depending upon the parents, the chances of having a left handed child are as follows:

A. When both father and mother are left handed:

Chances of left handed child is 24%.

B. When father is right handed and mother is left handed:

Chances of left handed child is 22%.

C. When father is left handed and mother is right handed:

Chances of left handed child is 17%.

D. When both father and mother are right handed:

Chances of left handed child is 9%.

Assuming that P(A) = P(B) = P(C) = P(D) = $\frac{1}{4}$ and L denotes the event that child is left handed.

i. Find P $\left(\frac{L}{C}\right)$. (1)

ii. Find P $\left(\frac{\bar{L}}{A}\right)$. (1)

iii. Find P $\left(\frac{A}{L}\right)$. (2)

OR

Find the probability that a randomly selected child is left handed given that exactly one of the parents is left handed. (2)

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

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 direction cosines of line along which motorcycle A is running. (1)

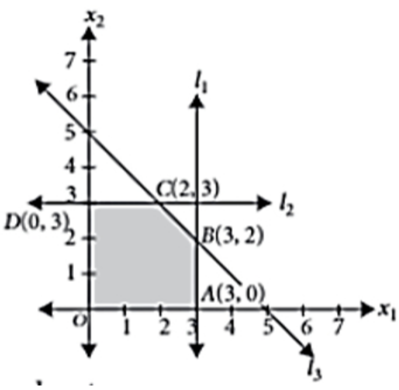
iii. Find the direction ratios of line along which motorcycle B is running. (2)

OR

Find the shortest distance between the given lines. (2)

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

Corner points of the feasible region for an LPP are (0, 3), (5, 0), (6, 8), (0, 8). Let Z = 4x - 6y be the objective function.



i. At which corner point the minimum value of Z occurs? (1)

ii. At which corner point the maximum value of Z occurs? (1)

iii. What is the value of (maximum of Z - minimum of Z)? (2)

OR

The corner points of the feasible region determined by the system of linear inequalities are (2)