Class XII | Session 2026-27
Subject - Mathematics
Sample Question Paper - Set 8

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 $A = \begin{bmatrix} 4 & x+2 \\ 2x-3 & x+1 \end{bmatrix}$ is symmetric then what is x equal to? **[1]**

   a) 5 b) 2

   c) 3 d) -1

2. If A and B are square matrices of order 3, such that Det.A = –1, Det.B =3 then, the determinant of 3AB is equal to **[1]**

   a) –9 b) –27

   c) -81 d) 81

3. The inverse of the matrix $\begin{vmatrix} 2 & -1 \\ 3 & 4 \end{vmatrix}$ is **[1]**

   a) $\begin{vmatrix} 4/11 & 1/11 \\ -3/11 & 2/11 \end{vmatrix}$ b) $\begin{vmatrix} 4 & 1 \\ -3 & 2 \end{vmatrix}$

   c) $\begin{vmatrix} 2 & 1 \\ 0 & 3 \end{vmatrix}$ d) $\begin{vmatrix} 0 & 0 \\ 0 & 0 \end{vmatrix}$

4. If $x = a(\cos\theta + \theta\sin\theta)$ and $y = a(\sin\theta - \theta\cos\theta)$ $\frac{dy}{dx} = ?$ **[1]**

   a) tan θ b) a cot θ

   c) a tan θ d) cot θ

5. Equation of a line passing through point (1, 1, 1) and parallel to z-axis is **[1]**

   a) $\frac{\mathrm{x}-1}{1} = \frac{\mathrm{y}-1}{1} = \frac{\mathrm{z}-1}{1}$ b) $\frac{\mathrm{x}-1}{0} = \frac{\mathrm{y}-1}{0} = \frac{\mathrm{z}-1}{1}$

   c) $\frac{\mathrm{x}}{1} = \frac{\mathrm{y}}{1} = \frac{\mathrm{z}}{1}$ d) $\frac{\mathrm{x}}{0} = \frac{\mathrm{y}}{0} = \frac{\mathrm{z}-1}{1}$

6. The general solution of the differential equation $e^x\,dy + (y\,e^x + 2x)\,dx = 0$ is **[1]**

a) $x\,e^y + y^2 = C$
b) $y\,e^y + x^2 = C$
c) $x\,e^y + x^2 = C$
d) $y\,e^x + x^2 = C$

7. Corner points of the feasible region for an LPP are (0, 2), (3, 0), (6, 0), (6, 8) and (0, 5).Let F = 4x + 6y be the objective function. The Minimum value of F occurs at **[1]**

a) any point on the line segment joining the points (0, 2) and (3, 0).
b) (0, 2) only
c) the mid-point of the line segment joining the points (0, 2) and (3, 0) only
d) (3, 0) only

8. The value of $\sin^{-1}\left(\cos \frac{3\pi}{5}\right)$ is **[1]**

a) $\frac{-3\pi}{5}$
b) $\frac{-\pi}{10}$
c) $\frac{\pi}{10}$
d) $\frac{3\pi}{5}$

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

a) $\sin^{-1}(2x + 1) + C$
b) $\sin^{-1}(2x - 1) + C$
c) $\sin^{-1}(x + 1) + C$
d) $\sin^{-1}(x - 1) + C$

10. If A = $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$, then A^4 = **[1]**

a) $\begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$
b) $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$
c) $\begin{bmatrix} 1 & 1 \\ 0 & 0 \end{bmatrix}$
d) $\begin{bmatrix} 0 & 0 \\ 1 & 1 \end{bmatrix}$

11. Maximize Z = 100x + 120y , subject to constraints $2x + 3y \le 30$, $3x + y \le 17$, $x \ge 0$, $y \ge 0$. **[1]**

a) 1200
b) 1260
c) 1280
d) 1300

12. What is the vector perpendicular to both the vectors $\hat{\imath} - \hat{\jmath}$ and $\hat{\imath}$? **[1]**

a) $\hat{\jmath}$
b) $\hat{k}$
c) $-\hat{\jmath}$
d) $\hat{\imath}$

13. The value of $\begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix}$ = 3A - B then the values of A and B are: **[1]**

a) A = 2abc, B = a + b + c
b) A = 3abc, B = a + b + c
c) A = 0, $B = a^2 + b^2 + c^2$
d) A = abc, $B = a^3 + b^3 + c^3$

14. If $P(A \cap B) = \frac{1}{8}$ and $P(\bar{A}) = \frac{3}{4}$, then $P\left(\frac{B}{A}\right)$ is equal to: **[1]**

a) $\frac{1}{2}$
b) $\frac{2}{3}$
c) $\frac{1}{3}$
d) $\frac{1}{6}$

15. The degree of the differential equation $\left(\frac{d^2y}{dx^2}\right)^3 + \left(\frac{dy}{dx}\right)^2 + \sin\left(\frac{dy}{dx}\right) + 1 = 0$ is **[1]**

a) Not defined
b) 1
c) 2
d) 3

16. The position vectors of three consecutive vertices of a parallelogram ABCD are $A(4\hat{i}+2\hat{j}-6\hat{k})$, B $(5\hat{i}-3\hat{j}+\hat{k})$ and $C(12\hat{i}+4\hat{j}+5\hat{k})$. The position vector of D is given by **[1]**

a) $-11\hat{i}-9\hat{j}+2\hat{k}$
b) $-3\hat{i}-5\hat{j}-10\hat{k}$
c) $11\hat{i}+9\hat{j}-2\hat{k}$
d) $21\hat{i}+3\hat{j}$

17. The derivative of sin x w.r.t. cos x is **[1]**

a) cosec x
b) tan x
c) -cot x
d) cot x

18. The lines l_1 and l_2 intersect. The shortest distance between them is **[1]**

a) zero
b) positive
c) infinity
d) negative

19. **Assertion (A):** A particle moving in a straight line covers a distance of x cm in t second, where $x = t^3 + 3t^2 - 6t + 18$. The velocity of particle at the end of 3 seconds is 39 cm/s. **[1]**

Reason (R): Velocity of the particle at the end of 3 seconds is $\frac{dx}{dt}$ at t = 3.

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 number of onto functions from a set P containing 5 elements to a set Q containing 2 elements is 30. **[1]**

Reason (R): Number of onto functions from a set containing m elements to a set containing n elements is n^m.

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: $\sec^{-1} x$. **[2]**

OR

Evaluate $\cos\left[\cos^{-1}\left(\frac{-\sqrt{3}}{2}\right)+\frac{\pi}{6}\right]$

22. Find the intervals of function $f(x) = (2x^3 + 9x^2 + 12x + 15)$ is **[2]**

a. increasing
b. decreasing.

23. A man 1.6m tall walks at the rate of 0.3 m/s away from a street light is 4 m above the ground. At what rate is the tip of his shadow moving? At what rate is his shadow lengthening? **[2]**

OR

For the function $f(x) = 2x^3 - 3x^2 - 12x + 4$, find the points of local maxima and minima.

24. Find $\int \frac{dx}{2\sin^2 x+5\cos^2 x}$ **[2]**

[2]

25. If $A=\begin{bmatrix}\cos\theta & \cos\theta\\ -\sin\theta & \cos\theta\end{bmatrix}$ and $A(\operatorname{adj} A)=\begin{bmatrix}k & 0\\ 0 & k\end{bmatrix}$, then fin the value of k.

Section C

26. Evaluate the integral: $\int x^2 \tan^{-1} x dx$ **[3]**

27. In a game a man wins a rupee for a six and looses a rupee for any other number when a fair die is thrown. The man decided to throw a die thrice but to quit as and when he gets a six. Find the expected value of the amounts he wins/loses. **[3]**

28. Prove that $\int_1^3 \frac{dx}{x^2(x+1)} = \frac{2}{3} + \log\frac{2}{3}$ **[3]**

OR

Evaluate: $\int \frac{1}{\cos 2x + 3\sin^2 x} dx$

29. Solve differential equation: $(1 + y + x^2y)dx + (x + x^3)dy = 0$ **[3]**

OR

Find the particular solution of the differential equation $\frac{dy}{dx}$ + 2y tan x = sin x, given that y = 0 when x = $\frac{\pi}{3}$.

30. If $\vec{a}$, $\vec{b}$, $\vec{c}$ are three vectors such that $|\vec{a}| = 5$, $|\vec{b}| = 12$ and $|\vec{c}| = 13$, and $\vec{a}+\vec{b}+\vec{c}=\vec{o}$ find the value of $\vec{a}\cdot\vec{b}+\vec{b}\cdot\vec{c}+\vec{c}\cdot\vec{a}$ **[3]**

OR

Express the vector $\vec{a}=5\hat{i}-2\hat{j}+5\hat{k}$ as the sum of two vectors such that one is parallel to the vector $\vec{b}=3\hat{i}+\hat{k}$ and other is perpendicular to $\vec{b}$.

31. If x = $\tan\left(\frac{1}{a}\log y\right)$, then show that $\left(1+x^2\right)\frac{d^2y}{dx^2}+(2x-a)\frac{dy}{dx}=0$. **[3]**

Section D

32. Find the area between the curves y = x and y = x^2 **[5]**

33. Show the relation R in the set A = $\{x \in Z : 0 \leq x \leq 12\}$, given by R = {(a, b) : a = b}, is an equivalence relation. Find the set of all elements related to 1 in each case. **[5]**

OR

Let R be relation defined on the set of natural number N as follows:

R = {(x, y): x ∈ N, y ∈ N, 2x + y = 41}. Find the domain and range of the relation R. Also verify whether R is reflexive, symmetric and transitive.

34. If $A=\begin{bmatrix}0 & -\tan\frac{\alpha}{2}\\ \tan\frac{\alpha}{2} & 0\end{bmatrix}$ and I is the identity matrix of order 2, show that $I+A=(I-A)\begin{bmatrix}\cos\alpha & -\sin\alpha\\ \sin\alpha & \cos\alpha\end{bmatrix}$. **[5]**

35. If the sum of lengths of the hypotenuse and a side of a right angled triangle is given, show that the area of the triangle is maximum, when the angle between them is $\frac{\pi}{3}$. **[5]**

OR

Prove that the volume of the largest cone that can be inscribed in a sphere of radius R is $\frac{8}{27}$ of the volume of the sphere.

Section E

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

In pre-board examination of class XII, commerce stream with Economics and Mathematics of a particular school, 50% of the students failed in Economics, 35% failed in Mathematics and 25% failed in both Economics and Mathematics. A student is selected at random from the class.

i. Find the probability that the selected student has failed in Economics, if it is known that he has failed in Mathematics? (1)

ii. Find the probability that the selected student has failed in Mathematics, if it is known that he has failed in Economics? (1)

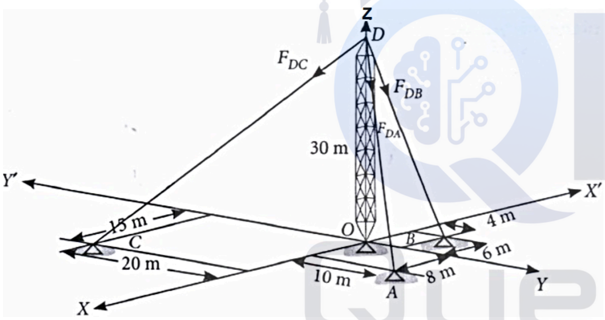
iii. Find the probability that the selected student has passed in Mathematics, if it is known that he has failed in Economics? (2)

OR

Find the probability that the selected student has passed in Economics, if it is known that he has failed in Mathematics? (2)

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

Consider the following diagram, where the forces in the cable are given.



i. What is the equation of the line along cable AD? (1)

ii. What is length of cable DC? (1)

iii. Find vector DB (2)

OR

What is sum of vectors along the cable? (2)

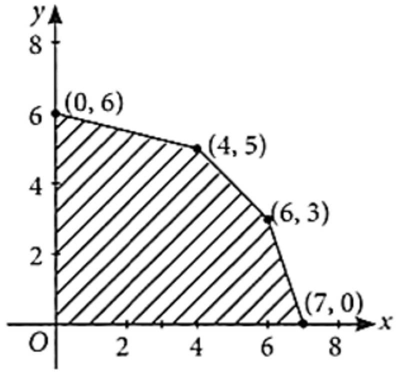
38. **Read the following text carefully and answer the questions that follow:** **[4]**

Linear programming is a method for finding the optimal values (maximum or minimum) of quantities subject to the constraints when a relationship is expressed as linear equations or inequations.

i. At which points is the optimal value of the objective function attained? (1)

ii. What does the graph of the inequality $3x + 4y < 12$ look like? (1)

iii. Where does the maximum of the objective function $Z = 2x + 5y$ occur in relation to the feasible region shown in the figure for the given LPP? (2)



OR

What are the conditions on the positive values of p and q that ensure the maximum of the objective function Z = px + qy occurs at both the corner points (15, 15) and (0, 20) of the feasible region determined by the given system of linear constraints? (2)