Class XII | Session 2026-27
Subject - Mathematics
Sample Question Paper - Set 7

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 be a skew-symmetric matrix of order 3. If |A| = x, then $(2023)^x$ is equal to: **[1]**

a) $(2023)^2$ b) $\frac{1}{2023}$

c) 2023 d) 1

2. If A is a square matrix of order 3 and |A| = 6, then the value of |adj A| is: **[1]**

a) 6 b) 216

c) 27 d) 36

3. The value of $\begin{vmatrix} x+y & y+z & z+x \\ z & x & y \\ 1 & 1 & 1 \end{vmatrix}$ is **[1]**

a) 1 b) x + y + z

c) 0 d) 2(x + y + z)

4. If A is a square matrix such that $A^2 = I$, then A^{-1} is equal to **[1]**

a) 0 b) A + I

c) 2A d) A

5. A line making angles $45^0 and 60^0$ with the positive directions of the axis of x and y makes with the positive **[1]**

direction of Z axis , an angle of

a) 45^0
b) 60^0
c) $60^0 or 120^0$
d) 120^0

6. The Integrating Factor of the differential equation $\left(1-y^2\right)\frac{dx}{dy}+yx=ay\left(-1<y<1\right)$ is **[1]**

a) $\frac{1}{1-y^2}$
b) $\frac{1}{y^2-1}$
c) $\frac{1}{\sqrt{1-y^2}}$
d) $\frac{1}{\sqrt{y^2-1}}$

7. In an LPP, if the objective function z = ax + by has the same maximum value on two corner points of the feasible region, then the number of points at which z_{max} occurs is: **[1]**

a) 0
b) 2
c) infinite
d) finite

8. If $\hat{i}, \hat{j}, \hat{k}$ are unit vectors along with three mutually perpendicular directions, then: **[1]**

a) $\hat{\mathbf{i}}\cdot\hat{\mathbf{j}}=1$
b) $\hat{i}\cdot\hat{k}=0$
c) $\hat{\mathrm{i}}\times\hat{\mathrm{k}}=0$
d) $\hat{\mathrm{i}}\times\hat{\mathrm{j}}=1$

9. $\int 2^{x+2}$ dx is equal to: **[1]**

a) $\frac{2^{x+2}}{\log 2}+C$
b) $2^{x+2}+C$
c) $2\cdot\frac{2^x}{\log 2}+C$
d) $2^{x+2}\log 2+C$

10. If $\left|\frac{A^{-1}}{2}\right|=\frac{1}{k|A|}$, where A is a 3×3 matrix, then the value of k is: **[1]**

a) $\frac{1}{8}$
b) 2
c) 8
d) $\frac{1}{2}$

11. The region represented by the inequation system x, y $\geq$ 0, y $\leq$ 6, x + y $\leq$ 3 is **[1]**

a) bounded in second quadrant
b) unbounded in first and second quadrants
c) unbounded in first quadrant
d) bounded in first quadrant

12. 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) $21\hat{i}+3\hat{j}$

13. If d is the determinant of a square matrix A of order n, then the determinant of its adjoint is **[1]**

a) d^{n+1}
b) d^{n-1}
c) d^n
d) d

14. An insurance company insured 2000 scooter drivers, 4000 car drivers and 6000 truck drivers. The probability of an accidents are 0.01, 0.03 and 0.15 respectively. One of the insured persons meets with an accident. What is the probability that he is a scooter driver? **[1]**

a) $\frac{1}{52}$
b) $\frac{3}{52}$
c) $\frac{5}{52}$
d) $\frac{1}{4}$

15. The number of arbitrary constants in the general solution of a differential equation of fourth order are: **[1]**

a) 4
b) 3
c) 1
d) 2

16. In $\triangle ABC$, $\overrightarrow{AB} = \hat{i} + \hat{j} + 2\hat{k}$ and $\overrightarrow{AC} = 3\hat{i} - \hat{j} + 4\hat{k}$. If D is mid-point of BC, then vector $\overrightarrow{AD}$ is equal to: **[1]**

a) $2\hat{i} - 2\hat{j} + 2\hat{k}$
b) $\hat{i} - \hat{j} + \hat{k}$
c) $4\hat{i} + 6\hat{k}$
d) $2\hat{i} + 3\hat{k}$

17. If x = log $(1 + t^2)$ and y = t - $\tan^{-1}$ t, then $\frac{dy}{dx}$ is equal to **[1]**

a) e^x - y
b) e^x - 1
c) $\frac{\sqrt{e^x - 1}}{2}$
d) t^2 - 1

18. The cartesian equation of a line is given by $\frac{2x-1}{\sqrt{3}} = \frac{y+2}{2} = \frac{z-3}{3}$ **[1]**

The direction cosines of the line is

a) $\frac{\sqrt{3}}{\sqrt{55}}, \frac{-4}{\sqrt{55}}, \frac{6}{\sqrt{55}}$
b) $\frac{\sqrt{3}}{\sqrt{55}}, \frac{4}{\sqrt{55}}, \frac{6}{\sqrt{55}}$
c) $\frac{3}{\sqrt{55}}, \frac{4}{\sqrt{55}}, \frac{6}{\sqrt{55}}$
d) $\frac{-3}{\sqrt{55}}, \frac{4}{\sqrt{55}}, \frac{6}{\sqrt{55}}$

19. **Assertion (A):** If manufacturer can sell x items at a price of ₹$\left(5 - \frac{x}{100}\right)$ each. The cost price of x items is ₹ $\left(\frac{x}{5} + 500\right)$. Then, the number of items he should sell to earn maximum profit is 240 items. **[1]**

Reason (R): The profit for selling x items is given by $\frac{24}{5}x - \frac{x^2}{100}$ - 300.

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):** A function f: Z $\rightarrow$ Z defined as f(x) = x^3 is injective. **[1]**

Reason (R): A function f: A $\rightarrow$ B is said to be injective if every element of B has a pre-Image in A.

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. Simplify $\sec^{-1}\left(\frac{1}{2x^2-1}\right)$, $0 < x < \frac{1}{\sqrt{2}}$. **[2]**

OR

Write the value of $\sin^{-1}\left(\frac{1}{3}\right) - \cos^{-1}\left(-\frac{1}{3}\right)$

22. The volume of a cube is increasing at the rate of 7 cm^3 /sec. How fast is its surface area increasing at the instant when the length of an edge of the cube is 12 cm? **[2]**

23. Find the value of a for which f(x) = a (x + sin x) + a is increasing on R. **[2]**

OR

The money to be spent for the welfare of the employees of a firm is proportional to the rate of change of its total revenue (marginal revenue).

If the total revenue (in Rs.) received from the sale of x units of a product is given by R(x) = $3x^2$ + 36x + 5, then find the marginal revenue, when x = 5 and write which value does the question indicate?

24. Evaluate: $\int \frac{x \cos^{-1} x}{\sqrt{1-x^2}} dx$ **[2]**

25. Show that $f(x) = \cos\left(2x + \frac{\pi}{4}\right)$ is an increasing function on $\left(\frac{3\pi}{8}, \frac{7\pi}{8}\right)$ **[2]**

Section C

26. Evaluate: $\int \frac{(3\sin\theta - 2)\cos\theta}{(5 - \cos^2\theta - 4\sin\theta)} d\theta$ **[3]**

27. In a set of 10 coins, 2 coins are with heads on both the sides. A coin is selected at random from this set and tossed five times. If all the five times, the result was heads, find the probability that the selected coin had heads on both the sides. **[3]**

28. Evaluate $\int_{-1}^{2} \left|x^3 - x\right| dx$. **[3]**

OR

Evaluate: $\int \frac{\sin 2x}{(1 - \cos 2x)(2 - \cos 2x)} dx$.

29. Solve the differential equation: y (1 - x^2) $\frac{dy}{dx}$ = x (1 + y^2) **[3]**

OR

Find the particular solution of the differential equation (1 + e^{2x})dy + (1 + y^2)e^x dx = 0, given that y = 1, when x = 0.

30. Minimise Z = 13x - 15y subject to the constraints: $x + y \leqslant 7, 2x - 3y + 6 \geqslant 0, x \geqslant 0\ y \geqslant 0$. **[3]**

OR

Solve graphically the following linear programming problem:

Maximise z = 6x + 3y,

Subject to the constraints:

4x + y $\geq$ 80,

3x + 2y $\leq$ 150,

x + 5y $\geq$115,

x > 0, y $\geq$ 0.

31. Find $\frac{dy}{dx}$ when y = $x^{\log x}$ + $(\log x)^x$ **[3]**

Section D

32. Using integration, find the area of the region bounded by the line x - y + 2 = 0, the curve x = $\sqrt{y}$ and Y-axis. **[5]**

33. Each of the following defines a relation on N: **[5]**

i. x is greater than y, x, y $\in$ N

ii. x + y = 10, x, y $\in$ N

iii. xy is square of an integer x, y $\in$ N

iv. x + 4y = 10x, y $\in$ N.

Determine which of the above relations are reflexive, symmetric and transitive.

OR

Show that the function f : R - {3} $\rightarrow$ R - {1} given by $f(x) = \frac{x-2}{x-3}$ is a bijection.

34. If A = $\begin{bmatrix} 2 & -3 & 5 \\ 3 & 2 & -4 \\ 1 & 1 & -2 \end{bmatrix}$ find A^{-1}, using A^{-1} solve the system of equations **[5]**

2x - 3y + 5z = 11

3x + 2y - 4z = -5

x + y - 2z = -3

35. Find the shortest distance between the lines l_1 and l_2 whose vector equations are **[5]**

$\vec{r} = \hat{i} + \hat{j} + \lambda(2\hat{i} - \hat{j} + \hat{k})$ ...(1)

and $\vec{r} = 2\hat{i} + \hat{j} - \hat{k} + \mu(3\hat{i} - 5\hat{j} + 2\hat{k})$ ...(2)

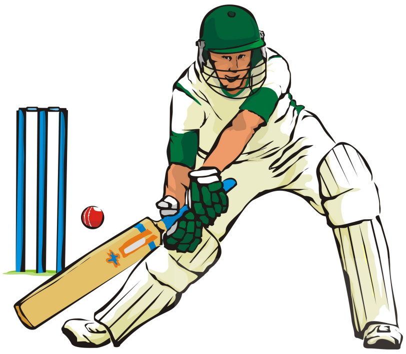
OR

Find the image of the point with position vector $3\hat{i}+\hat{j}+2\hat{k}$ in the plan $\vec{r}\cdot(2\hat{i}-\hat{j}+\hat{k})=4$ Also, find the position vectors of the foot of the perpendicular and the equation of the perpendicular line through $3\hat{i}+\hat{j}+2\hat{k}$.

Section E

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

In a bilateral cricket series between India and South Africa, the probability that India wins the first match is 0.6. If India wins any match, then the probability that it wins the next match is 0.4, otherwise, the probability is 0.3. Also, it is given that there is no tie in any match.



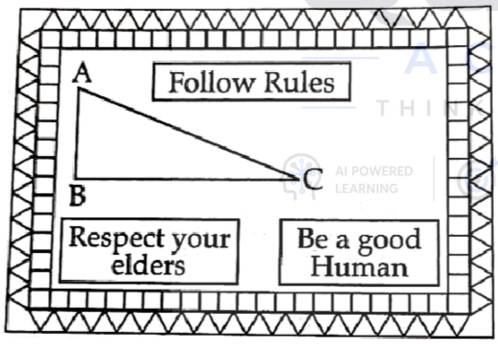
i. Find the probability that India won the second match, if India has already loose the first match. (1)
ii. Find the probability that India losing the third match, if India has already lost the first two matches. (1)
iii. Find the probability that India losing the first two matches. (2)

OR

Find the probability that India winning the first three matches. (2)

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

The slogans on chart papers are to be placed on a school bulletin board at the points A, B and C displaying A (follow Rules), B (Respect your elders) and C (Be a good human). The coordinates of these points are (1, 4, 2), (3, -3, -2) and (-2, 2, 6), respectively.



i. If $\vec{a}$, $\vec{b}$ and $\vec{c}$ be the position vectors of points A, B, C, respectively, then find $|\vec{a}+\vec{b}+\vec{c}|$. (1)
ii. If $\vec{a}=4\hat{i}+6\hat{j}+12\hat{k}$, then find the unit vector in direction of $\vec{a}$. (1)
iii. Find area of $\triangle$ABC. (2)

OR

Write the triangle law of addition for $\triangle$ABC. Suppose, if the given slogans are to be placed on a straight line, then the value of $|\vec{a}\times\vec{b}+\vec{b}\times\vec{c}+\vec{c}\times\vec{a}|$. (2)

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

The temperature of a person during an intestinal illness is given by $f(x) = -0.1x^2 + mx + 98.6$, $0 \le x < 12$, m being a constant, where f(x) is the temperature in $^{\circ}$F at x days.

i. Is the function differentiable in the interval (0, 12)? Justify your answer. (1)

ii. If 6 is the critical point of the function, then find the value of the constant m. (1)

iii. Find the intervals in which the function is strictly increasing/strictly decreasing. (2)

OR

Find the points of local maximum/local minimum, if any, in the interval (0, 12) as well as the points of absolute maximum/absolute minimum in the interval [0, 12]. Also, find the corresponding local minimum and the absolute maximum/absolute minimum values of the function. (2)