CBSE Board
Class XII Mathematics
Sample Paper 1

Time: 3 hrs **Total Marks: 100**

General Instructions:

1. **All** the questions are **compulsory**.
2. The question paper consists of **37** questions divided into **three parts** A, B, and C.
3. **Part A** comprises of **20** questions of **1 mark** each. **Part B** comprises of **11** questions of **4 marks** each. **Part C** comprises of **6** questions of **6 marks** each.
4. There is no overall choice. However, an internal choice has been provided in **three questions of 4 marks** each, **four questions of 6 marks** each. You have to attempt only one of the alternatives in all such questions.
5. Use of calculator is **not** permitted.

Section A

Q 1 – Q 20 are multiple choice type questions. Select the correct option.

1. Distance of a point P(a, b, c) from the z-axis is

A. 0

B. $\sqrt{a^2 + b^2}$

C. $\sqrt{b^2 + c^2}$

D. $\sqrt{a^2 + c^2}$

2. Two dice are thrown simultaneously. The probability of getting a pair of ones is

A. $\frac{1}{3}$

B. $\frac{1}{6}$

C. $\frac{1}{18}$

D. $\frac{1}{36}$

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

A. $\begin{bmatrix} 4 & 1 \\ 5 & -6 \end{bmatrix}$

B. $\begin{bmatrix} -4 & 5 \\ -1 & 6 \end{bmatrix}$

C. $\begin{bmatrix} -4 & 5 \\ 1 & 6 \end{bmatrix}$

D. $\begin{bmatrix} -4 & 1 \\ 5 & -6 \end{bmatrix}$

4. Angle between the two diagonals of a cube is

A. 30°

B. 45°

C. $\cos^{-1}\left(\frac{1}{\sqrt{3}}\right)$

D. $\cos^{-1}\left(\frac{1}{3}\right)$

5. Find the projection of $a = \hat{i} - 3\hat{k}$ on $b = 3\hat{i} + \hat{j} - 4\hat{k}$.

A. $\frac{15}{\sqrt{26}}$

B. $\frac{\sqrt{15}}{26}$

C. $\frac{\sqrt{26}}{15}$

D. $\frac{26}{\sqrt{15}}$

6. Find the principal values of $\tan^{-1}(-1)$.

A. $\frac{\pi}{4}$

B. $\frac{\pi}{2}$

C. $\frac{3\pi}{4}$

D. π

7. Two cards are drawn from a well shuffled deck of 52 playing cards with replacement. The probability that both cards are queen is

A. $\frac{1}{13} + \frac{1}{13}$

B. $\frac{1}{13} \times \frac{1}{13}$

C. $\frac{1}{13}+\frac{1}{17}$

D. $\frac{1}{13}\times\frac{1}{17}$

8. The minimum value of $\Delta = \begin{vmatrix} 1 & 1 & 1 \\ 1 & 1+\sin\theta & 1 \\ 1+\cos\theta & 1 & 1 \end{vmatrix}$ (θ is real) is:

A. $-\frac{1}{2}$

B. $\frac{1}{2}$

C. -1

D. 1

9. Solve the system of inequations: $2x + y > 1$ and $2x - y \geq -3$ for x.

A. $x < \frac{1}{2}$

B. $x \leq -\frac{1}{2}$

C. $x > \frac{1}{2}$

D. $x \geq -\frac{1}{2}$

10. Integration of $\cos^{-1}(\sin x)$ is

A. $(\pi - x)$

B. $x(\pi - x)$

C. $\frac{x}{2}(\pi - x)$

D. $2x(\pi - x)$

11. The function $f(x) = x^9 + 3x^7 + 64$ is increasing on

A. Set of all real numbers

B. $(0, \infty)$

C. $(-\infty, 0)$

D. $R - \{1\}$

12. If $A = \begin{bmatrix} i & 0 \\ 0 & i \end{bmatrix}, n \in N,$ then A^{4n} equals

A. $\begin{bmatrix} i & 0 \\ 0 & i \end{bmatrix}$

B. $\begin{bmatrix} 0 & i \\ i & 0 \end{bmatrix}$

C. $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

D. $\begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$

13. If $\vec{a} = 2\hat{i} - 3\hat{j} - k$ and $\vec{b} = \hat{i} + 4\hat{j} - 2\vec{k}$, then $a \times b$ is

A. $10\hat{i} + 3\hat{j} + 11k$

B. $2\hat{i} + 5\hat{j} + 5k$

C. $10\hat{i} - 3\hat{j} + 11k$

D. $2\hat{i} - 5\hat{j} + 11k$

14. If $a*b = a^2 + b^2$, then the value of $(4*5) * 3$ is

A. 60

B. 50

C. 1690

D. 1936

15. The value of b for which the function $f(x) = \begin{cases} 5x - 4 & , 0 < x \le 1 \\ 4x^2 + 3bx & , 1 < x < 2 \end{cases}$ is continuous at every point of its domain is

A. $-\frac{5}{3}$

B. $-\frac{13}{3}$

C. -1

D. 0

16. Value of the integral $\int \tan^{-1}\left(\frac{\sin 2x}{1 + \cos 2x}\right) dx$ is

A. $\frac{x^2}{2} + c$

B. $x + c$

C. $\tan x + c$

D. 1

17. Area bounded by the curve y = cos x between x = 0 and x = 2π is

A. 0
B. 1 square unit
C. 2 square units
D. 4 square units

18. If $\begin{vmatrix} 2x & 5 \\ 8 & x \end{vmatrix} = \begin{vmatrix} 6 & -2 \\ 7 & 3 \end{vmatrix}$, then the value(s) of x is/are

A. 3
B. ±6
C. $3\sqrt{2}$
D. $\sqrt{22}$

19. If $\int_0^{\alpha} \frac{1}{1+4x^2} dx = \frac{\pi}{8}$, the value of α is

A. $\frac{1}{2}\tan\frac{\pi}{8}$
B. $\frac{1}{2}$
C. 1
D. $\frac{1}{2\sqrt{2}}$

20. Find integrating factor of the differential equation $(x \log x)\frac{dy}{dx} + y = 2\log x$.

A. x
B. x log x
C. log x
D. e^x

Section B

21. If θ is the angle between two vectors $\hat{i} - 2\hat{j} + 3\hat{k}$ and $3\hat{i} - 2\hat{j} + \hat{k}$ then find sin θ.

22. Discuss the continuity of the function f(x) at x = 1.

$$\text{Given}: f(x) = \begin{cases} \frac{3}{2} - x, & \frac{1}{2} \le x \le 1 \\ \frac{3}{2}, & x = 1 \\ \frac{3}{2} + x, & 1 < x \le 2 \end{cases}$$

23. Solve the differential equation $(x^2 - y^2)dx + 2xy\,dy = 0$. Given that y = 1 when x = 1.

24. Evaluate: $\int_{-1}^{2} (7x - 5)\,dx$, as a limit of sums.

OR

Evaluate: $\int_2^3 \frac{\sqrt{x}}{\sqrt{x} + \sqrt{5 - x}}\,dx$

25. A company has two plants of manufacturing scooters. Plant I manufactures 70% of the scooters and plant II manufactures 30%. At plant I, 30% of the scooters are rated of standard quality and at plant II, 90% of the scooters are rated of standard quality. A scooter is chosen at random and is found to be of standard quality. Find the probability that it is manufactured by plant II.

26. Show that the function f: N → N defined by $f(n) = n - (-1)^n$ for all (n Є N), is a bijection.

OR

Show that relation R defined by (a, b) R (c, d) ⇒ a + d = b + c on the set N x N is an equivalence relation.

27. Find the equation of the plane passing through the line of intersection of the planes $\vec{r} \cdot (\hat{i} + \hat{j} + \hat{k}) = 1$ and $\vec{r} \cdot (2\hat{i} + 3\hat{j} - \hat{k}) + 4 = 0$ and parallel to x-axis.

28. Solve the equation: $\tan^{-1}\frac{x + 1}{x - 1} + \tan^{-1}\frac{x - 1}{x} = \tan^{-1}(-7)$

29. Show that $\begin{vmatrix} 3p & -p + q & -p + r \\ -q + p & 3q & -q + r \\ -r + p & -r + q & 3r \end{vmatrix} = 3(p + q + r)(pq + qr + rp)$.

30. Solve the integral $\int x(\log x)^2 dx$

OR

Solve the integral $\int \frac{\cos x}{(1-\sin x)(2-\sin x)} dx.$

31. Find $\frac{d^2y}{dx^2}$ if $x = a\left(\cos t + \log \tan \frac{t}{2}\right)$ and $y = a \sin t.$

Section C

32. Using integration, find the area of the circle $x^2 + y^2 = 16$ which is exterior to the parabola $y^2 = 6x$.

33. Find the angle between the lines whose direction cosines are given by the equations: $3l + m + 5n = 0$; $6mn - 2nl + 5lm = 0$.

OR

Find the distance of the point $(-1, -5, -10)$ from the point of intersection of the line and the plane $\vec{r} \cdot (\hat{i} - \hat{j} + \hat{k}) = 5.$

34. A window is in the form of a rectangle above which there is a semi-circle. If the perimeter of the window is p cm, show that the window will allow the maximum possible light only when the radius of the semi-circle is $\frac{p}{\pi + 4}$ cm.

OR

Show that the surface area of a closed cuboid with a square base and given volume is the least when it is a cube.

35. Find the inverse of the following matrix if exists, using elementary row transformation.

$$\begin{bmatrix} 1 & 3 & -2 \\ -3 & 0 & -5 \\ 2 & 5 & 0 \end{bmatrix}$$

36. A factory produce bolts and nuts with the help of two machines A and B. It takes 3 hours on machine A and 1 hour on machine B to produce a pack of nuts. Similarly, a pack of bolts is produced by machines A and B working 1 hour and 3 hours respectively. The factory earns a profit of Rs. 19.60 per package on bolts and Rs. 9.00 per package on nuts. How many packages of each should be produced each day so as to maximize the profit, if the machines are operated at the most for 12 hours a day?

OR

One kind of chocolate requires 16g of flour and 3g of fat, and another kind 8g of flour and 6g of fat. Find the maximum number of chocolates which can be made from 0.4kg of flour and 0.12kg of fat assuming that there is no shortage of the other ingredients used in making the chocolates.

37. A class has 15 students whose ages are 14, 17, 15, 14, 21, 17, 19, 20, 16, 18, 20, 17, 16, 19 and 20 years. One student is selected in such a manner that each has the same chance of being chosen and the age X of the selected student is recorded. What is the probability distribution of the random variable X? Find mean and variance.

OR

An insurance company insured 2000 scooter drivers, 4000 car drivers and 6000 truck drivers. The probability of 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?