# CBSE

# Sample Question Paper 1

## Mathematics

### Class XII

**Time : 3 hrs** **Maximum Marks : 100**

***General Instructions***

(*i*) All questions are compulsory.

(*ii*) The question paper consists of 29 questions divided into four sections A, B, C and D. Section A comprises of 4 questions of one mark each, Section B comprises of 8 questions of two marks each, Section C comprises of 11 questions of four marks each and Section D comprises of 6 questions of six marks each.

(*iii*) All questions in Section A are to be answered in one word, one sentence or as per the exact requirement of the question.

(*iv*) There is no overall choice. However, internal choice has been provided in 3 questions of four marks each and 3 questions of six marks each. You have to attempt only one of the alternatives in all such questions.

(*v*) Use of calculators is not permitted. You may ask for logarithmic tables, if required.

## Section A

**(1 × 4 = 4)**

***Question numbers 1 to 4 carry 1 mark each.***

**1.** Let A be the set of all 100 candidates enrolled for an examination. Let $f: A \rightarrow N$ be the function defined by $f(x)$ = registration number of the candidate $x$. Show that $f$ is one-one but not onto.

**2.** Evaluate $\Delta = \begin{vmatrix} a & e & d \\ c & a & b \\ a & e & d \end{vmatrix}$ without actually calculating.

**3.** Find a vector in the direction of vector $\vec{a} = 3\hat{i} - 4\hat{j}$ having magnitude 5 units.

**4.** If $\tan^{-1}\left(\frac{1-x}{1+x}\right) = \frac{1}{2}\tan^{-1} x, x > 0;$ find the value of $x$.

## SECTION B

**(2 × 8 = 16)**

***Question numbers 5 to 12 carry 2 marks each.***

**5.** Write the function $\tan^{-1}\frac{x}{\sqrt{a^2 - x^2}}, |x| < a$ in the simplest form.

**6.** Find the equation of a curve passing through $\left(1, \frac{\pi}{3}\right)$ if the slope of the tangent to the curve at any point $A(x, y)$ is $\frac{y}{x} - \sin^2\frac{y}{x}$

**7.** Find $2A^2 + 7A - 3I$, if $A = \begin{bmatrix} 2 & -5 & 7 \\ -9 & 1 & 0 \\ 4 & 0 & -1 \end{bmatrix}$

**8.** If, $\tan^{-1}\left(\frac{x-2}{x-3}\right) + \tan^{-1}\left(\frac{x+2}{x+3}\right) = \frac{\pi}{4}$, then find the value of $x$.

**9.** Find the equation of all lines having slope 2 and being tangent to the curve $y + \frac{2}{x-3} = 0$.

**10.** Find the position vector of the mid-point of the vector joining the points $A(4, -1, 5)$ and $B(-2, 0, 3)$.

**11.** If $f(x) = \begin{cases} \frac{x^3 + x^2 - 16x + 20}{(x-2)^2}, & x \neq 2 \\ k, & x = 2 \end{cases}$ is continuous at $x = 2$, find the value of $k$.

**12.** Find the integral of $\frac{2x^2 - 4x + 1}{\sqrt{x}}$.

## SECTION C

**(4 × 11 = 44)**

***Question numbers 13 to 23 carry 4 marks each.***

**13.** Probability of completing a specific task independently by A and B are $\frac{1}{3}$ and $\frac{1}{4}$ respectively. If both of them try to complete the task independently, then find the probability that

**i.** the task is completed.

**ii.** exactly one of them completed the task.

**14.** Find the area of the region bounded by the curve $y^2 = 9x$ and the line $x = 5$.

**15.** Show that the function $f : R \to R$ given by $f(x) = x^3 + x$ is a bijection.

**16.** Verify Mean Value Theorem, if $f(x) = 2x^2 - 6x - 4$ in the interval $[a, b]$, where $a = 2$ and $b = 5$. Find all $c \in (2, 5)$ for which $f'(c) = 0$.

**OR**

Find $\frac{d^2y}{dx^2}$ in terms of $y$ if $y = \sin^{-1}x$.

**17.** Express the matrix P as the sum of a symmetric and a skew symmetric matrix where

$$P = \begin{bmatrix} -4 & 2 & 1 \\ 3 & -1 & 4 \\ 2 & 0 & 3 \end{bmatrix}$$

**OR**

Find the inverse of the matrix $A = \begin{bmatrix} 2 & -4 \\ 0 & 1 \end{bmatrix}$ if it exists.

**18.** Find the area enclosed by the curve $x = 3\cos t$, $y = 2\sin t$.

**19.** If three vectors $\vec{a} = \hat{i} + 2\hat{j} - 4\hat{k}$, $\vec{b} = 3\hat{j} + \hat{k}$ and $\vec{c} = 3\hat{i} - 2\hat{j} + \hat{k}$ are such that $\vec{a} + \lambda\vec{b} \perp \vec{c}$, then find the value of $\lambda$.

**20.** If $x = \sqrt{a^{\sin^{-1}t}}$, $y = \sqrt{a^{\cos^{-1}t}}$, show that $\frac{dy}{dx} = -\frac{y}{x}$

**21.** Prove that the lines x = ay + b, z = cy + d and $x = a'y + b'$, $z = c'y + d'$ are perpendicular if aa′ + cc′ + 1 = 0

**OR**

Find the angle between the lines whose direction cosines are given by the equations $l + m + n = 0,\ l^2 + m^2 - n^2 = 0.$

**22.** Evaluate $\int \frac{x^2 dx}{x^4 - 5x^2 + 6} dx.$

**23.** Find two positive numbers such that their sum is 40 and the product of their squares is maximum.

## Section D

**(6 × 6 = 36)**

***Question numbers 24 to 29 carry 6 marks each.***

**24.** Solve the following LPP graphically:

Maximize $Z = 5x + 7y$

Subject to

$x + y \leq 4$

$3x + 8y \leq 24$

$10x + 7y \leq 35$

$x + y \geq 0$

**25.** The sum of three numbers is 6. If we multiply the third number by 2 and add the first number to the result, we get 7. By adding second and third numbers to three times the first number, we get 12. Find the numbers using matrix method.

**OR**

For what value of $a$ and $b$, the following system of equations is consistent?

$x + y + z = 6$

$2x + 5y + az = b$

$x + 2y + 3z = 14$

**26.** **(a)** Find the equations of the line passing through the point (2, 0, –1) and parallel to the planes $2x + 4y = 0$ and $6y - 2z = 0$.

**(b)** Find the equations of the plane that passes through three points:

(2, 4, 1), (–2, 0, 4), (6, 1, –3)

**27.** A shopkeeper sells three types of flower seeds $A_1$, $A_2$ and $A_3$. They are sold as a mixture where the proportions are 4 : 4 : 2 respectively. The germination rates of the three types of seeds are 45%, 60% and 35%. Calculate the probability

(i) of a randomly chosen seed to germinate.

(ii) that it will not germinate given that the seed is of type $A_3$.

(iii) that it is of the type $A_2$ given that a randomly chosen seed does not germinate.

**OR**

There are 5 cards numbered 1 to 5, one number on one card. Two cards are drawn at random without replacement. Let X denote the sum of the numbers on two cards drawn. Find the mean and variance of X.

**28.** Solve the differential equation:

$$\left(1 + y^2\right)(1 + \log\log x)dx + xdy = 0$$ when $x = 1, y = 1$.

**OR**

Solve the differential equation:

$$x \log x \frac{dy}{dx} + y = \frac{2}{x} \log x$$

**29.** Evaluate

$$\int_0^{\frac{\pi}{2}} (2\log\sin x - \log\sin 2x)dx$$