Time : 3 Hours
Maximum Marks : 80

MATHEMATICS
CBSE
Sample Question Papers

Self Assessment Paper 1

General Instructions :

1. *This question paper contains two **parts A and B**. Each part is compulsory. Part A carries **24** marks and Part B carries **56** marks.*
2. ***Part-A** has Objective Type Questions and **Part-B** has Descriptive Type Questions.*
3. *Both Part A and Part B have choices.*

Part – A :

1. *It consists of two sections- **I and II.***
2. *Section **I** comprises of 16 very short answer type questions.*
3. *Section **II** contains **2** case studies. Each case study comprises of 5 case-based MCQs. An examinee is to attempt **any 4 out of 5** MCQs.*

Part – B :

1. *It consists of three sections-**III, IV and V.***
2. *Section **III** comprises of 10 questions of **2 marks** each.*
3. *Section **IV** comprises of 7 questions of **3 marks** each.*
4. *Section **V** comprises of 3 questions of **5 marks** each.*
5. *Internal choice is provided in **3** questions of Section –III, **2** questions of Section -IV and **3** questions of Section-V. You have to attempt only one of the alternatives in all such questions.*

PART-A

Section-I

Question numbers 1 to 16 are very short answer type questions.

1. Find the domain of function $\cos^{-1}(2x - 1)$.

AI 2. Let $A = \{1, 2, 3, ...n\}$ and $B = \{a, b\}$. Then find the number of surjections from A into B.

3. If $R = \{(x, y) : x + 2y = 10\}$ is a relation on N, find the range of R.

4. If $\begin{vmatrix} 2 & 3 & 2 \\ x & x & x \\ 4 & 9 & 1 \end{vmatrix} + 3 = 0$, then find the value of x.

5. Find the values of x and y make the following pair of matrices equal :

$$\begin{bmatrix} 3x+7 & 5 \\ y+1 & 2-3x \end{bmatrix}, \begin{bmatrix} 0 & y-2 \\ 8 & 4 \end{bmatrix}.$$

6. If $\begin{bmatrix} 2 & 3 \\ 3 & 2 \end{bmatrix}\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 6 \\ 5 \end{bmatrix}$, then find the value of x and y.

7. Evaluate : $\int_0^{\pi/8} \tan^2(2x)\,.$

OR

Find the value of $\int_1^4 |x-5|\,dx.$

AI 8. If $y = \log\left(\frac{1-x^2}{1+x^2}\right)$, then find $\frac{dy}{dx}$.

OR

Write the order and the degree of the following differential equation :

$$x^3\left(\frac{d^2y}{dx^2}\right)^2 + x\left(\frac{dy}{dx}\right)^4 = 0$$

9. Find the point, where the tangent to the curve $y = e^{2x}$ at the point (0, 1) meets x-axis ?

OR

AI If $f(x) = \begin{cases} mx+1 & \text{if } x \le \frac{\pi}{2} \\ \sin x + n, & \text{if } x > \frac{\pi}{2} \end{cases}$, is continuous at $x = \frac{\pi}{2}$ then what is the relation between m and n ?

10. Write a unit vector in the direction of the sum of vectors $\vec{a} = 2\vec{i} + 2\vec{j} - 5\vec{k}$ and $\vec{b} = 2\vec{i} + \vec{j} - 7\vec{k}$.

OR

AI If tangent of the curve $y^2 + 3x - 7 = 0$ at the point (h, k) is parallel to line $x - y = 4$, then the value of k is ..... .

11. Find the direction cosines of the line : $\frac{x-1}{2} = -y = \frac{z+1}{2}$

12. If the cartesian equation of a line are $\frac{3-x}{5} = \frac{y+4}{7} = \frac{2z-6}{4}$, write the vector equation for the line.

13. Find a vector in the direction $\vec{a} = \hat{i} - 3\hat{j}$ that has magnitude 5 units.

14. If a line has direction ratios 3, – 1, – 3, then find its direction cosines.

AI 15. If A and B are two events such that $P(A|B) = p$, $P(A) = p$, $P(B) = 1/3$ and $P(A \cup B) = 5/9$, then find p.

16. If A and B are two events such that P(A) = 0.5, P(B) = 0.8 and P(A ∪ B) = 0.9, then find P(A/B).

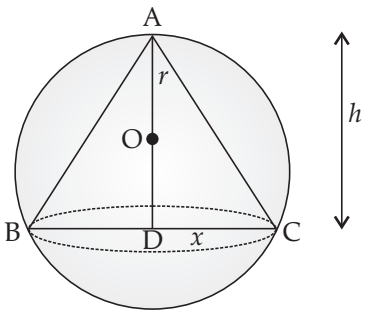
OR

If P(A) = 0.4, P(B) = 0.8 and P(B|A) = 0.6, then P(A ∪ B) is equal to

Section-II

Both the case study based questions are compulsory. Attempt any 4 sub parts from each question 17 and 18. Each question carries 1 mark.

17. There is an right circular cone of maximum volume that can be inscribed in a sphere of radius r.



Based on the above information answer the following questions :

(i) What is the volume of cone (V) ?

(a) $\frac{1}{3}\pi(-h^3+2h^2r)$ **(b)** $\frac{1}{2}\pi(-h^3+2h^2r)$ **(c)** $\frac{1}{4}\pi(-h^3+2h^2r)$ **(d)** $\frac{1}{5}\pi(-h^3+2h^2r)$

(ii) What is the volume of $\frac{dV}{dh}$?

(a) $\frac{\pi}{2}(-3h^2+4hr)$ **(b)** $\frac{\pi}{4}(-3h^2+4hr)$ **(c)** $\frac{\pi}{3}(-3h^2+4hr)$ **(d)** $\frac{\pi}{5}(-3h^2+4hr)$

(iii) What is the value of $\frac{d^2V}{dh^2}$?

(a) $-\frac{4\pi r^2}{3}$ **(b)** $-\frac{4\pi r^3}{3}$ **(c)** $-\frac{4\pi r}{3}$ **(d)** $-\frac{4\pi r^5}{3}$

(iv) What is the relation between h and r ?

(a) $2h = 4r$ **(b)** $3h = 4r$ **(c)** $2h = 3r$ **(d)** $3h = 2r$

(v) What is the value of OD ?

(a) $r - h$ **(b)** $h - r$ **(c)** $r - \frac{h}{2}$ **(d)** $h - \frac{r}{2}$

18. Two numbers are selected at random (without replacement) from the first six positive integers. Let x denotes the larger of the two numbers obtained.

First 6 positive integers

↓ ↓ ↓ ↓ ↓ ↓

1 2 3 4 5 6

Based on the above information, answer the following questions :

(i) What is the value of P(X = 5) = ?

(a) $\frac{4}{15}$ **(b)** $\frac{5}{15}$ **(c)** $\frac{3}{15}$ **(d)** $\frac{2}{15}$

(ii) What is the value of P(X = 3) = ?

(a) $\frac{1}{15}$ **(b)** $\frac{2}{15}$ **(c)** $\frac{3}{15}$ **(d)** $\frac{5}{15}$

(iii) What is the value of mean of the distribution ?

(a) 4 **(b)** 4.22 **(c)** 4.44 **(d)** 4.66

(iv) What is the formula of variance ?

(a) $\Sigma X_i^2 P_i - (\mu)^2$ **(b)** $\Sigma X_i^2 P_i - \Sigma X_i P_i (X)^2$

(c) $\Sigma X_i P_i^2 - (\mu)^2$ **(d)** $\Sigma X_i P_i^2 - \Sigma X_i P_i (X)^2$

(v) What is the value of variance ?

(a) 1.51 **(b)** 1.53 **(c)** 1.55 **(d)** 1.57

PART-B

Section-III

Question numbers 19 to 28 carry 2 marks each.

19. Let $f : X \to Y$ be a function. Define a relation R on X given by $R = \{(a, b) : f(a) = f(b)\}$. Show that R is a transitive relation.

20. If $A = \begin{bmatrix} 4 & 2 \\ -1 & 1 \end{bmatrix}$, show that $(A - 2I)(A - 3I) = 0$.

21. Find $\int \frac{x+1}{(x+2)(x+3)} dx$.

OR

AI Find the value of $\int_0^1 \tan^{-1}\left(\frac{1-2x}{1+x-x^2}\right) dx$.

22. Find the particular solution of the differential equation $\frac{dy}{dx} = \frac{1+y^2}{1+x^2}$; given that $y(0) = \sqrt{3}$.

23. Find the sum of the order and the degree of the following differential equation :

$$\frac{d^2y}{dx^2} + \sqrt[3]{\frac{dy}{dx}} + (1+x) = 0$$

24. If $|\vec{a}| = 2, |\vec{b}| = 7$ and $\vec{a} \times \vec{b} = 3\hat{i} + 2\hat{j} + 6\hat{k}$, find the angle between $\vec{a}$ and $\vec{b}$.

AI **25.** If $\vec{a} = 2\hat{i} - 3\hat{j} + \hat{k}$, $\vec{b} = -\hat{i} + \hat{k}$, $\vec{c} = 2\hat{j} - \hat{k}$ are three vectors, find the area of the parallelogram having diagonals $\vec{a} + \vec{b}$ and $\vec{b} + \vec{c}$.

26. If E and F be two events such that $P(E) = \frac{1}{3}$, $P(F) = \frac{1}{4}$, find $P(E \cup F)$ if E and F are independent events.

OR

Suppose that 5 men out of 100 and 25 women out of 1000 are good orators. Assuming that there are equal number of men and women, find the probability of choosing a good orator.

27. Find the second derivative of e^{2x} with respect to x.

OR

If $y = \sin^{-1}\left(6x\sqrt{1-9x^2}\right)$, $-\frac{1}{3\sqrt{2}} < x < \frac{1}{3\sqrt{2}}$, then find $\frac{dy}{dx}$.

28. Find the interval of the function $f(x) = \frac{2x^2 - 1}{x^4}$, $x > 0$.

Section-IV

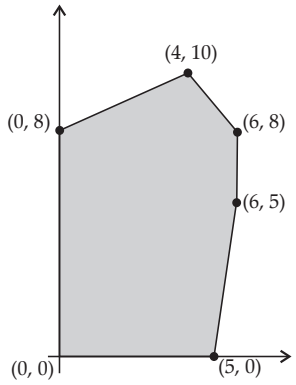
Question Number 29 to 35 carry 3 marks each.

AI **29.** Show that the function $f : R \to R$ defined by $f(x) = \frac{x}{x^2+1}$, $\forall\, x \in R$ is neither one-one nor onto.

30. If $y = (\cos x)^x + \tan^{-1}\sqrt{x}$, then find $\frac{dy}{dx}$.

OR

The feasible solution for an LPP is shown in given figure. Let $Z = 3x - 4y$ be the objective function. Find the point of minimum of Z.



31. Solve $\left(1+x^2\right)\frac{dy}{dx}+2xy-4x^2=0$ subject to the initial condition $y(0) = 0$.

32. Find the intervals on which the function $f(x) = (x - 1)^3(x - 2)^2$ is (a) strictly increasing (b) strictly decreasing.

33. Find : $\int \frac{\sin x}{\sin^3 x+\cos^3 x}dx$.

34. Find : $\int \frac{x^2+x+1}{(x^2+1)(x+2)}dx$.

35. $\int \cot^2 x\,dx$ is equal to .....

OR

If $\int_0^a \frac{1}{1+4x^2}dx=\frac{\pi}{8}$, then a = ...

Section-V

Question numbers 36 to 38 carry 5 marks each.

AI **36.** If $A=\begin{bmatrix}1 & 3 & 4\\ 2 & 1 & 2\\ 5 & 1 & 1\end{bmatrix}$, Find A^{-1}.

Hence, solve the system of equations :

$$x + 3y + 4z = 8$$
$$2x + y + 2z = 5$$

and $$5x + y + z = 7$$

OR

Find the values of p and q, for which

$$f(x)=\begin{cases}\frac{1-\sin^3 x}{3\cos^2 x}, & \text{if } x<\frac{p}{2}\\ p, & \text{if } x=\frac{\pi}{2},\\ \frac{q(1-\sin x)}{(p-2x)^2}, & \text{if } x>\frac{p}{2}\end{cases}$$

is continuous at $x=\frac{\pi}{2}$.

AI **37.** Find the vector and cartesian equations of the plane passing through the points (2, 2, – 1), (3, 4, 2) and (7, 0, 6). Also find the vector equation of a plane passing through (4, 3, 1) and parallel to the plane obtained above.

OR

Show that the line of intersection of the planes $x + 2y + 3z = 8$ and $2x + 3y + 4z = 11$ is coplanar with the line $\frac{x+1}{1} = \frac{y+1}{2} = \frac{z+1}{3}$. Also find the equation of the plane containing them.

AI **38.** Solve the following linear programming problem graphically :

Minimize : $Z = 6x + 3y$

Subject to the constraints : $\begin{cases} 4x + y \geq 80 \\ x + 5y \geq 115 \\ 3x + 2y, \leq 150 \\ x \geq 0, y \geq 0 \end{cases}$

OR

Solve the following linear programming problem graphically :
Minimize : $Z = 600x + 400y$
Subject to the constraints :

$$x + 2y \leq 12$$
$$2x + y \leq 12$$
$$4x + 5y \geq 20$$

and $x, y \geq 0$

■■■