BHARTIYA SHIKSHA BOARD
SAMPLE QUESTION PAPER 2025-26
CLASS - XII
MATHEMATICS (149)

Time allowed : 3 hours | Maximum marks : 80

General Instructions : Mathematics (149)

Read the following instructions very carefully and strictly follow them :

(i) *This question paper contains* **38** *questions.* **All** *questions are* ***compulsory***.

(ii) *This question paper is divided into* ***five*** *Sections –* **A, B, C, D** *and* **E**.

(iii) *In* **Section A,** *Questions no.* **1** *to* **18** *are multiple choice questions (MCQs) and questions number* **19** *and* **20** *are Assertion-Reason based questions of* **1** *mark each.*

(iv) *In* **Section B,** *Questions no.* **21** *to* **25** *are very short answer (VSA) type questions, carrying* **2** *marks each.*

(v) *In* **Section C,** *Questions no.* **26** *to* **31** *are short answer (SA) type questions, carrying* **3** *marks each.*

(vi) *In* **Section D,** *Questions no.* **32** *to* **35** *are long answer (LA) type questions carrying* **5** *marks each.*

(vii) *In* **Section E,** *Questions no.* **36** *to* **38** *are case study based questions carrying* **4** *marks each.*

(viii) *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 2 questions in Section E.*

(ix) *Use of calculators is* ***not*** *allowed.*

सामान्य निर्देश :

निम्नलिखित निर्देशों को बहुत सावधानी से पढ़िए और उनका सख़्ती से पालन कीजिए :

(i) *इस प्रश्न-पत्र में* **38** *प्रश्न हैं ।* ***सभी*** *प्रश्न* ***अनिवार्य*** *हैं ।*

(ii) *यह प्रश्न-पत्र* ***पाँच*** *खण्डों में विभाजित है –* **क, ख, ग, घ** *एवं* **ङ** ।

(iii) ***खण्ड क*** *में प्रश्न संख्या* **1** *से* **18** *तक बहुविकल्पीय तथा प्रश्न संख्या* **19** *एवं* **20** *अभिकथन एवं तर्क आधारित* **1** *अंक के प्रश्न हैं ।*

(iv) ***खण्ड ख*** *में प्रश्न संख्या* **21** *से* **25** *तक अति लघु-उत्तरीय (VSA) प्रकार के* **2** *अंकों के प्रश्न हैं ।*

(v) ***खण्ड ग*** *में प्रश्न संख्या* **26** *से* **31** *तक लघु-उत्तरीय (SA) प्रकार के* **3** *अंकों के प्रश्न हैं ।*

(vi) ***खण्ड घ*** *में प्रश्न संख्या* **32** *से* **35** *तक दीर्घ-उत्तरीय (LA) प्रकार के* **5** *अंकों के प्रश्न हैं ।*

(vii) ***खण्ड ङ*** *में प्रश्न संख्या* **36** *से* **38** *प्रकरण अध्ययन आधारित* **4** *अंकों के प्रश्न हैं ।*

(viii) *प्रश्न-पत्र में समग्र विकल्प नहीं दिया गया है । यद्यपि, खण्ड ख के 2 प्रश्नों में, खण्ड ग के 3 प्रश्नों में, खण्ड घ के 2 प्रश्नों में तथा खण्ड ङ के 2 प्रश्नों में आंतरिक विकल्प का प्रावधान दिया गया है ।*

(ix) *कैल्कुलेटर का उपयोग* ***वर्जित*** *है ।*

SECTION-A

Question number 1 to 20 are multiple choice questions of 1 mark each.

1. If R be a relation in $\mathbb{R}$ defined as aRb iff $|a-b| > 0$, then the relation R is 1

(A) reflexive (B) Symmetric (C) Transitive (D) Symmetric and transitive.

2. If $A = \begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix}$, then A^{10} is 1

(A) $20A$ (B) $2^{10}A$ (C) 2^9A (D) $10A$

3. If A and B are invertible matrices of same order, then $AB^T - BA^T$ is a 1

(A) Skew symmetric matrix (B) symmetric matrix

(C) Null matrix (D) Invertible matrix

4. For a square matrix A, if $A^2 - 3A + I = O$ and $A^{-1} = xA + yI$, then the value of $x+y$ is 1

(A) -3 (B) 3 (C) -2 (D) 2

5. The number of points where the function $f(x) = |x-1| + |x+2|$ is not differentiable, is 1

(A) 0 (B) 3 (C) 1 (D) 2

6. If $y = \cos^{-1}\left(\frac{x^3}{2} - \frac{3x}{2}\right)$, then $\frac{dy}{dx}$ is 1

(A) $\frac{3}{\sqrt{4-x^2}}$ (B) $\frac{-3}{\sqrt{4-x^2}}$ (C) $\frac{-1}{\sqrt{4-x^2}}$ (D) $\frac{-1}{\sqrt{1-\frac{x^2}{4}}}$

Q.No.		
7	Side of an equilateral triangle expands at the rate of 2 cm/s. The rate of increase of its area when each side is 15 cm is (A) $15\sqrt{2}$ cm^2/s (B) 15 cm^2/s (C) 7.5 cm^2/s (D) $15\sqrt{3}$ cm^2/s	1
8.	The interval in which the function $f(x) = x^2 e^{-x}$ is increasing is (A) $(-\infty, 0)$ (B) $(0, 2)$ (C) $(2, \infty)$ (D) $(-\infty, \infty)$	1
9.	$\int \frac{dx}{e^x - 1}$ is equal to: (A) $\log\lvert e^x - 1\rvert + c$ (B) $\log\lvert 1 - e^x\rvert + c$ (C) $\log\lvert 1 - e^{-x}\rvert + c$ (D) $\log\lvert e^x + 1\rvert + c$	1
10.	The value of $\int_0^4 \lvert x - 1\rvert\, dx$ is (A) 5 (B) 4 (C) 2 (D) $\frac{9}{2}$	1
11.	The area under the curve $y = \sqrt{4 - x^2}$ included between the lines $x = 0$, $x = 2$ and the x-axis is (A) π sq. units (B) $\frac{\pi}{4}$ sq. units (C) 1 sq. units (D) $\frac{\pi}{3}$ sq. units	1
12.	The integrating factor of the differential equation $(x + 2y^2)\frac{dy}{dx} = y$, $(y > 0)$ is (A) x (B) $\frac{1}{x}$ (C) $\frac{1}{y}$ (D) y	1
13.	The general solution of the differential equation $x\,dy + y\,dx = 0$ is (A) $x + y = c$ (B) $xy = c$ (C) $y = cx$ (D) $x^2 + y^2 = c$	1

Q.No.	Question	
14.	The unit vector perpendicular to both the vectors $\hat{i}+\hat{k}$ and $\hat{i}-\hat{k}$ is (A) $2\hat{j}$ (B) $\hat{j}$ (C) $\frac{\hat{i}+\hat{k}}{\sqrt{2}}$ (D) $\frac{\hat{i}-\hat{k}}{\sqrt{2}}$	1
15.	The angle between the lines $2x=3y=-z$ and $6x=-y=-4z$ is (A) 0° (B) 60° (C) 90° (D) 30°	1
16.	Direction ratios of a vector parallel to the line $\frac{x-3}{2}=-y=\frac{1-2z}{-6}$ are. (A) 2, -1, -6 (B) 2, -1, 6 (C) 2, -1, 3 (D) 2, -1, -3.	1
17.	If the sum of numbers obtained on throwing a pair of dice is 9, then the probability that the number obtained on one of the dice is 4, is (A) $\frac{1}{18}$ (B) $\frac{1}{9}$ (C) $\frac{2}{9}$ (D) $\frac{1}{2}$	1
18.	A bag contains 4 white, 3 black and 2 green balls. If 2 balls are drawn at random from the bag without replacement, then probability that both the balls are black is (A) $\frac{1}{12}$ (B) $\frac{1}{18}$ (C) $\frac{1}{24}$ (D) $\frac{1}{36}$	1

Questions number 19 and 20 are Assertion and Reason based questions carrying 1 mark each. Two statements are given, one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer from the codes (a), (b), (c) and (d) as given below.

(a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).

(b) Both Assertion (A) and Reason (R) are true, but Reason (R) is ***not*** the correct explanation of the Assertion (A).

(c) Assertion (A) is true and Reason (R) is false.

(d) Assertion (A) is false and Reason (R) is true.

19. Assertion (A): If α, β and γ are the angles which a vector makes with the positive direction of x, y and z axes respectively, then $\sin^2\alpha + \sin^2\beta + \sin^2\gamma = 2$.

Reason (R): The sum of squares of the direction cosines of vector is 1.

20. Assertion (A): For any two matrices A and B of same order, $(A+B)^T = A^T + B^T$

Reason (R): For two matrices A and B such that AB is defined, $(AB)^T = A^T \cdot B^T$

SECTION B

In this section there are 5 very short answer type questions of 2 marks each.

21. Find the value of $\tan^2(\sec^{-1}2) + \cot^2(\operatorname{cosec}^{-1}3)$.

OR

Find the value of

$$\cos^{-1}\left(-\frac{1}{2}\right) - 2\sin^{-1}\left(\frac{1}{2}\right) + 3\cos^{-1}\left(\frac{-1}{\sqrt{2}}\right) - 4\tan^{-1}(-1)$$

22. Show that $A = \begin{bmatrix} 2 & -3 \\ 3 & 4 \end{bmatrix}$ satisfies the equation

$$A^2 - 6A + 17I = 0$$

OR

Using determinants, find the area of $\triangle ABC$ with vertices A(3,1), B(9,3) and C(5,7). Also find the equation of line AB using determinants.

Q. No.

23. Find the rate of change of the volume of a sphere with respect to its surface area when the radius is 2 cm.

24. If $\vec{a}+\vec{b}+\vec{c}=\vec{0}$ and $|\vec{a}|=3$, $|\vec{b}|=5$ and $|\vec{c}|=7$, find the angle between $\vec{a}$ and $\vec{b}$.

25. One bag contains 3 white and 4 black balls. Another bag contains 4 white and 5 black balls. A ball drawn at random from first bag is transferred to second bag and then a ball is drawn at random from the second bag. Find the probability that the ball drawn is black.

SECTION C

In this section there are 6 short answer questions of 3 marks each.

26. Find the value of the constant k so that the function:

$$f(x)=\begin{cases}\dfrac{\sqrt{1+kx}-\sqrt{1-kx}}{x}, & \text{if } -1\le x<0\\ \dfrac{2x+1}{x-1}, & \text{if } 0\le x<1,\end{cases}$$ is continuous at $x=0$.

OR

If $x=a\cos^3\theta$, $y=a\sin^3\theta$, then find the value of $\dfrac{d^2y}{dx^2}$ at $\theta=\pi/6$

27. Find the intervals in which $f(x)=\dfrac{x}{2}+\dfrac{2}{x}$; $x\neq 0$ is strictly increasing or strictly decreasing.

28. (a) Find: $\int \frac{2}{(1-x)(1+x^2)}\,dx$

OR

(b) Find: $\int \frac{x+3}{\sqrt{5-4x-x^2}}\,dx$

29. Evaluate: $\int_0^{\pi} \frac{x \sin x}{1+\cos^2 x}\,dx$

30. (a) If $y(x)$ is a solution of the differential equation $\left(\frac{2+\sin x}{1+y}\right)\frac{dy}{dx} = -\cos x$ and $y(0) = 1$, then find the value of $y(\pi/2)$.

OR

(b) Solve the following differential equation

$$y\,dx + x \log\left(\frac{y}{x}\right)dy - 2x\,dy = 0$$

31. If $\vec{a} = \hat{i} + 4\hat{j} + 2\hat{k}$, $\vec{b} = 3\hat{i} - 2\hat{j} + 7\hat{k}$ and $\vec{c} = 2\hat{i} - \hat{j} + 4\hat{k}$, then find a vector $\vec{d}$ which is perpendicular to $\vec{a}$ and $\vec{b}$ and $\vec{c} \cdot \vec{d} = 15$

SECTION D

This section consists of 4 questions of 5 marks each.

32. (a) Prove that the relation R on $N \times N$, defined as $(a,b)R(c,d)$ iff $ad = bc$; $\forall (a,b), (c,d) \in N \times N$ is an equivalence relation.

OR.

(b) Let $A = R - \{3\}$ and $B = R - \{1\}$. Consider a function $f: A \to B$ defined by $f(x) = \frac{x-2}{x-3}$. Show that f is one-one and onto function.

33. The area between the curve $x = y^2$ and $x = 4$ is divided into two equal parts by the line $x = a$. Find the value of a.

34 (a) Find the shortest distance between the lines given by
$\vec{r} = (8+3\lambda)\hat{i} - (9+16\lambda)\hat{j} + (10+7\lambda)\hat{k}$ and
$\vec{r} = (15\hat{i} + 29\hat{j} + 5\hat{k}) + \mu(3\hat{i} + 8\hat{j} - 5\hat{k})$

OR.

(b) Find the image of the point P(1, 6, 3) in the line
$\frac{x}{1} = \frac{y-1}{2} = \frac{z-2}{3}$

35. Solve graphically:

Minimise $Z = 6x + 3y$
subject to
$4x + y \geq 80$,
$x + 5y \geq 115$,
$3x + 2y \leq 150$,
$x \geq 0, y \geq 0$

SECTION E

This section consists of 3 case based questions of 4 marks each.

37. Two schools P and Q want to award their selected
36. students on the values of Tolerance, kindness and leadership. The school P wants to award ₹ x each, ₹ y each and ₹ z each for respective values to 3, 2 and 1 students respectively with a total of award money of ₹ 2200. School Q wants to spend ₹ 3100 to award its 4, 1 and 3 students on the respective

values (by giving the same award money to the three values as school P). If the total amount of award for one prize on each value is ₹ 1200, using matrices, find the following:

(i) Represent the money spent by school P by an equation in terms of x, y and z.

(ii) Represent the money spent by school Q by an equation in terms of x, y and z.

(iii) Taking the third equation as $x+y+z=1200$,

(a) Solve the three equations by matrix methods to find x, y and z.

OR

(b) If the third equation is given as $x+y+z=1000$ Solve the three equation and find x, y and z.

37. A volley ball player serves the ball which takes a parabolic path given by the equation $h(t) = -7t^2 + 28t + 1$, where $h(t)$ is the height of ball (in metres) at any time t (in seconds), $(t \geq 0)$.

Based on the above information, answer the following questions:

(i) Is $h(t)$ a continuous function? Justify.

(ii) Find the height of ball after 1 sec.

(iii) Find the time at which the height of the ball is maximum. Also find the maximum height.

OR

Find the intervals where $h(t)$ is increasing or decreasing.

38. An insurance company divided the people of an area into two classes: those who are accident prone and those who are not. The company's statistics show that an accident prone person will have an accident at sometimes within a fixed one year period with probability 0.6, whereas this probability is 0.2 for a person who is not accident prone. The company knows that 20% of the population is accident prone.

Based on the given information, answer the following questions.

Let E_1: The policy holder is accident prone

E_2: The policy holder is not accident prone

A: The policy holder has an accident within a year.

(i) Find $P(A|E_1)$

(ii) Find $P(A|E_2)$

(iii) Find the probability that a new policy holder will have an accident within a year of purchasing policy

(a)

OR

(b) If a new policy holder met with an accident within a year, find the probability that it was an accident prone person.