केंद्रीय विद्यालय संगठन, कोलकाता संभाग

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प्री-बोर्ड परीक्षा/ PRE-BOARD EXAMINATION – 2025-26

कक्षा/**CLASS – XII** अधिकतम अंक / **MAX.MARKS – 80**

विषय/**SUB. – MATHEMATICS (041)** समय /**TIME – 03 HOURS**

General Instructions:

1. This Question paper contains **- five sections** A, B, C, D and E. Each section is compulsory. However, there are internal choices in some questions.
2. **Section A** has **18 MCQ's and 02 Assertion-Reason** based questions of 1 mark each.
3. **Section B** has **5 Very Short Answer (VSA)-type** questions of 2 marks each.
4. **Section C** has **6 Short Answer (SA)-type** questions of 3 marks each.
5. **Section D** has **4 Long Answer (LA)-type** questions of 5 marks each.
6. **Section E** has **3 source based/case based/passage based/integrated units of assessment** (4 marks each) with sub parts.
7. Use of calculator is not allowed.

SECTION A

(Multiple Choice Questions of 1 mark each)

1. The value of $\cos^{-1}\left(\cos\left(\frac{13\pi}{6}\right)\right)$ is:

(A) $\frac{13\pi}{6}$ (B) $\frac{7\pi}{6}$ (C) $\frac{5\pi}{6}$ (D) $\frac{\pi}{6}$

2. If matrix A $=\begin{bmatrix} 2 & -2 \\ -2 & 2 \end{bmatrix}$ and $A^2 = pA$, then the value of p is

(A) 1 (B) 2 (C) -4 (D) 4

3. If A $=\begin{bmatrix} 2 & x-3 & x-2 \\ 3 & -2 & -1 \\ 4 & -1 & -5 \end{bmatrix}$ is a symmetric matrix then x is

(A) 3 (B) 6 (C) 8 (D) 0

4. If $\begin{vmatrix} 16 & x \\ x & 4 \end{vmatrix} = \begin{vmatrix} 8 & 32 \\ 2 & 8 \end{vmatrix}$ then the value(s) of x is/are

(A) 8 (B) -8 (C) ± 8 (D) 32

5. Let $A = \begin{bmatrix} p & q \\ r & s \end{bmatrix}$ be a square matrix such that $adj\ A = A$. Then $(p + q + r + s)\ is\ equal\ to$

(A) 2p (B)2q (C) 2r (D) 0

6. If the area of triangle is 40 sq units with vertices (1,-6), (5,4) and (k,4). then k is

(A) 13 (B) -3 (C) -13,-2 (D) 13,-3

7. The function f:R→R defined by f(x)=$|x-1|$ is:
   (A) Continuous as well as differentiable at x=1
   (B) Not continuous but differentiable at x=1
   (C) Continuous but not differentiable at x=1
   (D) Neither Continuous nor differentiable at x=1

8. If x = t^2 and y = t^3 then $\frac{d^2y}{dx^2}$ is equal to

(A) $\frac{3}{4t}$ (B) $\frac{3}{2}$ (C) $\frac{3}{2t}$ (D) $\frac{3t}{2}$

9. The function $f(x) = \ tanx - x$

(A) Always increases (B)Always decreases

(C)Never increases (D)Sometimes increases and sometime decreases

10. $\int e^x secx(1 + tanx)dx$ is equal to

(A) $e^x cosx + c$ (B) $e^x secx + c$

(C) $e^x sinx + c$ (D) $e^x tanx + c$

11. The value of $\int_{-\pi/2}^{\pi/2} x^{2022}\ \sin^{-1} x\ dx\ \ is$

(A) 2022/2021 (B) 2021/2022 (C) 1 (D) 0

12. If m is the order and n is the degree of the differential equation $y''' + y'' + y' = \sin y$, then m^n is –

(A)2 (B) 3 (C) 1 (D) 9

13. If $|\vec{a}| = 2$, $|\vec{b}| = 3$ and $\vec{a}.\vec{b}$ = $2\sqrt{5}$ then find the value of $|\vec{a}\ \times\ \vec{b}|$

(A) ± 4 (B) 4 (C) -4 (D) $\sqrt{26}$

14. Write the value of($\hat{\imath}$ x $\hat{\jmath}$) .$\hat{k}$ + ($\hat{\jmath}$ x $\hat{k}$). $\hat{\imath}$ + ($\hat{\imath}$ x $\hat{k}$). $\hat{\jmath}$

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

15. If a line makes equal acute angles with coordinate axes , then direction cosines of the line is

(A)1,1,1 (B)$\frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}$ (C)$\frac{1}{3}, \frac{1}{3}, \frac{1}{3}$ (D)$\frac{1}{\sqrt{3}}, \frac{-1}{\sqrt{3}}, \frac{-1}{\sqrt{3}}$

16. The corner point of the feasible region determined by the system of linear constraints are (0,10), (5,5), (15,15) and (0,20) . let Z = px+ qy , where p,q >0.

Condition on p and q so that the maximum of z occurs at both the points (15,15) and (0,20) is

(A)p = q (B)p = 2q (C)q = 2p (D)q = 3p

17. The linear function which is to be optimized in the Linear Programming Problem is known as

(A)constraints (B)optimal solution (C)objective function (D)decision variables

18. If A and B are events such that P(A|B) = P(B|A), then
(A) $A \subset B$ but $A \neq B$ (B) A = B (C) $A \cap B = \varphi$ (D) P(A) = P(B).

ASSERTION-REASON BASED QUESTIONS

In the following questions, a statement of assertion (A) is followed by a statement of Reason (R). Choose the correct answer out of the following choices.

(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

19. **Assertion(A):** $cos^{-1}\left(cos\frac{5\pi}{6}\right) = \frac{5\pi}{6}$

Reason(R): The Principal value of $cos^{-1}x\ is\ [0,\pi]$

20. **Assertion(A):** The projection of the vector $\vec{a} = 2\hat{\imath} + 3\hat{\jmath}\ on\ the\ vector\ \vec{b} = 2\hat{\imath} + 2\hat{\jmath} + \hat{k}\ is\ \frac{5}{3}\sqrt{6}$

Reason(R): The projection of the vector $\vec{a}$ on $\vec{b}$ is $\frac{1}{|\vec{a}\,|}$ $(\vec{a}\,.\,\vec{b})$.

SECTION B

This section comprises of very short answer type-questions (VSA) of 2 marks each.

21. (a) Find the value of tan^{-1}(-1) + $sin^{-1}\left(-\frac{1}{2}\right) + cos^{-1}\left(\frac{-1}{\sqrt{2}}\right)$.

OR

(b) Find the domain of $sin^{-1}(5x-4)$

22. If $x\sqrt{1+y} + y\sqrt{1+x} = 0\ with\ x \neq y\ and -1 < x, y < 1$,
then $prove\ that\ \frac{dy}{dx} = \frac{-1}{(1+x)^2}$

23. Find the value of m, for which the function

$$f(x) = \begin{cases} m(x^2 - x), & x > 0 \\ \cos x + 1, & x \leq 0 \end{cases}$$ is continuous at x=0 .

24. If the vectors $\vec{a}$, $\vec{b}$ and $\vec{c}$ are unit vectors such that $\vec{a} + \vec{b} + \vec{c} = \vec{0}$ then find the value of $\vec{a} . \vec{b} + \vec{b} . \vec{c} + \vec{c} . \vec{a}$.

25. (a) Integrate $e^x(\frac{1 + \sin x}{1 + \cos x})$ with respect to x.

OR (b) Find the area of the region bounded by the curve $y^2 = 4x \text{ and } x = 3$

SECTION C

This section comprises of short answer type-questions (SA) of 3 marks each.

26. a) If $y = e^{a\cos^{-1}x}$,$-1 \leq x \leq 1$ then show that: $(1 - x^2)\frac{d^2y}{dx^2} - x\frac{dy}{dx} - a^2y = 0$

OR

(b) If $y = x^{sinx} + (sinx)^{cosx}$ then find $\frac{dy}{dx}$.

27. A ladder 5 m long is leaning against a wall. The bottom of the ladder is pulled along the ground, away from the wall, at the rate of 2cm/s. How fast is its height on the wall decreasing when the foot of the ladder is 4 m away from the wall ?

28. (a) Sketch the graph of $y = |x + 3|$. What does the integral $\int_{-6}^{0}|x + 3|dx$ represent ? Hence evaluate the integral.

OR

(b) Find the area bounded by the curves $y = x^3$, the x-axis and the ordinates $x = -2$ and $x = -1$

29. (a)Find the value of p so that the lines $\frac{1-x}{3} = \frac{7y-14}{2p} = \frac{z-3}{2}$ and $\frac{7-7x}{3p} = \frac{y-5}{1} = \frac{6-z}{5}$ are at right angles. Hence write the equation of the first line in the vector form.

OR

(b)Find the distance between the lines $\vec{r} = (\hat{\imath} + 2\hat{\jmath} - 4\hat{k}) + \lambda(2\hat{\imath} + 3\hat{\jmath} + 6\hat{k})$ and
$\vec{r} = (3\hat{\imath} + 3\hat{\jmath} - 5\hat{k}) + \mu(2\hat{\imath} + 3\hat{\jmath} + 6\hat{k})$.

30. Assume that each born child is equally likely to be a boy or a girl. If a family has two children, what is the conditional probability that both are girls given that (i) the youngest is a girl, (ii) at least one is a girl?

31. Solve the Linear Programming Problem Graphically:

Minimise $Z = 5x + 10y$ subject to $x + 2y \leq 120$, $x + y \geq 60$, $x - 2y \geq 0$, $x, y \geq 0$

SECTION D

This section comprises of long answer type-questions (LA) of 5 marks each.

32. If $A = \begin{bmatrix} 1 & 1 & 1 \\ 0 & 1 & 3 \\ 1 & -2 & 1 \end{bmatrix}$, find A^{-1}. Using A^{-1} solve the system of following system of equations:

$x + y + z = 6, \quad y + 3z = 11, \; x - 2y + z = 0$

33. (a) Evaluate: $\int \frac{x}{(x-1)^2(x+2)} dx$

OR

(b) Evaluate: $\int_0^{\frac{\pi}{4}} \frac{\sin x + \cos x}{16 + 9\sin 2x} dx$

34. (a) Solve the differential equation $(1 + x^2)\, dy + 2xy\, dx = \cot x\, dx, (x \neq 0)$

OR

(b) Solve differential equation $xdy - ydx = \sqrt{x^2 + y^2}dx$

35. Find the shortest distance between the lines whose equations are

$$\vec{r} = (1 - t)\hat{\imath} + (t - 2)\hat{\jmath} + (3 - 2t)\hat{k}$$
$$\vec{r} = (s + 1)\hat{\imath} + (2s - 1)\hat{\jmath} - (2s + 1)\hat{k}$$

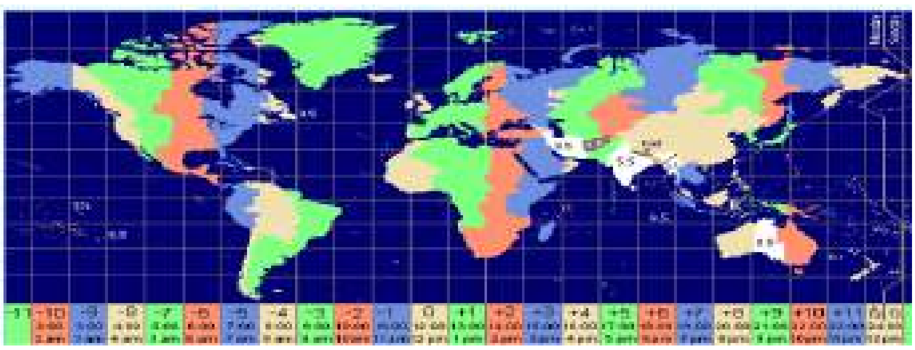
SECTION E

(This section comprises of 3 case-study/passage-based questions of 4 marks each with two sub-parts. First two case study questions have three sub-parts (i), (ii), (iii) of marks 1, 1, 2 respectively.

36. The Earth has 24 time zones, defined by dividing the Earth into 24 equal longitudinal segments. These are the regions on Earth that have the same standard time. For example, USA and India fall in different time zones, but Sri Lanka and India are in the same time zone.

A relation R is defined on the set U = {All people on the Earth} such that

R = {(x, y)| the time difference between the time zones x and y reside in is less than or equal to 6 hours}.

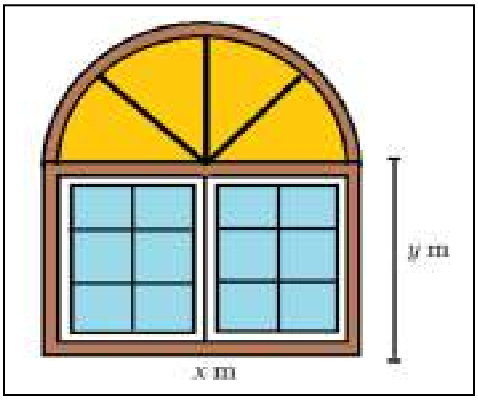


Based on this information answer the following question

(i) Is the relation is reflexive?
(ii) Check whether the relation is symmetric.
(iii) (a) Is the relation is Transitive

OR (iii) (b) is this relation a function ? Justify your answer

37. Read the following passage and answer the question given below:
Dr. S. P. Chatterjee residing in Barrackpore went to see an apartment of 3 BHK in New Town. The window of the house was in the form of a rectangle surmounted by a semicircular opening having a perimeter of the window 10 m as shown in figure.



(i) If x and y represents the length and breadth of the rectangular region, find the relation between the variables.
(ii) Express the area A of the window as a function of x.
(iii) (a)Find the value of x for which the area of the whole window is the maximum.
OR
(iii) (b) For maximum value of A, find the breadth of the rectangular part of the window.

38. Read the following passage and answer the question given below:
In a village, there are three mohallas A, B and C. In mohalla A, 60% farmers believe in new technology of agriculture, while in mohalla B, 70 % and that in mohalla C is 80 %. A farmer is selected at random from the village.

(i) What is the total probability that a farmer believes in new technology of agriculture?

(ii) The district agriculture officer selects a farmer at random in the village and he found that the selected farmer believes in new technology of agriculture. What is the probability that the farmer belongs to mohalla B?

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