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PUBDET-2025

Paper Code : 03

5020302789
(Booklet Number)

Subject : ECONOMICS/STATISTICS/ MATHEMATICS (Paper-III)

Duration : 90 Minutes **No. of Questions : 50** **Full Marks : 100**

INSTRUCTIONS

1. All questions are of objective type having four answer options for each. Only one option is correct. Correct answer will carry full marks **2**. In case of incorrect answer or any combination of more than one answer, ½ mark will be deducted.
2. Questions must be answered on OMR sheet by darkening the appropriate bubble marked A, B, C or D.
3. Use only **Black/Blue ink ball point pen** to mark the answer by complete filling up of the respective bubbles.
4. Mark the answers only in the space provided. Do not make any stray mark on the OMR sheet.
5. Write question booklet number and your roll number carefully in the specified locations of the **OMR Sheet**. Also fill appropriate bubbles.
6. Write your name (in block letter), name of the examination center and put your signature (as it appeared in Admit Card) in appropriate boxes in the **OMR Sheet**.
7. The **OMR Sheet** is liable to become invalid if there is any mistake in filling the correct bubbles for question booklet number/roll number or if there is any discrepancy in the name/signature of the candidate, name of the examination center. The OMR Sheet may also become invalid due to folding or putting stray marks on it or any damage made to it. The consequence of such invalidation due to incorrect marking or careless handling by the candidate will be the sole responsibility of the candidate.
8. Candidates are not allowed to carry any written or printed material, calculator, slide rule, pen, docu-pen, logtable, wristwatch, graph, any communication device like mobile phone, bluetooth etc. inside the examination hall. Any candidate found with such prohibited items will be **reported against** and his/her candidature will be summarily cancelled.
9. Rough work must be done in the Question Booklet itself. Additional blank pages are given in the question booklet for rough work.
10. Hand over the OMR Sheet to the invigilator before leaving the Examination Hall.
11. This booklet contains questions in both English and Bengali. Necessary care and precaution were taken while framing the Bengali version. However, if any discrepancy(ies) is/are found between the two versions, the information provided in the English version will stand and will be treated as final.
12. Candidates are allowed to take the Question Booklet after Examination is over.

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Paper – III

MATHEMATICS

1. If $f(x)+2f\left(\frac{1}{x}\right)=3x, x\neq 0$ and $S=\{x\in \mathbf{R}: f(x)=f(-x)\}$, then S

(A) contains exactly two elements.
(B) contains more than two elements.
(C) is an empty set.
(D) contains exactly one element.

যদি $f(x)+2f\left(\frac{1}{x}\right)=3x, x\neq 0$ এবং $S=\{x\in \mathbf{R}: f(x)=f(-x)\}$ হয় তাহলে S সেট-এ

(A) কেবলমাত্র দুটি উপাদান থাকবে।
(B) দুটির বেশি উপাদান থাকবে।
(C) কোনো উপাদান থাকবে না।
(D) একটি মাত্র উপাদান থাকবে।

2. $\int_0^{\frac{\pi}{2}} \frac{dx}{1+\left(\tan x\right)^{2025}} = ?$

(A) π
(B) $\frac{\pi}{2}$
(C) 0
(D) $\frac{\pi}{4}$

3. Let 'f' and 'g' be two real valued functions defined as

$$f(x)=\begin{cases}7x^2+x-8, & x\leq 1\\ 4x+5, & 1\leq x\leq 7\\ 8x+3, & x>7\end{cases} \text{ and } g(x)=\begin{cases}|x|, & x<-3\\ 0, & -3\leq x<2\\ x^2+4, & x\geq 2\end{cases}$$

Then the value of 4 (gof) (2) – (fog) (9) is

'f' এবং 'g' দুটি বাস্তব মান বিশিষ্ট অপেক্ষক নিম্নলিখিতভাবে সংজ্ঞায়িত :

$$f(x)=\begin{cases}7x^2+x-8, & x\leq 1\\ 4x+5, & 1\leq x\leq 7\\ 8x+3, & x>7\end{cases} \text{ এবং } g(x)=\begin{cases}|x|, & x<-3\\ 0, & -3\leq x<2\\ x^2+4, & x\geq 2\end{cases}$$

তাহলে 4 (gof) (2) – (fog) (9)-এর মান হবে

(A) 0
(B) 2
(C) 5
(D) 9

4. If $\begin{vmatrix} x^2+2x & 2x+1 & 1 \\ 2x+1 & x+2 & 1 \\ 3 & 3 & 1 \end{vmatrix} = (x-1)^K$, then $K = ?$

যদি $\begin{vmatrix} x^2+2x & 2x+1 & 1 \\ 2x+1 & x+2 & 1 \\ 3 & 3 & 1 \end{vmatrix} = (x-1)^K$ হয় তাহলে $K = ?$

(A) 3 (B) 2

(C) 1 (D) 4

5. Let $a, b, c \in \mathbb{R}$ and $2a + 3b + 6c = 0$. Then at least one real root of the equation $ax^2 + bx + c = 0$ lies in the interval.

যদি $2a + 3b + 6c = 0$ হয় যেখানে $a, b, c \in \mathbb{R}$, তাহলে $ax^2 + bx + c = 0$ সমীকরণের অন্তত একটি বাস্তব বীজ যে অন্তরে থাকবে সেটি হল

(A) $(-1, 1)$ (B) $(0, 1)$

(C) $(1, 2)$ (D) $(-2, -1)$

6. The equation of the circle passing through the intersection of circles $x^2 + y^2 - 1 = 0$ and $x^2 + y^2 - 2x - 4y + 1 = 0$ and touching $x + 2y = 0$ is

$x^2 + y^2 - 1 = 0$ এবং $x^2 + y^2 - 2x - 4y + 1 = 0$ বৃত্তদ্বয়ের ছেদ বিন্দুদ্বয়গামী এবং $x + 2y = 0$ সরলরেখাকে স্পর্শ করে এরূপ বৃত্তের সমীকরণ হল

(A) $x^2 + y^2 - x - 2y = 0$ (B) $x^2 + y^2 - x + 2y = 0$

(C) $x^2 + y^2 + x - 2y = 0$ (D) $x^2 + y^2 + x + 2y = 0$

7. $\int_0^1 |5x - 3| dx = ?$

(A) $\frac{13}{10}$ (B) 0

(C) $\frac{3}{10}$ (D) $\frac{1}{2}$

8. $\cos\left(\frac{\pi}{1000}\right)+\cos\left(\frac{2\pi}{1000}\right)+...+\cos\left(\frac{999\pi}{1000}\right)=?$

(A) 0 (B) 1

(C) $\frac{\sqrt{3}}{2}$ (D) $\frac{1}{2}$

9. Let $p_n(x)$, $n=0, 1, ...$ be polynomials defined by $p_0(x)=1, p_1(x)=x, p_n(x)=xp_{n-1}(x)-p_{n-2}(x)$ for $n \geq 2$. Then $p_{10}(0)=?$

$p_n(x)$, $n=0, 1, ...$ বহুপদী সংখ্যামালা যেখানে $p_0(x)=1, p_1(x)=x, p_n(x)=xp_{n-1}(x)-p_{n-2}(x)$, যেখানে $n \geq 2$। তাহলে $p_{10}(0)=?$

(A) 0 (B) 10

(C) 1 (D) -1

10. If $f_{n+1}(x)=e^{f_n(x)}, n \geq 1$ and $f_1(x)=e^x$, then $\frac{d}{dx}f_n(x)=?$

যদি $f_{n+1}(x)=e^{f_n(x)}, n \geq 1$ এবং $f_1(x)=e^x$ হয় তাহলে $\frac{d}{dx}f_n(x)=?$

(A) $f_1(x)$ (B) $e^{f_n(x)}$

(C) $e^x f_n(x)$ (D) $f_1(x)f_2(x)...f_n(x)$

11. The modulus and amplitude of the complex number $1+\cos\alpha-i\sin\alpha$ $(\pi<\alpha<2\pi)$ are

$1+\cos\alpha-i\sin\alpha$ $(\pi<\alpha<2\pi)$ জটিল রাশিটির মডিউলাস এবং অ্যামপ্লিটিউড হল

(A) $2\cos\frac{\alpha}{2}, \frac{\alpha}{2}-\pi$ (B) $-2\cos\frac{\alpha}{2}, \frac{\alpha}{2}+\pi$

(C) $-2\cos\frac{\alpha}{2}, \pi-\frac{\alpha}{2}$ (D) $2\cos\frac{\alpha}{2}, \pi+\frac{\alpha}{2}$

12. The maximum value of $(x+2)^5(7-x)^4$, where $-2<x<7$ is

$(x+2)^5(7-x)^4$ যেখানে $-2<x<7$, এর চরম মান হল

(A) $5^4 4^5$ (B) $5^5 4^4$

(C) $5^3 4^2$ (D) $5^5 4^5$

13. The area bounded by the ellipse $x^2+9y^2=9$ and the straight line $x+3y=3$ is

উপবৃত্ত $x^2+9y^2=9$ ও সরলরেখা $x+3y=3$ দ্বারা সীমাবদ্ধ অঞ্চলের ক্ষেত্রফল হল

(A) 3π (B) 4π

(C) 6π (D) 9π

14. $\lim\limits_{x\to 0}\dfrac{e^{\tan x}-e^x}{\tan x-x}=$?

(A) 1 (B) e

(C) $\dfrac{1}{e}$ (D) 0

15. If $|Z_1|=|Z_2|=\ldots=|Z_{2025}|=1$ and $|Z_1+Z_2+\ldots+Z_{2025}|=2026$, then the value of $\left|\dfrac{1}{Z_1}+\dfrac{1}{Z_2}+\ldots+\dfrac{1}{Z_{2025}}\right|$ is

যদি $|Z_1|=|Z_2|=\ldots=|Z_{2025}|=1$ এবং $|Z_1+Z_2+\ldots+Z_{2025}|=2026$ হয়, তাহলে $\left|\dfrac{1}{Z_1}+\dfrac{1}{Z_2}+\ldots+\dfrac{1}{Z_{2025}}\right|$-এর মান হবে

(A) 2025 (B) 2024

(C) 1 (D) 2026

16. The real numbers 'x' for which $x^2+4|x|-4=0$, are

যে বাস্তব সংখ্যাগুলির জন্য $x^2+4|x|-4=0$ হয়, সেগুলি হল

(A) $8\pm\sqrt{2}$ (B) $-8\pm\sqrt{2}$

(C) $\sqrt{8}\pm 2$ (D) $\pm\left(\sqrt{8}-2\right)$

17. The number of different rectangles those can be formed from a chess board is

একটি দাবার ছকে আয়তক্ষেত্রের সংখ্যা হল

(A) 784 (B) 1296

(C) 64 (D) 1008

18. Let $\vec{a}=\vec{i}-2\vec{j}+\vec{k}$ and $\vec{b}=\vec{i}-\vec{j}+\vec{k}$. If $\vec{c}$ is a vector such that $\vec{b}\times\vec{c}=\vec{b}\times\vec{a}$ and $\vec{c}\cdot\vec{a}=0$, then $\vec{c}\cdot\vec{b}$ is equal to

$\vec{a}=\vec{i}-2\vec{j}+\vec{k}$ এবং $\vec{b}=\vec{i}-\vec{j}+\vec{k}$। যদি $\vec{c}$ এমন একটি ভেক্টর হয় যে $\vec{b}\times\vec{c}=\vec{b}\times\vec{a}$ এবং $\vec{c}\cdot\vec{a}=0$, তাহলে $\vec{c}\cdot\vec{b}$-এর মান হবে

(A) $-\frac{3}{2}$ (B) $\frac{1}{2}$

(C) $-\frac{1}{2}$ (D) -1

19. $\lim_{n\to\infty}\sum_{K=1}^{n}\frac{1}{K(K+1)}=?$

(A) 0 (B) 1

(C) $\log 2$ (D) -1

20. The smallest positive integer 'n' for which $(\sin\theta+i\cos\theta)^n=(\cos\theta-i\sin\theta)^n$ is

যে সর্বনিম্ন ধনাত্মক পূর্ণসংখ্যা n-এর জন্য $(\sin\theta+i\cos\theta)^n=(\cos\theta-i\sin\theta)^n$ হয় সেটি হল

(A) 1 (B) 8

(C) 4 (D) 12

21. If the straight line $lx+my+n=0$ touches the hyperbola $\frac{x^2}{a^2}-\frac{y^2}{b^2}=1$ then which of the following is true?

যদি $lx+my+n=0$ সরলরেখাটি $\frac{x^2}{a^2}-\frac{y^2}{b^2}=1$ পরাবৃত্তকে স্পর্শ করে তাহলে নীচের কোনটি সত্য?

(A) $n^2=a^2l^2-b^2m^2$
(B) $n^2=a^2l^2+b^2m^2$
(C) $n^2=b^2l^2-a^2m^2$
(D) $n^2=b^2l^2+a^2m^2$

22. The function $f:\mathbb{R}-\{1\}\to\mathbb{R}-\{2\}$ defined by $f(x)=\frac{2x}{x-1}$ is

(A) one-one, not onto
(B) onto but not one-one
(C) one-one and onto
(D) neither one-one nor onto

$f:\mathbb{R}-\{1\}\to\mathbb{R}-\{2\}$ অপেক্ষকটি যদি $f(x)=\frac{2x}{x-1}$ দ্বারা সংজ্ঞায়িত হয়, তাহলে অপেক্ষকটি

(A) one-one, কিন্তু onto নয়
(B) onto কিন্তু one-one নয়
(C) one-one এবং onto
(D) one-one এবং onto কোনোটাই নয়

23. If $f(x)$ is a polynomial then $f''(e^x)$ is

যদি $f(x)$ একটি বহুপদী সংখ্যামালা হয় তবে $f''(e^x)$ এর মান হবে

(A) $f'(x)e^{2x}$
(B) $f''(x)e^x$
(C) $e^{2x}f''(e^x)+e^xf'(x)$
(D) $e^{2x}f''(x)-e^xf'(x)$

24. If $\lim_{x\to0}\left(\frac{1+cx}{1-cx}\right)^{\frac{1}{x}}=4$ then $\lim_{x\to0}\left(\frac{1+2cx}{1-2cx}\right)^{\frac{1}{x}}$ is

যদি $\lim_{x\to0}\left(\frac{1+cx}{1-cx}\right)^{\frac{1}{x}}=4$ হয় তবে $\lim_{x\to0}\left(\frac{1+2cx}{1-2cx}\right)^{\frac{1}{x}}$-এর মান হবে

(A) 2
(B) 4
(C) 16
(D) 64

25. The function $f(x)$ is twice differentiable such that $f''(x)=-f(x)$. If $f'(x)=g(x)$, $h(x)=\{f(x)\}^2+\{g(x)\}^2$ and $h(5)=5$, then $h(10)$ equals

দুবার অবকলনযোগ্য $f(x)$ অপেক্ষকটি এমন যে $f''(x)=-f(x)$। যদি $f'(x)=g(x)$, $h(x)=\{f(x)\}^2+\{g(x)\}^2$ এবং $h(5)=5$ হয় তাহলে $h(10)$-এর মান হবে

(A) 5
(B) 10
(C) 25
(D) 50

26. The value of the integral $\int\frac{\sqrt{x}}{\sqrt{a^3-x^3}}dx$ is

$\int\frac{\sqrt{x}}{\sqrt{a^3-x^3}}dx$ সমাকলনটির মান হবে

(A) $\frac{2}{3}\sin^{-1}(\frac{x}{a})^{\frac{3}{2}}+c$
(B) $\cos^{-1}(\frac{x}{a})^{\frac{3}{2}}+c$
(C) $\frac{2}{3}\cos^{-1}(\frac{x}{a})^{\frac{3}{2}}+c$
(D) $\sin^{-1}(\frac{x}{a})^{\frac{3}{2}}+c$

27. The primitive differential equation is $ydx+y^2dy=xdy$, where $x\in\mathbb{R}, y>0, y=y(x), y(1)=1$. Then $y(-3)$ is equal to

একটি প্রাথমিক অবকল সমীকরণ হল $ydx+y^2dy=xdy$, যেখানে $x\in\mathbb{R}, y>0, y=y(x), y(1)=1$.
তাহলে $y(-3)$-এর মান হবে

(A) 3
(B) 2
(C) 1
(D) 5

28. From a bag containing 20 distinct objects, the number of ways one can select an odd number of objects is

20 টি ভিন্ন বস্তু রাখা একটি থলি থেকে কতরকম উপায়ে বিজোড় সংখ্যক বস্তু নির্বাচন করা যাবে তার সংখ্যা হল

(A) 2^{20}
(B) 2^{19}
(C) 20!
(D) 10

29. The value of n for which the determinant has the value zero is

n-এর যে মানের জন্য

$$\begin{vmatrix} {}^8C_3 & {}^9C_5 & {}^{10}C_7 \\ {}^8C_4 & {}^9C_6 & {}^{10}C_8 \\ {}^9C_n & {}^{10}C_{n+2} & {}^{11}C_{n+4} \end{vmatrix} = 0$$

হয় সেটি হল

(A) 3 (B) 4

(C) 5 (D) 6

30. An unbiased die is thrown independently two times. Given that the first throw gives an even number, the probability that the sum obtained is 8 is

একটি অপাক্ষপিক ছক্কা স্বাধীনভাবে দুবার নিক্ষেপ করা হল। যদি প্রথম নিক্ষেপে একটি জোড় সংখ্যা পড়ে তাহলে দুবার নিক্ষেপের ফলে প্রাপ্ত সংখ্যাগুলির যোগফল 8 হওয়ার সম্ভাবনা হল

(A) $\frac{5}{36}$ (B) $\frac{1}{6}$

(C) $\frac{4}{21}$ (D) $\frac{7}{36}$

31. If $a_0, a_1, \cdots a_n$ are real numbers such that $(1+z)^n = a_0 + a_1 z + a_2 z^2 + \cdots + a_n z^n$ for all complex number z, then $(a_0 - a_2 + a_4 - a_6 + \cdots)^2 + (a_1 - a_3 + a_5 - a_7 \cdots)^2$ has the value

যদি $a_0, a_1, \cdots a_n$ বাস্তব সংখ্যা হয় এবং সব অবাস্তব সংখ্যা z-এর জন্য $(1+z)^n = a_0 + a_1 z + a_2 z^2 + \cdots + a_n z^n$ হয়, তবে $(a_0 - a_2 + a_4 - a_6 + \cdots)^2 + (a_1 - a_3 + a_5 - a_7 \cdots)^2$-এর মান হবে

(A) 2^n (B) $(a_0^2 + a_1^2 + \cdots + a_n^2)$

(C) 2^{n^2} (D) $2n^2$

32. Let $A = [a_{ij}]$ be a square matrix of order 2 with entries either 0 or 1. Let E be the event that A is symmetric as well as invertible. Then the probability P(E) is

A একটি 2 ঘাত বর্গ ম্যাট্রিক্স যার উপাদানগুলি 0 বা 1. E একটি ঘটনা যা নির্দেশ করে A সমসত্ত্ব ও ইনভার্টিবল। তাহলে E-এর সম্ভাবনা P(E) হবে

(A) $\frac{3}{8}$ (B) $\frac{1}{8}$

(C) $\frac{1}{4}$ (D) $\frac{3}{16}$

33. The interval in which the function $f(x)=x^x, x>0$ is strictly increasing is

$f(x)=x^x, x>0$ অপেক্ষকটি যে অন্তরালে strictly increasing হবে তা হল

(A) $(0,\frac{1}{e}]$ (B) $[\frac{1}{e^2},1]$

(C) $(0,\infty)$ (D) $(\frac{1}{e},\infty)$

34. The solution of the differential equation $\frac{dy}{dx}=\frac{3e^{2x}+3e^{4x}}{e^x+e^{-x}}$ is

$\frac{dy}{dx}=\frac{3e^{2x}+3e^{4x}}{e^x+e^{-x}}$ অবকল সমীকরণটির সমাধান হল

(A) $y=3e^{3x}+c$ (B) $y=3e^{2x}+c$

(C) $y=e^{3x}+c$ (D) $y=9e^{3x}+c$

35. If

যদি

$$\begin{vmatrix} a+x & a-x & a-x \\ a-x & a+x & a-x \\ a-x & a-x & a+x \end{vmatrix}=0$$

then the value of x is

তাহলে x-এর মান হবে

(A) 1 (B) 0

(C) 2 (D) -2

36. Let $\vec{a}$ and $\vec{b}$ be two non-zero vectors such that $|\vec{a}+\vec{b}|=|\vec{a}-\vec{b}|$. Then

ধরা যাক $\vec{a}$ এবং $\vec{b}$ দুটি অশূন্য ভেক্টর এবং $|\vec{a}+\vec{b}|=|\vec{a}-\vec{b}|$। তাহলে

(A) $\vec{a}\perp\vec{b}$ (B) $\vec{a}\parallel\vec{b}$

(C) $\vec{a}=\vec{b}$ (D) $\vec{a}\cdot\vec{b}=1$

37. $\int_{-a}^{a} |x|\,dx = ?$

(A) a (B) a^2
(C) 0 (D) $2a$

38. If p, r, n are positive integers where r and p are prime to n and if $\alpha = \cos\frac{2\pi r}{n} + i\sin\frac{2\pi r}{n}$ then $\sum_{j=0}^{n-1}\alpha^{jp}$ is

যদি p, r, n ধনাত্মক পূর্ণসংখ্যা হয় এবং r ও p, n দ্বারা অবিভাজ্য হয় এবং $\alpha = \cos\frac{2\pi r}{n} + i\sin\frac{2\pi r}{n}$ হয় তবে $\sum_{j=0}^{n-1}\alpha^{jp}$ -এর মান হবে

(A) 1 (B) 0
(C) α (D) i

39. The general solution of $y\frac{dy}{dx} + by^2 = a\cos x,\ 0 < x < 1$ is

$y\frac{dy}{dx} + by^2 = a\cos x,\ 0 < x < 1$-এর সাধারণ সমাধান হল

(A) $y^2 = 2a(2b\sin x + \cos x) + De^{-2bx}$
(B) $(4b^2+1)y^2 = 2a(\sin x + 2b\cos x) + De^{-2bx}$
(C) $(4b^2+1)y^2 = 2a(\sin x + 2b\cos x) + De^{2bx}$
(D) $y^2 = 2a(2b\sin x + \cos x) + De^{2bx}$
(D is a constant, D একটি ধ্রুবক)

40. If $y = f(x)$ is a curve where $f(x) = \int_0^1 \frac{x^2+t^2}{x-t}\,dt$, then the curve is

(A) a straight line (B) a parabola
(C) a hyperbola (D) an ellipse

যদি $y = f(x)$ একটি বক্ররেখা হয় এবং $f(x) = \int_0^1 \frac{x^2+t^2}{x-t}\,dt$, তাহলে বক্ররেখাটি একটি

(A) সরলরেখা (B) অধিবৃত্ত
(C) পরাবৃত্ত (D) উপবৃত্ত

41. Choose the option which best expresses the meaning of the sentence given below:

Rome wasn't built in a day.

(A) Important things take time to achieve.
(B) Important things can be achieved through shortcut.
(C) Important things cannot be achieved.
(D) Achieving important things is just the matter of a day.

42. Which among the following options, is Anthropology?

(A) The study of human societies and culture
(B) The study of abstract theories
(C) The study of celestial objects, space and the physical universe
(D) The study of cells and tissues

43. Choose the correct Antonym of 'Include' from the given options:

(A) Admit
(B) Contain
(C) Exclude
(D) Invite

44. Choose the correct sentence:

(A) The offer seemed so good to be true.
(B) The offer seemed so good that it could be true.
(C) The offer seemed too good to be true.
(D) The offer seemed too good to be untrue.

45. Which of the following pair of words, in the same order, seems appropriate to fill in the blanks in the given sentence to make it meaningful?

The _____ was calm, and I could _____ the boats in the distance.

(A) see; sea
(B) see; sun
(C) sun; sea
(D) sea; see

46. Choose the correct order of prepositions to complete the sentence.

It is very kind _____ you _____ help us.

(A) to; for
(B) of; to
(C) from; to
(D) in; for

47. Choose the word which is nearest in meaning to the word 'Novice'.

(A) Beginner
(B) Close
(C) Meagre
(D) Lavish

48. Fill in the blank with the correct option.

The traveller is so _____ that he could not continue the journey.

(A) handsome
(B) energetic
(C) tired
(D) thoughtful

49. Identify the adverb in the sentence:

He answered the question correctly.

(A) He
(B) question
(C) the
(D) correctly

50. Choose the Antonym of 'Ancient':

(A) Antique
(B) Old
(C) Modern
(D) Mythical