FIITJEE

CBSE TERM - I

ALL XIITH STUDYING BATCHES

Part Test – I

MATHEMATICS

(29th October 2021)

Time: 1:30 Hours **Maximum Marks: 40**

General Instructions:

1. The question paper contains three sections A, B and C
2. Section A consists of 20 questions MCQ Single Option Correct, out of which students will attempt any 16 questions only. Each question carries +1 Mark.
3. Section B consists of 20 questions MCQ Single Option Correct, out of which students will attempt any 16 questions only. Each question carries +1 Mark.
4. Section C consists of 10 questions MCQ Single Option Correct out of which 5 questions are based on case studies. Students will attempt any 8 questions only. Each question carries +1 Mark.
5. There is no negative marking.

Name of the Candidate : .....

Enroll Number : .....

Date of Examination : .....

MATHEMATICS

SECTION – A

*This section contains **20 Multiple Choice Questions** number **1 to 20**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE** is correct.*

1. If P and Q are two different matrices of order 3×4 and 4×3 respectively, then the order of matrix QP is
   (A) 3×3 (B) 4×4
   (C) 3×4 (D) 4×3

2. The principal value of $\cot^{-1}\left(-\sqrt{3}\right)$ is
   (A) $-\frac{\pi}{6}$ (B) $\frac{\pi}{6}$
   (C) $\frac{2\pi}{3}$ (D) $\frac{5\pi}{6}$

3. The function $f(x)=[x]$, where [x] denotes the greatest integer function, is continuous at
   (A) 4 (B) –2
   (C) 1 (D) 1.5

4. If $\sin^{-1}x=y,$ then
   (A) $0\le y\le\pi$ (B) $-\frac{\pi}{2}<y<\frac{\pi}{2}$
   (C) $0<\pi<\pi$ (D) $-\frac{\pi}{2}\le y\le\frac{\pi}{2}$

5. If A is a non – singular square matrix of order 3 such that $A^2=3A,$ then value of $|A|$ is
   (A) –3 (B) 3
   (C) 9 (D) 27

6. Derivative of $\cot x^o$ with respect to x is
   (A) $\text{cosec}\,x^o$ (B) $\text{cosec}\,x^o\cot x^o$
   (C) $-1^o\,\text{cosec}^2x^o$ (D) $-1^o\,\text{cosec}\,x^o\cot x^o$

7. For a square matrix A, $A+A^T$ is
   (A) Symmetric matrix (B) Skew – Symmetric matrix
   (C) Indentity matrix (D) Void matrix

8. If $\cos^{-1}\alpha+\cos^{-1}\beta+\cos^{-1}\gamma=3\pi$, then $\alpha(\beta+\gamma)+\beta(\gamma+\alpha)+\gamma(\alpha+\beta)$ is equal to

(A) 0 (B) 1
(C) 4 (D) 6

9. If, $\text{adj}\,A=\begin{bmatrix}5 & -6\\ -7 & 4\end{bmatrix}$, then A^{-1} is

(A) $\begin{bmatrix}5 & -6\\ -7 & 4\end{bmatrix}$ (B) $\begin{bmatrix}4 & 6\\ 7 & 5\end{bmatrix}$
(C) $-\frac{1}{22}\begin{bmatrix}5 & -6\\ -7 & 4\end{bmatrix}$ (D) $-\frac{1}{22}\begin{bmatrix}4 & 6\\ 7 & 5\end{bmatrix}$

10. If $y=Ae^{5x}+Be^{-5x}$, then $\frac{d^2y}{dx^2}$ is equal to

(A) 25y (B) 5y
(C) –25y (D) 10y

11. If $A=\begin{bmatrix}2 & -3 & 4\end{bmatrix}, B=\begin{bmatrix}3\\2\\2\end{bmatrix}, X=\begin{bmatrix}1 & 2 & 3\end{bmatrix}$ and $Y=\begin{bmatrix}2\\3\\4\end{bmatrix}$, then AB + XY equals

(A) [28] (B) [24]
(C) 28 (D) 24

12. The value of $\tan^{-1}\left[\tan\frac{3\pi}{4}\right]$ is

(A) $\frac{3\pi}{4}$ (B) $\frac{\pi}{4}$
(C) $-\frac{\pi}{4}$ (D) $-\frac{3\pi}{4}$

13. If A is any square matrix of order 3×3 such that $|A|=-7$, then the value of $|\text{adj}\,A|$ is

(A) 49 (B) 343
(C) –49 (D) –343

14. The function $f:R\to R$ given 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

15. If matrix $A=\begin{bmatrix} 0 & 2b & -2 \\ 3 & 1 & 3 \\ 3a & 3 & -1 \end{bmatrix}$ is a symmetric matrix, then the value of a is

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

(C) $\frac{3}{2}$ (D) $-\frac{3}{2}$

16. If $\sin^{-1}\left(\frac{2a}{1+a^2}\right)+\cos^{-1}\left(\frac{1-a^2}{1+a^2}\right)=2\tan^{-1}\left(\frac{2x}{1-x^2}\right)$, $a,x\in(0,1)$, then the value of x is

(A) 0 (B) $\frac{2a}{1-a^2}$

(C) $\frac{a}{2}$ (D) a

17. If A is any square matrix of order 3×3 such that $|\text{adj}\,A|=169$ and $|A|$ is non – negative, then the value of $|A|$ is

(A) 4 (B) 16

(C) 2 (D) 13

18. The value of λ so that the function f defined by $f(x)=\begin{cases}\lambda x, & \text{if} \quad x\le\pi \\ \cos x, & \text{if} \quad x>\pi\end{cases}$ is continuous at $x=\pi$ is

(A) $-\frac{1}{\pi}$ (B) $\frac{1}{\pi}$

(C) 2π (D) $-\frac{2}{\pi}$

19. If matrix $A=\begin{bmatrix} 1 & -1 \\ -1 & 1 \end{bmatrix}$ and $A^2=kA$, then the value of k is

(A) 1 (B) 2

(C) 3 (D) 5

20. The principal value of $\tan^{-1}\sqrt{3}-\sec^{-1}(-2)$ is

(A) $\frac{2\pi}{3}$ (B) $\frac{\pi}{3}$

(C) $\frac{4\pi}{3}$ (D) $-\frac{\pi}{3}$

SECTION – B

*This section contains **20 Multiple Choice Questions** number **21 to 40**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE** is correct.*

21. Value of $\begin{vmatrix} 1 & a & b+c \\ 1 & b & c+a \\ 1 & c & a+b \end{vmatrix}$ is

(A) 0 (B) –1
(C) 1 (D) 2

22. For the curve $\sqrt{x}+\sqrt{y}=1$, $\frac{dy}{dx}$ at $\left(\frac{1}{4},\frac{1}{4}\right)$ is

(A) –1 (B) 1
(C) 2 (D) None of these

23. If $A=\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$, then A^3+2A^2+4A equals

(A) 7A (B) 5A
(C) A (D) 3A

24. The range of the function defined by $f(x)=\sin^{-1}2x$ is

(A) $\left(-\frac{\pi}{2},\frac{\pi}{2}\right)$ (B) $[0,\pi]$
(C) $\left[-\frac{\pi}{2},\frac{\pi}{2}\right]$ (D) $\left[-\frac{\pi}{2},\frac{\pi}{2}\right]-\{0\}$

25. The maximum value of $\begin{vmatrix} 1 & 1 & 1 \\ 1 & 1+\sin\theta & 1 \\ 1+\cos\theta & 1 & 1 \end{vmatrix}$ is (θ is real number)

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

26. If $y = \log(\log x)$, then $\frac{d^2y}{dx^2}$ is

(A) $-\frac{(1+\log x)^2}{(x\log x)^2}$ (B) $\frac{(1-\log x)}{(x\log x)^2}$

(C) $\frac{(1+\log x)}{(x\log x)^2}$ (D) None of these

27. Let $A = \begin{bmatrix} 0 & 1 \\ 0 & 0 \end{bmatrix}$, then

(A) $A^2 = A$ (B) $A^2 = O$

(C) $A^2 = I$ (D) None of these

28. Domain of $\sin x + \sin^{-1} x$ is

(A) (–1, 1) (B) [0, 1]

(C) [–1, 1] (D) R

29. If A is a singular matrix, then $\text{adj}\, A$ is

(A) singular (B) non – singular

(C) symmetric (D) not defined

30. If the following function $f(x) = \begin{cases} \frac{\sqrt{1+kx} - \sqrt{1-kx}}{X}, & \text{for } -1 \le x < 0 \\ 2x^2 + 3x - 2, & \text{for } 0 \le x \le 1 \end{cases}$

is continuous at x = 0 then k is

(A) –4 (B) –3

(C) –2 (D) –1

31. Assuming that the sums and products given below are defined, which of the following is not true for matrices?

(A) $A + B = B + A$ (B) AB = AC does not imply B = C

(C) AB = O implies $A \neq O$ or $B \neq O$ (D) $(AB)' = B'A'$

32. The principal value of the expression $\cos^{-1}\left[\cos\left(-680^o\right)\right]$ is

(A) $\frac{2\pi}{9}$ (B) $\frac{-2\pi}{9}$

(C) $\frac{34\pi}{9}$ (D) $\frac{\pi}{9}$

33. If $\Delta = \begin{vmatrix} 5 & 3 & 8 \\ 2 & 0 & 1 \\ 1 & 2 & 3 \end{vmatrix}$, then the minor of the element a_{23} is

(A) 1 (B) 7
(C) –7 (D) 4

34. If the following function $f(x) = \begin{cases} k(x^2+2), & \text{when } x \le 0 \\ 3x+1, & \text{when } x > 0 \end{cases}$ is given to be continuous at x = 0, then the value of k is

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

35. $\sin\left[\frac{\pi}{6} - \sin^{-1}\left(-\frac{1}{2}\right)\right]$ is equal to

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

36. If $A = \left[a_{ij}\right]$ is matrix of order 2×2, such that $|A| = -15$ and C_{ij} represents the cofactor of a_{ij}, then the value of $a_{21}C_{21} + a_{22}C_{22}$ is

(A) 18 (B) 15
(C) 10 (D) –15

37. If the following function $f(x) = \begin{cases} \frac{\sin 3x}{x}, & \text{when } x \ne 0 \\ k, & \text{when } x = 0 \end{cases}$ is given to be continuous at x = 0, then the value of k is

(A) 3 (B) 2
(C) 1 (D) None of these

38. The value of the expression $\sin\left[\cot^{-1}\left(\cos\left(\tan^{-1}1\right)\right)\right]$ is

(A) 0 (B) 1
(C) $\frac{1}{\sqrt{3}}$ (D) $\sqrt{\frac{2}{3}}$

39. If A and B are square matrices of order 3 such that $|A| = -1, |B| = 3,$ then the value of $|2AB|$ is

(A) 24 (B) –24
(C) 20 (D) None of these

40. The function $f(x) = \begin{cases} \dfrac{x^2 - 9}{x - 3}, & \text{if } x \neq 3 \\ 2x + k, & \text{if } x = 3 \end{cases}$ is continuous function at x = 3, then k is

(A) 3 (B) 0
(C) –6 (D) $\dfrac{1}{6}$

SECTION – C

*This section contains **10 Multiple Choice Questions** number **41 to 50, out of which 5 questions are based on case studies.** Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE** is correct.*

41. The value of $\tan\left(2\tan^{-1}\frac{1}{3}\right)$ is

(A) $\frac{12}{5}$ **(B)** $\frac{3}{4}$

(C) $\frac{4}{5}$ (D) $\frac{5}{12}$

42. If $\Delta=\begin{vmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{vmatrix}$ and A_{ij} is a cofactor of a_{ij}, then the value of Δ is given by

(A) $a_{11}A_{31}+a_{12}A_{32}+a_{13}A_{33}$ (B) $a_{11}A_{11}+a_{12}A_{12}+a_{13}A_{13}$

(C) $a_{21}A_{31}+a_{22}A_{32}+a_{23}A_{33}$ (D) $a_{11}A_{31}+a_{21}A_{32}+a_{31}A_{33}$

43. The value of A and B such that the function $f(x)=\begin{cases} -2\sin x, & \text{if} \quad x\le -\frac{\pi}{2} \\ A\sin x+B, & \text{if} \quad -\frac{\pi}{2}<x<\frac{\pi}{2} \\ \cos x, & \text{if} \quad x\ge \frac{\pi}{2} \end{cases}$ is

continuous everywhere are

(A) A = 0, B = 1 (B) A = 1, B = 1

(C) A = –1, B = 1 (D) A = –1, B = 0

44. If $\text{adj.}A=\begin{bmatrix} 4 & 1 \\ 7 & 5 \end{bmatrix}$, the value of $|A|$ is

(A) 13 (B) –13

(C) 169 (D) None of these

45. If $y=\log\left(\sec\left(e^{x^2}\right)\right)$, then $\frac{dy}{dx}=$

(A) $2x\left(\tan e^{x^2}\right)e^{x^2}$ (B) $2x^{e^{x^2}}\left(\tan e^{x^2}\sec e^{x^2}\right)$

(C) $e^{x^2}\tan e^{x^2}$ (D) $x^{2^{e^{x^2}}}\tan e^{x^2}$

Case Study

Read the following and answer any four questions from (46) to (50):

Amit, Biraj and Chirag were given the task of creating a square matrix of order 2.
Below are the matrices created by them, A, B, C are the matrices created by Amit, Biraj and Chirag respectively.

$A:\begin{bmatrix}1 & 2\\ -1 & 3\end{bmatrix}, B=\begin{bmatrix}4 & 0\\ 1 & 5\end{bmatrix}$ and $C=\begin{bmatrix}2 & 0\\ 1 & -2\end{bmatrix}$

If a = 4 and b = –2, based on the above information answer the following

46 Sum of the matrices A, B and C, i.e. A + (B + C) is

(A) $\begin{bmatrix}1 & 6\\ 2 & 7\end{bmatrix}$ (B) $\begin{bmatrix}6 & 1\\ 7 & 2\end{bmatrix}$

(C) $\begin{bmatrix}7 & 2\\ 1 & 6\end{bmatrix}$ (D) $\begin{bmatrix}2 & 1\\ 7 & 6\end{bmatrix}$

47. $\left(A^T\right)^T$ is equal to

(A) $\begin{bmatrix}1 & 2\\ -1 & 3\end{bmatrix}$ (B) $\begin{bmatrix}2 & 1\\ 3 & -1\end{bmatrix}$

(C) $\begin{bmatrix}1 & -1\\ 2 & 3\end{bmatrix}$ (D) $\begin{bmatrix}2 & 3\\ -1 & 1\end{bmatrix}$

48. $(bA)^T$ is equal to

(A) $\begin{bmatrix}-2 & -4\\ 2 & -6\end{bmatrix}$ (B) $\begin{bmatrix}-2 & 2\\ -4 & -6\end{bmatrix}$

(C) $\begin{bmatrix}-2 & 2\\ -6 & -4\end{bmatrix}$ (D) $\begin{bmatrix}-6 & -2\\ 2 & 4\end{bmatrix}$

49. AC – BC is equal to

(A) $\begin{bmatrix}-4 & -6\\ -4 & 4\end{bmatrix}$ (B) $\begin{bmatrix}-4 & -4\\ 4 & -6\end{bmatrix}$

(C) $\begin{bmatrix}-4 & -4\\ 4 & -6\end{bmatrix}$ (D) $\begin{bmatrix}-6 & 4\\ -4 & -4\end{bmatrix}$

50. $(a+b)B$ is equal to

(A) $\begin{bmatrix}0 & 8\\ 10 & 2\end{bmatrix}$ (B) $\begin{bmatrix}2 & 10\\ 8 & 0\end{bmatrix}$

(C) $\begin{bmatrix}8 & 0\\ 2 & 10\end{bmatrix}$ (D) $\begin{bmatrix}2 & 0\\ 8 & 10\end{bmatrix}$