# FIITJEE

# CBSE TERM - I

## ALL XII$^{TH}$ STUDYING BATCHES

# Full Test – II

## MATHEMATICS

## (18$^{th}$ November 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. The Relation R in the set $\{1,2,3\}$ given by $R = \{(1,1),(2,2),(3,3),(1,2),(2,3)\}$ is
   (A) equivalence
   (B) symmetric
   (C) transitive
   (D) reflexive but neither symmetric nor transitive

2. Let T be the set of all triangles in a plane with R a relation in T given by $R = \{(T_1, T_2)$ : $T_1$ is congruent to $T_2\}$. Then, R is
   (A) reflexive only
   (B) not transitive
   (C) an equivalence relation
   (D) symmetric only

3. Let N be the set of natural numbers and the function $f: N \to N$ be defined by $f(n) = 2n + 3, \forall n \in N$. Then, f is
   (A) surjective
   (B) injective
   (C) bijective
   (D) None of these

4. The domain of the function $\cos^{-1}(2x-1)$ is
   (A) [0, 1]
   (B) [–1, 1]
   (C) (1, –1)
   (D) $[0, \pi]$

5. The value of $\tan^{-1}\left[2\sin\left(2\cos^{-1}\frac{\sqrt{3}}{2}\right)\right]$ is
   (A) $\frac{\pi}{3}$
   (B) $\frac{2\pi}{3}$
   (C) $\frac{-\pi}{3}$
   (D) $\frac{\pi}{6}$

6. The value of $\cos^{-1}\left(\frac{1}{2}\right) + 2\sin^{-1}\left(\frac{1}{2}\right)$ is
   (A) $\frac{2\pi}{3}$
   (B) $\frac{\pi}{3}$
   (C) $\frac{-2\pi}{3}$
   (D) $\frac{-\pi}{10}$

7. If $2\times 2$ matrix $A=\left[a_{ij}\right]$, whose elements are given by $a_{ij}=i+j^2$, then matrix A is

(A) $\begin{bmatrix}2 & 5\\ 3 & 6\end{bmatrix}$ (B) $\begin{bmatrix}2 & 3\\ 5 & 6\end{bmatrix}$

(C) $\begin{bmatrix}2 & 6\\ 3 & 5\end{bmatrix}$ (D) $\begin{bmatrix}3 & 6\\ 2 & 5\end{bmatrix}$

8. Which of the given values of x and y make the following pair of matrices equal?

$\begin{bmatrix}3x+7 & 5\\ y+1 & 2-3x\end{bmatrix}, \begin{bmatrix}0 & y-2\\ 8 & 9\end{bmatrix}$

(A) $x=-\frac{1}{3}, y=7$ (B) $x=-\frac{7}{3}, y=7$

(C) $x=\frac{2}{3}, y=7$ (D) None of these

9. After applying $R_2\to R_2-2R_1$ to $C=\begin{bmatrix}1 & 2\\ 2 & -1\end{bmatrix}$, we get

(A) $\begin{bmatrix}1 & 2\\ 2 & -1\end{bmatrix}$ (B) $\begin{bmatrix}1 & 2\\ 0 & -5\end{bmatrix}$

(C) $\begin{bmatrix}1 & 4\\ 2 & -3\end{bmatrix}$ (D) $\begin{bmatrix}2 & -1\\ 1 & 2\end{bmatrix}$

10. If $\begin{vmatrix}x & 2\\ 18 & x\end{vmatrix}=\begin{vmatrix}6 & 2\\ 18 & 6\end{vmatrix}$, then x is equal to

(A) 6 (B) $\pm 6$

(C) –6 (D) 0

11. If $A=\begin{bmatrix}2 & 3\\ 1 & 4\end{bmatrix}$, then adj A is

(A) $\begin{bmatrix}2 & 1\\ 4 & 3\end{bmatrix}$ (B) $\begin{bmatrix}4 & 2\\ 2 & 1\end{bmatrix}$

(C) $\begin{bmatrix}4 & -3\\ 1 & 2\end{bmatrix}$ (D) $\begin{bmatrix}4 & -3\\ -1 & 2\end{bmatrix}$

12. If area of triangle is 4 sq. units with vertices (k, 0), (4, 0) and (0, 2), then value of k are

(A) 0, 8 (B) 0, –8

(C) 0, 6 (D) 0, –6

13. If $f(x)=\begin{cases}3x-8, & x\le 5\\ 2k, & x>5\end{cases}$ is continuous at x = 5, then value of k is

(A) $\frac{7}{2}$ (B) $\frac{6}{5}$

(C) 7 (D) $\frac{8}{9}$

14. If $y=\log\left(\frac{1-x^2}{1+x^2}\right)$, then $\frac{dy}{dx}$ is equal to

(A) $\frac{4x^3}{1-x^4}$ (B) $\frac{-4x}{1-x^4}$

(C) $\frac{1}{4-x^4}$ (D) $\frac{-4x^3}{1-x^4}$

15. The derivative of $\cos^{-1}\left(e^x\right)$ w.r.t. x is

(A) $\frac{2e^x}{\sqrt{1-e^{2x}}}$ (B) $\frac{e^x}{\sqrt{1-e^{2x}}}$

(C) $\frac{-e^x}{\sqrt{1-e^{2x}}}$ (D) None of these

16. The function $f(x)=\tan x-x$ is

(A) always increases
(B) always decreases
(C) never increases
(D) sometimes increases and sometimes decreases

17. The tangent to the curve $y=e^{2x}$ at the point (0, 1) meets X axis at

(A) (0, 1) (B) $\left(-\frac{1}{2},0\right)$

(C) (2, 0) (D) (0, 2)

18. If the function f be given by $f(x)=2x^3-6x^2+6x+5$, then

(A) x = 0 is the only critical point of f (B) x = 1 is the point of local minima
(C) x = 1 is the point of local maxima (D) x = 1 is a point of inflexion

19. If $A=\begin{bmatrix} \frac{2}{3} & 1 & \frac{5}{3} \\ \frac{1}{3} & \frac{2}{3} & \frac{4}{3} \\ \frac{7}{3} & 2 & \frac{2}{3} \end{bmatrix}$ and $B=\begin{bmatrix} \frac{2}{5} & \frac{3}{5} & 1 \\ \frac{1}{5} & \frac{2}{5} & \frac{4}{5} \\ \frac{7}{5} & \frac{6}{5} & \frac{3}{5} \end{bmatrix}$ then $3A-5B$ is

(A) $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 1 & 0 \end{bmatrix}$ (B) $\begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$

(C) $\begin{bmatrix} 0 & 1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$ (D) $\begin{bmatrix} 0 & 0 & 1 \\ 0 & 0 & 1 \\ 1 & 0 & 0 \end{bmatrix}$

20. The linear programming problem minimize $Z=3x+2y$

$$x+y\geq 8$$

Subject to the constraints $3x+5y\leq 15$ has

$$x\geq 0,\ y\geq 0$$

(A) one solution
(B) no feasible solution
(C) two solutions
(D) infinitely many solutions

# 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. The Relation R is the set of real numbers, define as $R = \{(a,b) : a \le b^2\}$ is

(A) reflexive
(B) symmetric
(C) transitive
(D) neither reflexive nor symmetric nor transitive

22. Let $A = R - \{3\}$ and $B = R - \{1\}$. Consider the function $f : A \to B$ defined by $f(x) = \dfrac{x-2}{x-3}$, then $f(x)$ is

(A) one – one
(B) onto
(C) one – one and onto
(D) None of these

23. Let $A = [-1, 1]$, then the function $f(x) = x|x|$ defined on A is

(A) one – one
(B) onto
(C) bijective
(D) none of these

24. The principal value of $\sin^{-1}\left(\dfrac{1}{2}\right) + \cos^{-1}\left(\dfrac{1}{2}\right)$ is

(A) $\dfrac{\pi}{2}$
(B) $\dfrac{\pi}{3}$
(C) $\dfrac{\pi}{4}$
(D) $\dfrac{\pi}{6}$

25. The value of $\sin\left[\dfrac{\pi}{3} - \sin^{-1}\left(\dfrac{1}{2}\right)\right]$ is

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

26. The value of $\tan^{-1}\left[\dfrac{2}{\sqrt{3}}\sin\left(2\sin^{-1}\dfrac{\sqrt{3}}{2}\right)\right]$ is

(A) $\dfrac{\pi}{4}$
(B) $\dfrac{\pi}{2}$
(C) $\dfrac{\pi}{6}$
(D) $\pi$

27. If $3\times3$ matrix $A=\left[a_{ij}\right]_{3\times3}$, whose elements are given by $a_{ij}=2i-3j$, then matrix A is

(A) $\begin{bmatrix}-1 & -4 & -7\\ 1 & -2 & -5\\ 3 & 0 & -3\end{bmatrix}$ (B) $\begin{bmatrix}-1 & 1 & 3\\ -4 & -2 & 0\\ -7 & -5 & -3\end{bmatrix}$

(C) $\begin{bmatrix}-1 & -4 & -7\\ 1 & 2 & 5\\ 3 & 0 & -3\end{bmatrix}$ (D) $\begin{bmatrix}-1 & 4 & 7\\ 1 & -2 & 5\\ 0 & 3 & -3\end{bmatrix}$

28. If $\begin{bmatrix}x+3y & y\\ 7-x & 4\end{bmatrix}=\begin{bmatrix}4 & -1\\ 0 & 4\end{bmatrix}$, then value of x and y are respectively

(A) –1, 7 (B) 7, –1
(C) 1, 6 (D) 6, 1

29. On using elementary column operations $C_2\to C_2-2C_1$ in the following matrix equation $\begin{bmatrix}1 & -3\\ 2 & 4\end{bmatrix}=\begin{bmatrix}1 & -1\\ 0 & -1\end{bmatrix}\begin{bmatrix}3 & 1\\ 2 & 4\end{bmatrix}$, we have

(A) $\begin{bmatrix}1 & -5\\ 0 & 4\end{bmatrix}=\begin{bmatrix}1 & -1\\ -2 & 2\end{bmatrix}\begin{bmatrix}3 & -5\\ 2 & 0\end{bmatrix}$ (B) $\begin{bmatrix}1 & -5\\ 0 & 4\end{bmatrix}=\begin{bmatrix}1 & -1\\ 0 & 1\end{bmatrix}\begin{bmatrix}3 & -5\\ 0 & 2\end{bmatrix}$

(C) $\begin{bmatrix}1 & -5\\ 2 & 0\end{bmatrix}=\begin{bmatrix}1 & -3\\ 0 & 1\end{bmatrix}\begin{bmatrix}3 & 1\\ -2 & 4\end{bmatrix}$ (D) $\begin{bmatrix}1 & -5\\ 2 & 0\end{bmatrix}=\begin{bmatrix}1 & -1\\ 0 & 1\end{bmatrix}\begin{bmatrix}3 & -5\\ 2 & 0\end{bmatrix}$

30. The value of $\begin{vmatrix}3 & -4 & 5\\ 1 & 1 & -2\\ 2 & 3 & 1\end{vmatrix}$ is

(A) 46 (B) 64
(C) 45 (D) 42

31. If $\begin{vmatrix}2x+5 & 3\\ 5x+2 & 9\end{vmatrix}=0$, then the value of x is

(A) –12 (B) –13
(C) 12 (D) 13

32. If $A=\begin{bmatrix}2 & 5\\ 1 & 3\end{bmatrix}$, then $A^{-1}$ is

(A) $\begin{bmatrix}3 & -5\\ -1 & 2\end{bmatrix}$ (B) $\begin{bmatrix}3 & 1\\ -5 & 2\end{bmatrix}$

(C) $\begin{bmatrix}1 & 2\\ 3 & -5\end{bmatrix}$ (D) $\begin{bmatrix}3 & 5\\ 1 & -2\end{bmatrix}$

33. If $\sin y + x = \log x$, then $\frac{dy}{dx}$ is equal to

(A) $\frac{1-x}{\cos y}$ (B) $\frac{1+x}{\cos y}$

(C) $\frac{1+x}{x\cos y}$ (D) $\frac{1-x}{x\cos y}$

34. If $y = \tan^{-1}\left(\frac{\sqrt{x}+\sqrt{a}}{1-\sqrt{ax}}\right)$, then $\frac{dy}{dx}$ is equal to

(A) $\frac{1}{2\sqrt{x}[1+x]}$ (B) $\frac{1}{2x(1+x)}$

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

35. If $y = \log\left\{\tan\left(\frac{\pi}{4}+\frac{x}{2}\right)\right\}$, then $\frac{dy}{dx}$ is equal to

(A) cos x (B) sec x

(C) – cos x (D) sin x

36. The interval for which the function $f(x) = \cot^{-1}x + x$ increase is

(A) $(-1, 1)$ (B) $[-2, 2)$

(C) $(-\infty, \infty)$ (D) None of these

37. The equation of tangent to the curve $\frac{x^2}{a^2}-\frac{y^2}{b^2}=1$ at the point $\left(\sqrt{2}a, b\right)$ is

(A) $\sqrt{2}bx + ay = ab$ (B) $\sqrt{2}\,bx - ay = ab$

(C) $\sqrt{2}bx + y = ab$ (D) $2bx - ay = ab$

38. The slope of the normal to the curve $y = 2x^2 + 3\sin x$ at x = 0 is

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

(C) –3 (D) $\frac{-1}{3}$

39. If $\Delta = \begin{vmatrix} 1 & 0 & 4 \\ 3 & 5 & -1 \\ 0 & 1 & 2 \end{vmatrix}$, then

(A) $C_{11} = -11, C_{22} = 2, C_{31} = 20$ (B) $M_{21} = 6, M_{12} = 6, M_{31} = 20$

(C) $C_{33} = -20, C_{21} = 4, C_{13} = 3$ (D) $M_{11} = -11, M_{22} = 2, M_{32} = 13$

40. The maximum value of $Z = 11x + 7y$ subject to $x \le 3, y \le 2, x \ge 0$ and $y \ge 0$ is

(A) 47 (B) 50

(C) 51 (D) 33

# 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 principal value of $\tan^{-1}\left(\tan\frac{3\pi}{5}\right)$ is

(A) $\frac{2\pi}{5}$ (B) $\frac{-2\pi}{5}$

(C) $\frac{3\pi}{5}$ (D) $\frac{-3\pi}{5}$

42. Suppose P and Q are two different matrices of order $3\times n$ and $n\times p$, then the order of the matrix $P\times Q$ is

(A) $3\times p$ (B) $p\times 3$

(C) $n\times n$ (D) $3\times 3$

43. If A is a square matrix of order 3 and $|A|=5$, then the value of $|2A'|$ is

(A) –10 (B) 10

(C) –40 (D) 40

44. The value of $\sin^{-1}\left(\cos\frac{3\pi}{5}\right)$ is

(A) $\frac{\pi}{10}$ (B) $\frac{3\pi}{5}$

(C) $\frac{-\pi}{10}$ (D) $\frac{-3\pi}{5}$

45. If $y=x^x$, then $\frac{dy}{dx}$ is

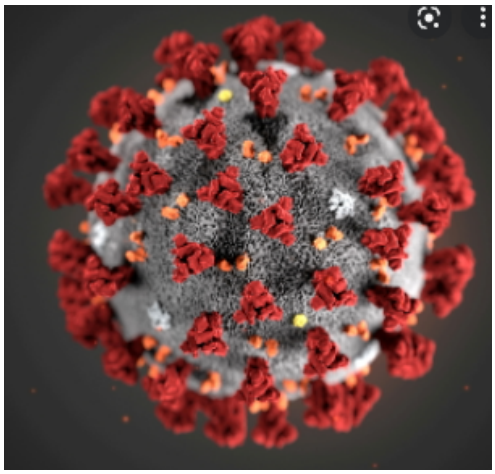
(A) $x^x(1-\log x)$ (B) $x^x\log\left(\frac{x}{e}\right)$

(C) $x^x\log\left(\frac{e}{x}\right)$ (D) $x^x\log(ex)$

## Case Study

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

Central government hired an organization to spread awareness about corona virus, in three ways: telephone, house calls and letters.



The cost per contact (in paise) is given in the matrix A as

Cost per contact

$$A = \begin{bmatrix} 30 \\ 50 \\ 40 \end{bmatrix} \begin{matrix} \text{Telephone} \\ \text{House call} \\ \text{Letter} \end{matrix}$$

The number of contacts of each type made in two cities X and is given by

$$B = \begin{bmatrix} 100 & 500 & 100 \\ 300 & 200 & 500 \end{bmatrix} \begin{matrix} \rightarrow X \\ \rightarrow Y \end{matrix}$$

On the basis of above information, answer the following questions,

46. The order of the matrix A is
(A) $1 \times 3$ (B) $3 \times 1$
(C) $1 \times 1$ (D) $3 \times 3$

47. The order of the matrix B is
(A) $2 \times 3$ (B) $3 \times 2$
(C) $3 \times 3$ (D) $2 \times 2$

48. BA =
(A) $\begin{bmatrix} 32000 & 39000 \end{bmatrix}$ (B) $\begin{bmatrix} 32000 \\ 39000 \end{bmatrix}$
(C) $\begin{bmatrix} 39000 & 32000 \end{bmatrix}$ (D) $\begin{bmatrix} 39000 \\ 32000 \end{bmatrix}$

49. (BA)' =

(A) $\begin{bmatrix}32000 & 39000\end{bmatrix}$

(B) $\begin{bmatrix}39000 & 32000\end{bmatrix}$

(C) $\begin{bmatrix}32000\\39000\end{bmatrix}$

(D) $\begin{bmatrix}39000\\32000\end{bmatrix}$

50. $(A+B)'$ has order

(A) $3\times1$

(B) $2\times3$

(C) $2\times2$

(D) cannot be determined