

FIITJEE

CBSE TERM - I ALL XIITH STUDYING BATCHES

Full Test – I

MATHEMATICS (16th 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 value of x such that $\begin{bmatrix} 1 & 1 & x \\ 0 & 2 & 1 \\ 2 & 1 & 0 \end{bmatrix} \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix} = [0]$

(A) -1 (B) -2
(C) 1 (D) 2
2. The range of the function $f(x) = 11 - 3 \sin x$ is

(A) $[6, 14]$ (B) $[8, 14]$
(C) $[8, 12]$ (D) $[8, 11]$
3. If $f(x) = \begin{vmatrix} 1 & x & x+1 \\ 2x & x(x-1) & (x+1)x \\ 3x(x-1) & x(x-1)(x-2) & (x+1)x(x-1) \end{vmatrix}$, then $f(100)$ is equal to

(A) 0 (B) 1
(C) 100 (D) -100
4. The parameter on which the value of the determinant $\begin{vmatrix} 1 & a & a^2 \\ \cos(p-d)x & \cos px & \cos(p+d)x \\ \sin(p-d)x & \sin px & \sin(p+d)x \end{vmatrix}$ does not depend upon is

(A) a (B) p
(C) d (D) x
5. The value of $\tan\left(2 \tan^{-1}\left(\frac{1}{5}\right) - \frac{\pi}{4}\right)$ is equal to

(A) $\frac{7}{17}$ (B) $\pi - \frac{7}{17}$
(C) $-\frac{7}{17}$ (D) none of these
6. A tangent to the curve $y = \frac{x^2}{2}$ which is parallel to the line $y = x$ cuts off an intercept from the y-axis is

(A) 1 (B) $-1/3$
(C) $1/2$ (D) $-1/2$

7. If $y = \sqrt{\sin x + \sqrt{\sin x + \sqrt{\sin x + \dots \infty}}}$, then the value of $\frac{dy}{dx}$ is
- (A) $\frac{\sqrt{\sin x}}{\sqrt{y+1}}$ (B) $\frac{\sin x}{y+1}$
 (C) $\frac{\cos x}{2y+1}$ (D) $\frac{\cos x}{2y-1}$
8. Period of the function $|\cos 2x|$ is
- (A) 2π (B) π
 (C) $\frac{\pi}{2}$ (D) $\frac{\pi}{4}$
9. If $A = \begin{bmatrix} 4 & x+2 \\ 2x-3 & x+1 \end{bmatrix}$ is symmetric, then x is equal to
- (A) 4 (B) 5
 (C) 6 (D) 7
10. The value of the determinant $\begin{vmatrix} 1 & 1 & 1 \\ p & q & r \\ p^2 - qr & q^2 - pr & r^2 - pq \end{vmatrix}$ is
- (A) pqr (B) $p + q + r$
 (C) $p + q + r - pqr$ (D) 0
11. $f(x) = \begin{cases} ax^2 + bx + c, & |x| > 1 \\ x + 1, & |x| \leq 1 \end{cases}$. If f(x) is continuous for all values of x, then;
- (A) $b = 1, a + c = 0$ (B) $b = 0, a + c = 2$
 (C) $b = 1, a + c = 1$ (D) none of these
12. If $\sin^{-1}x + \tan^{-1}x = \frac{\pi}{2}$, then $2x^2 + 1 =$
- (A) $\sqrt{5}$ (B) $\frac{\sqrt{5}-1}{2}$
 (C) 2 (D) none of these
13. The derivative of $f(x) = |x|$ at $x = 0$ is
- (A) 1 (B) 0
 (C) -1 (D) does not exist
14. If f(x) is a function that is odd and even simultaneously, then $f(3) - f(2)$ is equal to
- (A) 1 (B) -1
 (C) 0 (D) none of these

15. If $A = \text{diagonal}(d_1, d_2, \dots, d_n)$, then A^n is
 (A) diagonal $(d_1^{n-1}, d_2^{n-2}, \dots, d_n^{n-1})$ (B) diagonal $(d_1^n, d_2^n, \dots, d_n^n)$
 (C) A (D) none
16. $\lim_{x \rightarrow 0} \frac{1 - \cos x}{x^2}$ is equal to
 (A) π (B) $1/4$
 (C) $1/2$ (D) 1
17. Value of $\cos(2 \cos^{-1}(4/5))$ equals to
 (A) $6/25$ (B) $7/25$
 (C) $4/25$ (D) $8/25$
18. The absolute minimum value of $x^4 - x^2 - 2x + 5$
 (A) is equal to 5 (B) is equal to 3
 (C) is equal to 7 (D) does not exist
19. If $f(x)$ and $g(x)$ be two given function with all real numbers as their domain, then $h(x) = (f(x) + f(-x)) (g(x) - g(-x))$. is
 (A) always an odd function
 (B) an odd function when both the f and g are odd
 (C) an odd function when f is even and g is odd
 (D) none of these
20. If a matrix has 12 elements, no. of possible orders it can have
 (A) 2 (B) 4
 (C) 6 (D) none

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. Let $h(x) = \min\{x, x^2\}$ for every real number x , then
 (A) h is continuous for all x (B) h is differentiable for all x
 (C) $h'(x) = 1 \forall x > 0$ (D) none of these
22. If $4 \cos^{-1}x + \sin^{-1}x = \pi$ then x equals to
 (A) $1/2$ (B) $1/\sqrt{2}$
 (C) 1 (D) $\sqrt{3}/2$
23. The function defined as $f: \left[-\frac{\pi}{2}, \frac{\pi}{2}\right] \rightarrow [-1, 1]$, $f(x) = \sin x$ is
 (A) one-one onto (B) many-one onto
 (C) one-one into (D) many-one into
24. The equation of the tangent to the curve $f(x) = 1 + e^{-2x}$ where it cuts the line $y = 2$ is
 (A) $x + 2y = 2$ (B) $2x + y = 2$
 (C) $x - 2y = 1$ (D) $x - 2y + 2 = 0$
25. If $A = \begin{bmatrix} 3 & 4 \\ 1 & -6 \end{bmatrix}$, $B = \begin{bmatrix} -2 & 5 \\ 6 & 1 \end{bmatrix}$ and $A + 2X = B$, then matrix X is
 (A) $\begin{bmatrix} -5/2 & 1/2 \\ 5/2 & 7/2 \end{bmatrix}$ (B) $\begin{bmatrix} 5/2 & 1/2 \\ -5/2 & 7/2 \end{bmatrix}$
 (C) $\begin{bmatrix} 5/2 & -1/2 \\ 5/2 & 7/2 \end{bmatrix}$ (D) none
26. The number of points of non differentiability for the function $f(x) = |\log|x||$ are
 (A) 2 (B) 4
 (C) 5 (D) 3
27. Number of solution to the equation $\sin^{-1}x - \cos^{-1}x = \cos^{-1}\left(\frac{\sqrt{3}}{2}\right)$ is
 (A) one (B) two
 (C) four (D) none of these
28. If $f(x) = \sin x - 1$ then the range of $f(x)$ is
 (A) $[-2, 0]$ (B) $[0, 1]$
 (C) $[-1, 1]$ (D) $[-1, 0]$

29. A function $f(x)$ is defined as $f(x) = \begin{cases} x^2 - 3x + a, & x < 1 \\ -2, & x = 1 \\ bx + 3, & x > 1 \end{cases}$

What are the values of a and b respectively such that $f(x)$ is continuous at $x = 1$.

- (A) 1, -2 (B) 0, -5
(C) -1, 0 (D) 2, -3

30. If $\cos^{-1}x + \cos^{-1}y + \cos^{-1}z = 3\pi$, then $x^3 + y^3 + z^3$ is equal to
(A) -3 (B) 3
(C) 0 (D) None of these

31. Period of $|\sin 2x| + |\cos 8x|$ is:
(A) $\pi/2$ (B) $\pi/8$
(C) $\pi/16$ (D) None of these

32. The function $f(x) = |x| + |x - 1|$ is
(A) continuous at $x = 1$, but not differentiable
(B) both continuous and differentiable at $x = 1$
(C) not continuous at $x = 1$
(D) none of these

33. The value of $\tan[\cos^{-1} 4/5 + \tan^{-1} 2/3]$ or $\tan[\sin^{-1}(3/5) + \cot^{-1} 3/2]$ is
(A) 6/17 (B) 7/16
(C) 17/6 (D) none of these

34. The domain of $f(x) = \sqrt{\frac{2-x}{x+1}}$ is
(A) (-1, 2) (B) $\mathbb{R} - (-1, 2]$
(C) $\mathbb{R} - [-1, 2)$ (D) (-1, 2]

35. The principal value of $\sin^{-1}(\sin \frac{2\pi}{3})$ is
(A) $-2\pi/3$ (B) $2\pi/3$
(C) $4\pi/3$ (D) None of these

36. The function and its inverse
(A) are symmetric about $y = x$ line
(B) meet each other along the line $y = x$
(C) are symmetric about $y + x = 0$ line
(D) never intersect each other.

37. If $f(x) = \begin{cases} ax^2 + b, & x \leq 1 \\ bx^2 + ax + c, & x > 1 \end{cases}$, $b \neq 0$. Then $f(x)$ is continuous and differentiable at $x = 1$ if
(A) $c = 0, a = 2b$ (B) $a = b, c \in \mathbb{R}$
(C) $a = b, c = 0$ (D) $a = b, c \neq 0$

38. Let $f(-x) = f(x)$. Then $f'(x)$ must be
(A) an even function (B) an odd function
(C) a periodic function (D) neither odd nor even
39. The function $f(x) = (1 - x)^{1/3}$ is
(A) one– one & onto (B) many– one & onto
(C) one– one & into (D) many– one & into
40. If $y = \sin(\sin^{-1} 2x + \cos^{-1} 2x)$, $|x| \leq \frac{1}{2}$, then find $\frac{dy}{dx}$ is
(A) 1 (B) 0
(C) 2 (D) x

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. In order that a relation R defined on a non – empty set A is an equivalence relation, it is sufficient if R
 (A) is reflexive (B) is symmetric
 (C) is transitive (D) possesses all the above three properties
42. Let $A = \{1,2,3\}$ and consider the relation $R = \{(1,1),(2,2),(3,3),(1,2),(2,3),(1,3)\}$. The R is
 (A) reflexive but not symmetric (B) reflexive but not transitive
 (C) symmetric and transitive (D) neither symmetric nor transitive
43. The value of $\sin^{-1}\left[\sin\left(-\frac{17\pi}{8}\right)\right]$ is
 (A) $-\frac{17\pi}{8}$ (B) $\frac{17\pi}{8}$
 (C) $\frac{\pi}{8}$ (D) $-\frac{\pi}{8}$
44. If $\begin{bmatrix} x-y & z \\ 2x-y & w \end{bmatrix} = \begin{bmatrix} -1 & 4 \\ 0 & 5 \end{bmatrix}$, the value of $x + y$ is
 (A) 1 (B) 2
 (C) 3 (D) 4
45. If $\cos\left(\sin^{-1}\frac{3}{5} + \cos^{-1}x\right) = 0$, then x is equal to
 (A) $\frac{1}{5}$ (B) $\frac{2}{5}$
 (C) $\frac{3}{5}$ (D) 1

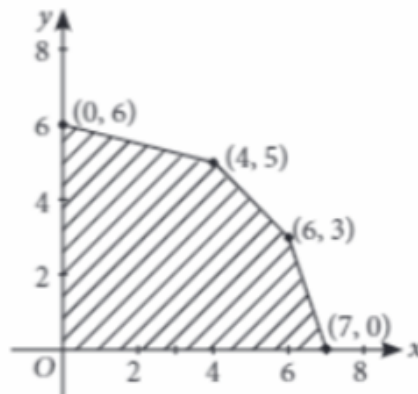
Case Study

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

Linear programming is a method for finding the optional values (maximum or minimum) of quantities subject to the constraints when relationship is expressed as linear equations or inequations.

- 46. The optimal value of the objective, function is attained at the points
 - (A) on X – axis
 - (B) on Y – axis
 - (C) which are corner points of the feasible region
 - (D) none of these
- 47. The graph of the inequality $3x + 4y < 12$ is
 - (A) half plane that contains the origin
 - (B) half plane that neither contains the origin nor the points of the line $3x + 4y = 12$
 - (C) whole XOY – plane excluding the points on line $3x + 4y = 12$
 - (D) None of these

- 48. The feasible region for an LPP is shown in the figure. Let $Z = 2x + 5y$ be the objective function. Maximum of Z occurs at
 - (A) (7, 0)
 - (B) (6, 3)
 - (C) (0, 6)
 - (D) (4, 5)



- 49. The corner points of the feasible region determined by the system of linear constraints are (0, 10), (5, 5), (15, 15), (0, 20). Let $Z = px + qy$, where $p, q > 0$. Condition on p and q also 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) $q = 3p$
- 50. The corner points of the feasible region determined by the system of linear constraints are (0, 0), (0, 40), (20, 40), (60, 20), (60, 0). The objective function is $Z = 4x + 3y$. Compare the quantity in Column A and Column B

Column A	Column B
Maximum of Z	325

- (A) The quantity in column A is greater
- (B) The quantity in column B is greater
- (C) The two quantities are equal
- (D) The relationship cannot be determined on the basis of the information supplied.