Sample Question Paper - 1 (TERM - I)

Class XII (Session - 2021-22)

Subject- Mathematics (Standard)

Time Allowed: 90 minutes **Maximum Marks: 40**

General Instructions:

1. **This question paper contains three sections - A, B and C. Each part is compulsory.**
2. **Section - A has 20 MCQs, attempt any 16 out of 20.**
3. **Section - B has 20 MCQs, attempt any 16 out of 20.**
4. **Section - C has 10 MCQs, attempt any 8 out of 10.**
5. **All questions carry equal marks.**
6. **There is no negative marking.**

Section - A

In this section, attempt any 16 questions out of the Questions Q1 to Q20

Each Question is of 1 mark weightage.

1. If $A = [a_{ij}]$ is a square matrix of order 2 such that $a_{ij} = \begin{cases} 1, \text{ when } i \neq j \\ 0, \text{ when } i = j \end{cases}$, then A^2 is:

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

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

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

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

2. Find the value of k if derivative of the function exists $f'(3) = 4, f(x) = \frac{kx^3}{3}$

(A) $k = \frac{4}{5}$

(B) $k = \frac{4}{7}$

(C) $k = \frac{4}{9}$

(D) $k = \frac{4}{11}$

3. Calculate the determinant of the given matrix $\begin{bmatrix} \sin\frac{\pi}{2} & 1 \\ \left(\sin\frac{\pi}{4}\right)^2 & 2 \end{bmatrix}$.

(A) $\frac{1}{2}$

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

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

(D) None of the above

4. If the set A contains 3 elements and the set B contains 6 elements, then the number of bijective mappings from A to B is:

(A) 520

(B) 10

(C) 0

(D) None of these

5. If $A = \begin{bmatrix} \cos\alpha & \sin\alpha \\ -\sin\alpha & \cos\alpha \end{bmatrix}$, then $A \cdot A^T =$

(A) Null Matrix

(B) I

(C) A

(D) $-A$

6. Let $f: R \to R$ be defined as $f(x) = 5x$. Choose the correct answer.

(A) f is one-one onto

(B) f is many-one onto

(C) f is one-one but not onto

(D) f is neither one-one nor onto

7. Find $\frac{dy}{dx}$ where $y = \operatorname{cosec} x \log x$

(A) $y = -\operatorname{cosec} x \times \cot x \times \log x + \frac{\operatorname{cosec} x}{x}$

(B) $y = \operatorname{cosec} x \times \cot x \times \log x - \frac{\cot x}{x}$

(C) $y = -\operatorname{cosec} x \times \cot x \times \log x - \frac{\cot x}{x}$

(D) $y = \operatorname{cosec} x \times \cot x \times \log x + \frac{\cot x}{x}$

8. Skew symmetric matrix is also called:

(A) symmetric

(B) identical matrix

(C) square matrix

(D) anti symmetric

9. Find $\frac{dy}{dx}$ where $y = e^{-\sin^{-1} x}$

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

(B) $-\frac{y}{\sqrt{1+x^2}}$

(C) $\frac{-e^{\sin^{-1}} x}{\sqrt{1-x^2}}$

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

10. For the constraints of a LPP problem given by $x_1 + 2x_2 \leq 2000, x_1 + x_2 \leq 1500, x_2 \leq 600$ and $x_1, x_2 \geq 0$ the points does not lie in the positive bounded region.

(A) (1000,0)

(B) (0,500)

(C) (2,0)

(D) (2000,0)

11. Let the relation R in the set $A = \{x \in Z: 0 \leq x \leq 12\}$, given by $R = \{(a, b): |a - b|$ is a multiple of $4\}$. Then [1], the equivalence class containing 1 is:

(A) {1,5,9}

(B) {0,1,2,5}

(C) ϕ

(D) A

12. What is the equation of the normal to the curve $y = 3x^2 - 7x + 5$ at $(0,5)$?

(A) $x - 7y + 35 = 0$

(B) $7x - 3y + 35 = 0$

(C) $3x + 7y + 35 = 0$

(D) $3x + 7y + 21 = 0$

13. Which of the function is not differentiable everywhere in R?

(A) $\log x$

(B) $\sin x$

(C) $|x|$

(D) $3x^3 + 5$

14. Value of k, for which $A = \begin{bmatrix} k & 8 \\ 4 & 2k \end{bmatrix}$ is a singular matrix is:

(A) 4

(B) -4

(C) ± 4

(D) 0

15. If $y = \log(\cos e^x)$ then $\frac{dy}{dx}$ will be :

(A) $x\tan e^x$

(B) $-e^{x\tan x}$

(C) $e^x \tan e^x$

(D) $-e^x \tan e^x$

16. The function $y = 5x^2 - 32x$ has a local minimum in the interval $(0,10)$.

(A) $x = 1$

(B) $x = 2$

(C) $x = 3.2$

(D) No local minimum

17. The point at which the normal to the curve $y = x + \frac{1}{x}, x > 0$ is perpendicular to the line $3x - 4y - 7 = 0$ is:

(A) $\left(2, \frac{5}{2}\right)$

(B) $\left(\pm 2, \frac{5}{2}\right)$

(C) $\left(-\frac{1}{2}, \frac{5}{2}\right)$

(D) $\left(\frac{1}{2}, \frac{5}{2}\right)$

18. If $A = \begin{bmatrix} 3 & 1 \\ -1 & 2 \end{bmatrix}$ then $\det(A^2 - 5A + 7I_2)$ is equal to:

(A) 0 (B) 1

(C) -1 (D) 2

19. Matrix $A = \begin{bmatrix} 0 & 3 & 2 \\ -3 & 3 & -5 \\ -2 & 5 & 0 \end{bmatrix}$ is

(A) Skew-symmetric matrix

(B) Symmetric matrix

(C) Scalar matrix

(D) None of these

20. What is second derivative of the function, $y = \log\left(\sqrt{1 - x^2}\right)$.

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

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

(C) $\frac{-1+x^2}{(1-x^2)^2}$

(D) $\frac{1+x^2}{(1-x^2)^2}$

SECTION-B

In this section, attempt any 16 questions out of the Questions 21 − 40.

Each Question is of 1 mark weightage.

21. If $x = a\sec\theta, y = b\tan\theta$, then $\frac{d^2y}{dx^2}$ at $\theta = \frac{\pi}{6}$ is:

(A) $\frac{-3\sqrt{3}b}{a^2}$

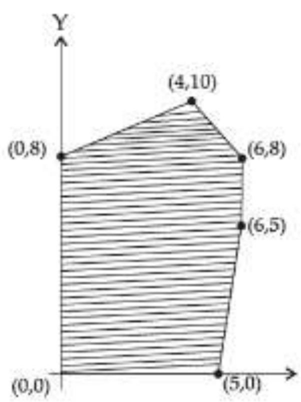
(B) $\frac{-2\sqrt{3}b}{a}$

(C) $\frac{-3\sqrt{3}b}{a}$

(D) $\frac{-b}{3\sqrt{3}a^2}$

22. In the given graph, the feasible region for a LPP is shaded.

The objective function $Z = 2x - 3y$, will be minimum at:



(A) (4,10)

(B) (6,8)

(C) (0,8)

(D) (6,5)

23. A linear programming problem is as follows:

Minimize $Z = 30x + 50y$

subject to the constraints,

$$3x + 5y \geq 15$$
$$2x + 3y \leq 18$$
$$x \geq 0, y \geq 0$$

In the feasible region, the minimum value of Z occurs at

(A) a unique point

(B) no point

(C) infinitely many points

(D) two points only

24. Let R be the relation in the set of integers Z given by $R = \{(a, b) : 3 \text{ divides } a - b\}$.

then R is :

(A) not reflexive

(B) reflexive

(C) symmetric

(D) transitive.

25. If $f(x) = |x|$, then the function is continuous but not differentiable at :

(A) $x = 0$

(B) $x \neq 0$

(C) $x = 1$

(D) $x = 2$

26. A dietician wishes to mix together two kinds of food X and y in such a way that the mixture contains at least 15 units of carbohydrate, at least 17 units of protein and at most 6 units of fat. The nutrient contents of 1 kg food is given below:

Food	Carbohydrate	Protein	Fat
X	1	3	1
Y	2	2	1

1 kg of food X costs Rs 16 and 1 kg of food Y cost Rs 20. Find the least cost of the mixture which will produce the required diet.

(A) 100

(B) 128

(C) 110

(D) 99

27. Which of the following functions from Z into Z are bijections?

(A) $f(x) = x^3$

(B) $f(x) = x + 8$

(C) $f(x) = 4x + 1$

(D) $f(x) = x^2 + 7$

28. Consider the set $A = \{1,3,5,7\}$. The number of reflexive relations on set A is :

(A) 2^{12}

(B) 12^2

(C) 2^4

(D) 4^2

29. The interval on which the function $f(x) = 2x^3 + 9x^2 + 12x - 1$ is decreasing is :

(A) $[-1, \infty)$

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

(C) $(-\infty, -2]$

(D) $[-1,1]$

30. $Z = 7x + y$, subject to $5x + y \leq 5, x + y \geq 3, x \geq 0, y \geq 0$.

Maximum value of Z occurs at

(A) $(3,0)$

(B) $\left(\frac{1}{2}, \frac{5}{2}\right)$

(C) $(0,3)$

(D) $(0,5)$

31. If A and B are symmetric matrices of same order, then $AB - BA$ is a:

(A) Skew-symmetric matrix

(B) Symmetric matrix

(C) Zero matrix

(D) Identity matrix

32. The matrix $\begin{bmatrix} 0 & -5 & 8 \\ 5 & 0 & 12 \\ -8 & -12 & 0 \end{bmatrix}$ is a

(A) diagonal matrix

(B) symmetric matrix

(C) skew symmetric matrix

(D) scalar matrix

33. 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) [25]

(C) [27]

(D) [26]

34. The equation of tangent to the curve $y(1 + x^2) = 2 - x$, where it crosses x-axis is :

(A) $x + 5y = 2$

(B) $x - 5y = 2$

(C) $5x - y = 2$

(D) $5x + y = 2$

35. Let R be the set of real numbers then

$A = \{(x, y) \in R \times R: y - x \text{ is an integer } \}$ is a

(A) only reflexive

(B) only symmetric

(C) transitive relation

(D) empty relation

36. Consider the non-empty set consisting of children in a family and a relation R defined as aRb if a is brother of b. Then R is

(A) symmetric but not transitive

(B) transitive but not symmetric

(C) neither symmetric nor transitive

(D) both symmetric and transitive

37. What is $\frac{d^2y}{dx^2} - \frac{dy}{dx}$ of the given function where $y = e^x \log \sin x$

(A) e^x

(B) $e^x(\operatorname{cosec}^2 x + \cot x)$

(C) $\operatorname{cosec}^2 x - \cot x$

(D) $e^x(-\operatorname{cosec}^2 x + \cot x)$

38. If function, $f(x) = \sin x$, then function in $[0,2\pi]$ is

(A) Decreasing

(B) Increases and then decreases

(C) Continuously increasing

(D) Neither increasing nor decreasing

39. What is the value of $k + m$ if the function is given by,

$$y = \begin{cases} k\cos x, x < \frac{\pi}{4} \\ m\sin x, x > \frac{\pi}{4} \\ y = 3, x = \frac{\pi}{4} \end{cases} \text{ is continuous at } \frac{\pi}{4}?$$

(A) $3\sqrt{2}$

(B) $\sqrt{2}$

(C) $6\sqrt{2}$

(D) $2\sqrt{2}$

40. For the curve $y = 5x - 2x^3$, If x increases at the rate of 2 units/sec, then at $x = 3$, the slope of curve is:

(A) increasing by 36unit/sec

(B) decreasing by 36 unit/sec

(C) decreasing by 72 unit/sec

(D) increasing by 72 unit/sec

SECTION-C

In this section, attempt any 8 questions. Each question is of 1-mark weightage.

41. For an objective function $Z = 3x_1 + 2x_2$, where $x_1, x_2 > 0$; the corner points of the feasible region determined by a set of constraints (linear inequalities) are (0,0), (0,4), (3,1) and (2,0). The condition on x_1 and x_2 such that the maximum and minimum Z occur at the points (3,1) and (0,0) respectively, then the maximum and minimum values are:

(A) Max. = 8, Mini. = 6

(B) $Max.$ = 6, Mini. = 0

(C) $Max_.$ = 8, Mini. = 0

(D) Max. = 11, Mini. = 0

42. The slope of the tangent to the curve $x = 1 - \cos\theta$ and $y = \theta - \sin\theta$ at $\theta = \frac{\pi}{4}$ is:

(A) 1

(B) $\sqrt{2}$

(C) $\sqrt{2} - 1$

(D) $1 - \sqrt{2}$

43. The absolute maximum value of $(x-1)^2 + 3$ in $[-3,1]$ is:

(A) 3

(B) 18

(C) 20

(D) 19

44. For an objective function $Z = 200x + 500y$, subject to the constraints,

$x + 2y \geq 10, 3x + 4y \leq 24, x \geq 0$ and $y \geq 0$. Then the minimum value of Z is:

(A) 2500

(B) 3000

(C) 2300

(D) 2800

45. Let $A = \begin{bmatrix} 2 & -1 & -1 \\ 3 & 1 & -1 \\ 1 & 1 & -1 \end{bmatrix}$, then $|A|$ is:

(A) 0

(B) 1

(C) 4

(D) -4

Questions 45 - 50 are based on a Case-Study.

In the school project Sheetal was asked to construct a triangle and name it as ABC.

Two angles A and B were given to be equal to $\tan^{-1}\frac{1}{2}$ and $\tan^{-1}\frac{1}{3}$ respectively.

46. The value of sin A is

(A) $\frac{1}{2}$

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

(C) $\frac{1}{\sqrt{5}}$

(D) $\frac{2}{\sqrt{5}}$

47. $\cos(A + B + C) =$

(A) 1

(B) 0

(C) -1

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

48. If $B = \cos^{-1} x$, then $x =$

(A) $\frac{1}{\sqrt{5}}$

(B) $\frac{3}{\sqrt{10}}$

(C) $\frac{1}{\sqrt{10}}$

(D) $\frac{2}{\sqrt{5}}$

49. If $A = \sin^{-1} x$; then the value of x is:

(A) $\frac{1}{\sqrt{5}}$

(B) $\frac{2}{\sqrt{5}}$

(C) $\frac{1}{\sqrt{10}}$

(D) $\frac{3}{\sqrt{10}}$

50. The third angle, $\angle C =$

(A) $\frac{\pi}{4}$

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

(C) $\frac{\pi}{2}$

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