Class 12 - Mathematics
Sample Paper - 01

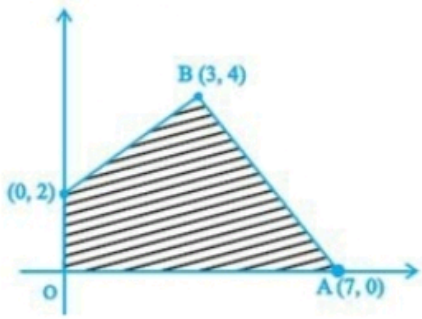
Maximum Marks: 40
Time Allowed: 90 minutes

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
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. There is no negative marking.
6. All questions carry equal marks.

SECTION – A
(Attempt any 16 Questions)

1. A relation R on a non-empty set A is said to be an equivalence relation if
   a. R is reflexive and symmetric
   b. R is reflexive, symmetric and transitive
   c. R is symmetric and transitive
   d. R is reflexive and transitive
2. Feasible region (shaded) for a LPP is shown in Figure. Maximize Z = 5x + 7y.



   a. 45
   b. 49
   c. 47
   d. 43
3. If $y = \frac{\log x}{x}$, then $\frac{d^2y}{dx^2} =$
   a. $\frac{2\log x - 3}{x^3}$
   b. None of these
   c. $\frac{2\log x - 3}{x^4}$
   d. $\frac{3 - 2\log x}{x^3}$
4. Find the area of triangle with vertices (1 ,1) , (2 ,2) and (3, 3).
   a. 1
   b. 3

c. 0
d. 2

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5. The maximum value of Z = 4x + 3y subjected to the constraints $3x + 2y \geq 160$, $5x + 2y > 200$, $x + 2y > 80$; $x, y > 0$ is
   a. None of these
   b. 230
   c. 300
   d. 320
6. The system of equations, $x + y = 2$ and $2x + 2y = 3$ has
   a. a unique solution
   b. finitely many solutions
   c. no solution
   d. infinitely many solutions
7. If $A = \begin{bmatrix} 2 & \lambda & -3 \\ 0 & 2 & 5 \\ 1 & 1 & 3 \end{bmatrix}$, then A^{-1} exists if.
   a. $\lambda = 2$
   b. $\lambda \neq -2$
   c. None of these
   d. $\lambda \neq 2$
8. If $A = \begin{bmatrix} 0 & 2 & 3 \\ -2 & 0 & -7 \\ -3 & 7 & 0 \end{bmatrix}$, then, which of the following is true :
   a. None of these
   b. A = - A'
   c. A = - A
   d. A = A'
9. Maximize $Z = x + y$, subject to $x - y \leq -1$, $-x + y \leq 0$, $x, y \geq 0$.
   a. Maximum Z = 14 at (2, 6)
   b. Maximum Z = 12 at (2, 6)
   c. Z has no maximum value
   d. Maximum Z = 8 at (2, 6)a
10. If $y = \tan^{-1}\sqrt{\frac{1-\cos x}{1+\cos x}}$ then $\frac{dy}{dx} = ?$
    a. $\frac{1}{2}$
    b. None of these
    c. $\frac{-1}{2}$
    d. $\frac{1}{(1+x^2)}$
11. If $x = f(t)\cos t - f'(t)\sin t$ and $y = f(t)\sin t + f'(t)\cos t$, then $\left(\frac{dx}{dt}\right)^2 + \left(\frac{dy}{dt}\right)^2 =$
    a. none of these
    b. $f(t) - f''(t)$
    c. $\{f(t) + f''(t)\}^2$
    d. $\{f(t) - f''(t))\}^2$

12. Two godowns A and B have grain capacity of 100 quintals and 50 quintals respectively. They supply to 3 ration shops, D, E and F whose requirements are 60, 50 and 40 quintals respectively. The cost of transportation per quintal from the godowns to the shops are given in the following table:

Transportation cost per quintal (in Rs)		
From/To	A	B
D	6	4
E	3	2
F	2.5	3

How should the supplies be transported in order that the transportation cost is minimum? What is the minimum cost?

a. From A : 12,52, 40 units; From B: 50,0,0 units to D, E and F respectively and minimum cost = Rs 530
b. From A : 10,50, 40 units; From B: 50,0,0 units to D, E and F respectively and minimum cost = Rs 510
c. From A : 10,53, 44 units; From B: 50,0,0 units to D, E and F respectively and minimum cost = Rs 570
d. From A : 10,52, 42 units; From B: 50,0,0 units to D, E and F respectively and minimum cost = Rs 550

13. The normal to the curve $x^2 = 4y$, passing through (1, 2) is
    a. x + y = 1
    b. x + y = 3
    c. x - y = 3
    d. x - y = 1
14. Let f(x) $= \begin{cases} 1+x & if\ x>0 \\ x & if\ x \leqslant 0 \end{cases}$ then $\underset{x\to 0}{Lt}$ f(x) is equal to
    a. 1
    b. 0
    c. $\frac{1}{2}$
    d. None of these
15. For the curve $\sqrt{x}+\sqrt{y}=1$, $\frac{dy}{dx}$ at (1/4, 1/4) is
    a. 2
    b. -1
    c. 1/2
    d. 1
16. The equations x + 2y + 2z = 1 and 2x + 4y + 4z = 9 have
    a. no solution
    b. only one solution
    c. only two solutions
    d. infinitely many solutions
17. If $y = \tan^{-1}\left(\frac{1-\cos x}{\sin x}\right)$ then $\frac{dy}{dx} = ?$
    a. 1
    b. $\frac{1}{2}$
    c. -1
    d. $\frac{-1}{2}$
18. The value of $\cos^{-1}(-1) - \sin^{-1}(1)$ is
    a. $\frac{3\pi}{2}$

b. π

c. $-\frac{3\pi}{2}$

d. $\frac{\pi}{2}$

19. $\lim_{x \to 0} \frac{2 \sin x - \sin 2x}{x^3}$ is equal to

a. $\frac{1}{2}$

b. 0

c. 1

d. None of these

20. $A = [a_{ij}]_{m \times n}$ is a square matrix, if

a. m = n

b. m > n

c. None of these

d. m < n

SECTION – B

(Attempt any 16 Questions)

21. Let R be the relation in the set {1, 2, 3, 4} given by R = {(1, 2), (2, 2), (1, 1), (4, 4), (1, 3), (3, 3), (3, 2)}. Then R is

a. An equivalence relation.

b. Symmetric and transitive but not reflexive.

c. Reflexive and symmetric but not transitive

d. Reflexive and transitive but not symmetric

22. $f(x) = (x + 1)^3 (x - 3)^3$ is increasing in

a. $(1, \infty)$

b. (-1, 3)

c. $(-\infty, 1)$

d. $(3, \infty)$

23. Determine the maximum value of Z = 11x + 7y subject to the constraints :$2x + y \leq 6$, $x \leq 2$, $x \geq 0$, $y \geq 0$.

a. 47

b. 43

c. 42

d. 45

24. If $y = e^{1/x}$ then $\frac{dy}{dx} = ?$

a. $\frac{-e^{1/x}}{x^2}$

b. $e^{1/x} \log x$

c. $\frac{1}{x} \cdot e^{(1/x - 1)}$

d. None of these

25. If the function f(x) defined by $f(x) = \begin{cases} \frac{\log(1+3x) - \log(1-2x)}{x} & , x \neq 0 \\ k & , x = 0 \end{cases}$ is continuous at x = 0, then k =

a. 5

b. none of these

c. -1

d. 1

26. $\cos(\tan^{-1} x)$ is equal to

a. $\frac{\sqrt{1+x^2}}{x}$
b. $-\frac{1}{\sqrt{1+x^2}}$
c. None of these
d. $\frac{1}{\sqrt{1+x^2}}$

27. S is a relation over the set R of all real numbers and its is given by (a, b) $\in$ S $\Leftrightarrow$ ab $\geq$ 0. Then, S is
a. an equivalence relation
b. reflexive and symmetric only
c. symmetric and transitive only
d. antisymmetric relation

28. If $\alpha = \tan^{-1}\left(\tan\frac{5\pi}{4}\right)$ and $\beta = \tan^{-1}\left(-\tan\frac{2\pi}{3}\right)$, then
a. none of these
b. $\alpha - \beta = \frac{7\pi}{12}$
c. $3a = 4\beta$
d. $4a = 3\beta$

29. The equations 2x + 3y = 7, 14x + 21y = 49 has
a. infinitely many solutions
b. finitely many solutions
c. a unique solution
d. no solution

30. $\begin{vmatrix} \cos 70^\circ & \sin 20^\circ \\ \sin 70^\circ & \cos 20^\circ \end{vmatrix}$ = ?
a. $\cos 50^o$
b. $\sin 50^o$
c. 1
d. 0

31. If $x = t^2, y = t^3$ then $\frac{d^2y}{dx^2}$ is
a. $\frac{3}{2t}$
b. $\frac{3}{4t}$
c. $\frac{3}{2t}$
d. $\frac{3}{4t}$

32. If f (x) = 2x and $g(x) = \frac{x^2}{2} + 1$, then which of the following can be a discontinuous function
a. $f(x) \cdot g(x)$
b. $\frac{g(x)}{f(x)}$
c. f(x) + g(x)
d. f(x) - g (x)

33. The curves $x = y^2$ and xy = k cut orthogonally(perpandicular) when
a. None of these
b. $8k^2 = 1$
c. $4k^2 = 1$
d. $6k^2 = 1$

34. The principal value of $\text{cosec}^{-1}(2)$ is
    a. $\frac{2\pi}{3}$
    b. $\frac{\pi}{3}$
    c. $\frac{5\pi}{6}$
    d. $\frac{\pi}{6}$
35. $\begin{vmatrix} \sin 23^\circ & -\sin 67^\circ \\ \cos 23^\circ & \cos 67^\circ \end{vmatrix}$ = ?
    a. $\frac{\sqrt{3}}{2}$
    b. $\sin 16^o$
    c. 1
    d. $\cos 16^o$
36. The optimal value of the objective function Z = ax + by may or may not exist, if the feasible region for a LPP is
    a. Unbounded
    b. A circle
    c. Bounded
    d. A polygon

37. The value of the determinant $\begin{vmatrix} 1 & 0 & 0 \\ 2 & \cos x & \sin x \\ 3 & \sin x & \cos x \end{vmatrix}$ is
    a. 1
    b. cos2x
    c. sin2x
    d. 0
38. Let $A = \begin{bmatrix} 1 & 0 & 0 \\ 5 & 2 & 0 \\ -1 & 6 & 1 \end{bmatrix}$, then adj (A) is
    a. $\begin{bmatrix} 2 & -5 & 32 \\ 0 & 1 & 6 \\ 0 & 0 & 2 \end{bmatrix}$
    b. $\begin{bmatrix} 2 & -25 & -32 \\ 0 & 2 & -36 \\ 0 & 0 & 1 \end{bmatrix}$
    c. $\begin{bmatrix} 2 & 0 & 0 \\ -25 & 2 & 0 \\ -32 & 36 & 1 \end{bmatrix}$
    d. $\begin{bmatrix} 2 & 0 & 0 \\ -5 & 1 & 0 \\ 32 & -6 & 2 \end{bmatrix}$
39. The differential coefficient of $\log(|\log x|)$ w.r.t. $\log x$ is

a. $\frac{1}{x|\log x|}$

b. $\frac{1}{x \log x}$

c. None of these

d. $\frac{1}{\log x}$

40. Let A = {1, 2, 3} and let R = {(1,1), (2, 2), (3, 3), (1, 2), (2,1), (2, 3), (3, 2)}. Then, R is

a. reflexive and transitive but not symmetric

b. an equivalence relation

c. symmetric and transitive but not reflexive

d. reflexive and symmetric but not transitive

SECTION – C

(Attempt any 8 Questions)

41. The principal value of $\cos^{-1}\left(\cos \frac{13\pi}{6}\right)$ is

a. $\frac{5\pi}{6}$

b. $\frac{7\pi}{6}$

c. $\frac{\pi}{6}$

d. $\frac{13\pi}{6}$

42. The feasible solution for an LPP is shown in Figure. Let Z = 3x – 4y be the objective function. Maximum value of Z occurs at

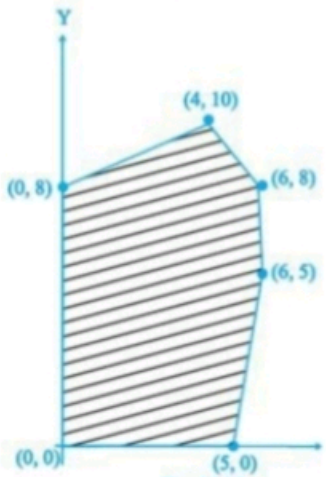

Fig. 12.12

a. (6, 8)

b. (6, 5)

c. (4, 10)

d. (5, 0)

43. The value of k which makes the function defined by $f(x) = \begin{cases} \sin \frac{1}{x}, & \text{if } x \neq 0 \\ k & \text{if } x = 0 \end{cases}$, continuous at x = 0 is

a. 1

b. None of these

c. -1

d. 8

44. The system of equations x + 2y = 5, 4x + 8y =20 has

a. None of these

b. no solution

c. a unique solution
d. infinitely many solutions

45. A relation R on a non – empty set A is an equivalence relation if it is
    a. reflexive, symmetric and transitive
    b. reflexive
    c. reflexive, antisymmetric, transitive
    d. symmetric and transitive

Answer questions 8-12 based on the following case study:

Jyoti has a rectangular painting canvas having a total area of 24 ft^2 which includes a border of 0.5 ft on the left, right, and a border of 0.75 ft on the bottom, top inside it.

Based on the above information, answer the following questions.

46. If Jyoti wants to paint in the maximum area, then she needs to maximize
    a. Area of outer rectangle
    b. Area of inner rectangle
    c. Area of top border
    d. None of these
47. If x is the length of the outer rectangle, then area of inner rectangle in terms of x is
    a. $(x + 3)\left(\frac{24}{x} - 2\right)$
    b. $(x - 1)\left(\frac{24}{x} + 1.5\right)$
    c. $(x - 1)\left(\frac{24}{x} - 1.5\right)$
    d. $(x - 1)\left(\frac{24}{x}\right)$
48. Find the range of x.
    a. $(1, \infty)$
    b. (1, 16)
    c. $(\infty, 16)$
    d. (-1, 16)
49. If area of inner rectangle is maximum, then x is equal to
    a. 2 ft
    b. 3 ft
    c. 4 ft
    d. 5 ft
50. If area of inner rectangle is maximum, then length and breadth of this rectangle are respectively
    a. 3 ft, 4.5 ft
    b. 4.5 ft, 5 ft
    c. 1 ft, 2 ft
    d. 2 ft, 4 ft

