SHREE RADHEY COACHING CENTER

CLASS 12 - MATHEMATICS

Sample Paper 1

Time Allowed: 1 hour and 30 minutes **Maximum Marks: 50**

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. Let R be the relation in the set N given by R = {(a, b) : a = b – 2, b > 6}. **[1]**

a) (6, 8) $\in$ R b) (8, 7) $\in$ R

c) (2, 4) $\in$ R d) (3, 8) $\in$ R

2. By graphical method, the solution of linear programming problem **[1]**

Maximize Z = $3x_1 + 5x_2$

Subject to $3x_1 + 2x_2 \leq 18$

$x_1 \leq 4$

$x_2 \leq 6$

$x_1 \geq 0$, $x_2 \geq 0$, is

a) $x_1 = 2$, $x_2 = 0$, Z = 6 b) $x_1 = 4$, $x_2 = 6$, Z = 42

c) $x_1 = 2$, $x_2 = 6$, Z = 36 d) $x_1 = 4$, $x_2 = 3$, Z = 27

3. If f(x) = e^xsinx in [0, π], then c in Rolle's theorem is **[1]**

a) $\frac{\pi}{6}$ b) $\frac{\pi}{4}$

c) $\frac{3\pi}{4}$ d) $\frac{\pi}{2}$

4. If $A = \begin{bmatrix} 2 & 0 \\ -3 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 4 & -3 \\ -6 & 2 \end{bmatrix}$ are such that 4A + 3X = 5B then X = ? **[1]**

a) $\begin{bmatrix} 4 & -5 \\ -6 & 2 \end{bmatrix}$ b) $\begin{bmatrix} 4 & 5 \\ -6 & -2 \end{bmatrix}$

c) None of these d) $\begin{bmatrix} -4 & 5 \\ 6 & -2 \end{bmatrix}$

5. Maximize Z = x + y, subject to x – y ≤ –1, –x + y ≤ 0, x, y ≥ 0. **[1]**

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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

6. $\begin{vmatrix} 1 & 1 & 1 \\ e & 0 & \sqrt{2} \\ 2 & 2 & 2 \end{vmatrix}$ is equal to **[1]**

a) 0

b) 3e

c) none of these

d) 2

7. If the value of a third order determinant is 11, then the value of the square of the determinant formed by the cofactors will be **[1]**

a) 1331

b) 14641

c) 121

d) 11

8. Let A = $\begin{bmatrix} 1 & 0 & 0 \\ 5 & 2 & 0 \\ -1 & 6 & 1 \end{bmatrix}$, then adj (A) is **[1]**

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) $\begin{bmatrix} 2 & 0 & 0 \\ -5 & 1 & 0 \\ 32 & -6 & 2 \end{bmatrix}$

9. Minimise Z = 13x – 15y subject to the constraints : x + y ≤ 7, 2x – 3y + 6 ≥ 0 , x ≥ 0, y ≥ 0. **[1]**

a) – 39

b) – 34

c) – 32

d) – 23

10. The smallest value of the polynomial $x^3 - 18x^2 + 96x$ in [0, 9] is **[1]**

a) 126

b) 160

c) 135

d) 0

11. If y = a cos ($\log_e x$) + b sin ($\log_e x$), then $x^2 y_2 + xy_1$ = **[1]**

a) y

b) -y

c) none of these

d) 0

12. One kind of cake requires 200g of flour and 25g of fat, and another kind of cake requires 100g of flour and 50g of fat. Find the maximum number of cakes which can be made from 5kg of flour and 1 kg of fat assuming that there is no shortage of the other ingredients used in making the cakes. **[1]**

a) Maximum number of cakes = 34 , 27 of kind one and 7 cakes of another kind

b) Maximum number of cakes = 33 , 22 of kind one and 11 cakes of another kind

c) Maximum number of cakes = 32 , 20

d) Maximum number of cakes = 30 , 20

of kind one and 12 cakes of another kind | of kind one and 10 cakes of another kind

13. An edge of a variable cube is increasing at the rate of 3cm/sec. Find the rate at which the volume of the cube is increasing when the edge is 10cm long. **[1]**

a) $800 cm^3/sec$
b) $400 cm^3/sec$
c) $900 cm^3/sec$
d) none of these

14. If y = $ae^{mx} + be^{-mx}$, then y_2 is equal to **[1]**

a) my_1
b) $-m^2y$
c) m^2y
d) None of these

15. Let $f(x) = |\sin x|$Then **[1]**

a) *f* is everywhere differentiable
b) *f* is everywhere continuous but not differentiable at x = $(2x + 1)\frac{\pi}{2}$, x $\in$ Z
c) None of these
d) *f* is everywhere continuous but not differentiable at $x = n\pi, n \in \mathbf{Z}$

16. The system of equations, x + 2y = 5 , 4x + 8y = 20 has **[1]**

a) no solution
b) none of these
c) a unique solution
d) infinitely many solutions

17. If y = log $\left(\frac{1+\sqrt{x}}{1-\sqrt{x}}\right)$ then $\frac{dy}{dx} = ?$ **[1]**

a) $\frac{-1}{x(1-\sqrt{x})^2}$
b) $\frac{1}{\sqrt{x}(1-x)}$
c) none of these
d) $\frac{\sqrt{x}}{2(1-\sqrt{x})}$

18. If $u = \cot^{-1}\{\sqrt{\tan\theta}\} - \tan^{-1}\{\sqrt{\tan\theta}\}$ then, $\tan\left(\frac{\pi}{4} - \frac{u}{2}\right) =$ **[1]**

a) $\sqrt{\tan\theta}$
b) tan θ
c) $\sqrt{\cot\theta}$
d) cot θ

19. If $\frac{d}{dx}$ $\{x^n - a_1 x^{n-1} + a_2 x^{n-2} + ... + (-1)^n a_n\} e^x = x^n e^x$, then the value of $a_r, 0 < r \le n$, is equal to **[1]**

a) $\frac{n!}{(n-r)!}$
b) none of these
c) $\frac{(n-r)!}{r!}$
d) $\frac{n!}{r!}$

20. The value of λ, for which system of equations. x + y + z = 1, x + 2y + 2z = 3, x + 2y + λz = 4, have no solution is **[1]**

a) 0
b) 1
c) 3.
d) 2

SECTION – B (Attempt any 16 Questions)

21. Let f (x) = $\cos^{-1} 2x$ then, dom f(x) = ? **[1]**

a) [-1,1]
b) $\left[\frac{-\pi}{2}, \frac{\pi}{2}\right]$

c) $\left[\frac{-1}{2}, \frac{1}{2}\right]$

d) $\left[\frac{-\pi}{4}, \frac{\pi}{4}\right]$

22. If $y = e^{1/x}$ then $\frac{dy}{dx} = ?$ **[1]**

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

23. A cottage industry manufactures pedestal lamps and wooden shades, each requiring the use of a grinding/cutting machine and a sprayer. It takes 2 hours on grinding/cutting machine and 3 hours on the sprayer to manufacture a pedestal lamp. It takes 1 hour on the grinding/cutting machine and 2 hours on the sprayer to manufacture a shade. On any day, the sprayer is available for at the most 20 hours and the grinding/cutting machine for at the most 12 hours. The profit from the sale of a lamp is Rs 5 and that from a shade is Rs 3. Assuming that the manufacturer can sell all the lamps and shades that he produces, how should he schedule his daily production in order to maximize his profit? **[1]**

a) 5 Pedestal lamps and 5 wooden shades; Maximum profit = Rs 38

b) 4 Pedestal lamps and 5 wooden shades; Maximum profit = Rs 36

c) 5 Pedestal lamps and 4 wooden shades; Maximum profit = Rs 35

d) 4 Pedestal lamps and 4 wooden shades; Maximum profit = Rs 32

24. Given that f (x) = $x^{1/x}$, x > 0 has the maximum value at x = e,then **[1]**

a) $e^\pi = \pi^e$

b) $e^\pi \leqslant \pi^e$

c) $e^\pi > \pi^e$

d) $e^\pi < \pi^e$

25. If y = sin (m $\sin^{-1}$ x), then (1 - x^2) y_2 - xy_1 is equal to **[1]**

a) $-m^2y$

b) none of these

c) my

d) m^2y

26. $\sin\left(\frac{\pi}{3} - \sin^{-1}\left(-\frac{1}{2}\right)\right)$ is equal to **[1]**

a) $\frac{1}{4}$

b) $\frac{1}{3}$

c) 1

d) $\frac{1}{2}$

27. If a relation R on the set A= {1, 2, 3} be defined by R = {(1, 2)}, then R is **[1]**

a) transitive

b) symmetric

c) none of these

d) reflexive

28. The domain of the function defined by f (x) = $\sin^{-1} \sqrt{x-1}$ is **[1]**

a) [1, 2]

b) none of these

c) [–1, 1]

d) [0, 1]

29. If A is 3×4 matrix and B is a matrix such that A^T B and BA^T are both defined. Then, B is of the type **[1]**

a) 4×4

b) 4×3

c) 3×3

d) 3×4

30. If the determinant $\begin{vmatrix} a & b & 2a\alpha+3b \\ b & c & 2b\alpha+3c \\ 2a\alpha+3b & 2b\alpha+3c & 0 \end{vmatrix}$ = 0, then the nature of a,b,c will be **[1]**

a) a, b, c are in G.P. only

b) a, b, c are in A.P.

c) α is a root of 4ax^2 + 12bx + 9c = 0 or,a, b, c are in G.P.

d) a, b, c are in H.P.

31. The function $f(x)=\frac{x^3+x^2-16x+20}{x-2}$ is not defined for x = 2. In order to make f(x) continuous at x = 2, f(2) should be defined as **[1]**

a) 2

b) 1

c) 0

d) 3

32. If $\sqrt{1-x^6}+\sqrt{1-y^6}$ = a^3(x^3 - y^3),then $\frac{dy}{dx}$ is equal to **[1]**

a) $\frac{y^2}{x^2}\sqrt{\frac{1-y^6}{1-x^6}}$

b) $\frac{x^2}{y^2}\sqrt{\frac{1-y^6}{1-x^6}}$

c) $\frac{x^2}{y^2}\sqrt{\frac{1-x^6}{1-y^6}}$

d) none of these

33. The function f(x) = 4 - 3x + 3x^2 - x^3 is decreasing **[1]**

a) Strictly decreasing on R

b) Strictly increasing on R

c) Decreasing on R

d) Increasing on R

34. $\cos\left(\cos^{-1}\left(\frac{7}{25}\right)\right)=$ **[1]**

a) $\frac{25}{7}$

b) None of these

c) $\frac{25}{24}$

d) $\frac{24}{25}$

35. If $A=\begin{bmatrix} 2x & 0 \\ x & x \end{bmatrix}$ and $A^{-1}=\begin{bmatrix} 1 & 0 \\ -1 & 2 \end{bmatrix}$ then x = ?. **[1]**

a) 1

b) -2

c) $\frac{1}{2}$

d) 2

36. A diet is to contain at least 80 units of vitamin A and 100 units of minerals. Two foods F1 and F2 are available. Food F1 costs Rs 4 per unit food and F2 costs Rs 6 per unit. One unit of food F1 contains 3 units of vitamin A and 4 units of minerals. One unit of food F2 contains 6 units of vitamin A and 3 units of minerals. Formulate this as a linear programming problem. Find the minimum cost for diet that consists of mixture of these two foods and also meets the minimal nutritional requirements. **[1]**

a) Minimum cost = Rs 104

b) Minimum cost = Rs 134

c) Minimum cost = Rs 114

d) Minimum cost = Rs 124

37. If $\Delta_1=\begin{vmatrix} 1 & 1 & 1 \\ a & b & c \\ a^2 & b^2 & c^2 \end{vmatrix}$, $\Delta_2=\begin{vmatrix} 1 & bc & a \\ 1 & ca & b \\ 1 & ab & c \end{vmatrix}$, then **[1]**

a) $\Delta_1+\Delta_2=0$

b) none of these

c) $\Delta_1=\Delta_2$

d) $\Delta_1+2\Delta_2=0$

38. The value of k for which the system of equations, x + ky + 3z = 0, 3x + ky – 2z = 0, 2x + 3y – 4z = 0, have a non-trival solution is **[1]**

a) $\frac{33}{2}$

b) $\frac{2}{33}$

c) 33

d) none of these

39. If 3 sin (xy) + 4 cos (xy) = 5, then $\frac{dy}{dx} =$ **[1]**

a) none of these

b) $\frac{3\cos(xy)+4\sin(xy)}{4\cos(xy)-3\sin(xy)}$

c) $\frac{3\sin(xy)+4\cos(xy)}{3\cos(xy)-4\sin(xy)}$

d) $-\frac{y}{x}$

40. Which of the following is not an equivalence relation on I, the set of integers: x, y **[1]**

a) xRy, x + y is an even integer

b) xRy, x = y

c) xRy, x ≤ y

d) xRy, x – y is an even integer

SECTION – C (Attempt any 8 Questions)

41. If $\cot^{-1}(\frac{-1}{5})$ = x then sin x = ? **[1]**

a) $\frac{7}{\sqrt{26}}$

b) None of these

c) $\frac{1}{\sqrt{26}}$

d) $\frac{5}{\sqrt{26}}$

42. Which of the following statements is correct? **[1]**

a) A LPP admits unique optimal solution

b) Every LPP admits an optimal solution

c) If an LPP admits two optimal solutions it has an infinite number of optimal solutions

d) The set of all feasible solutions of a LPP is not a converse set

43. The function f(x) = 1 + |cos x| is **[1]**

a) continuous everywhere

b) not differentiable at x = nπ, n∈Z

c) continuous no where

d) not differentiable at x = 0

44. The maximum value of $\Delta = \begin{vmatrix} 1 & 1 & 1 \\ 1 & 1+\sin\theta & 1 \\ 1+\cos\theta & 1 & 1 \end{vmatrix}$ is (θ is real number). **[1]**

a) $\frac{2\sqrt{3}}{4}$

b) $\frac{1}{2}$

c) $\frac{\sqrt{3}}{2}$

d) $\sqrt{2}$

45. Let R a relation on N x N defined by (a,b) R (c,d) = a + d = b + c Then R is **[1]**

a) Reflexive and symmetric but not transitive

b) Reflexive and transitive but not symmetric

c) An equivalence relation

d) Symmetric and transitive but not reflexive

46. A real estate company is going to build a new residential complex. The land they have purchased can hold at most 4500 apartments. Also, if they make x apartments, then the **[5]**

monthly maintenance cost for the whole complex would be as follows: Fixed cost = ₹50,00,000.

Variable cost = ₹$(160x - 0.04x^2)$

Based on the above information, answer the following questions.

i. The maintenance cost as a function of x will be
   a. $160x - 0.04x^2$
   b. 5000000
   c. $5000000 + 160x - 0.04x^2$
   d. None of these

ii. If C(x) denote the maintenance cost function, then the maximum value of C(x) occur at x =
   a. 0
   b. 2000
   c. 4500
   d. 5000

iii. The maximum value of C(x) would be
   a. ₹5225000
   b. ₹5160000
   c. ₹5000000
   d. ₹4000000

iv. The number of apartments, that the complex should have in order to minimize the maintenance cost, is
   a. 4500
   b. 5000
   c. 1750
   d. 3500

v. If the minimum maintenance cost is attained, then the maintenance cost for each apartment would be
   a. ₹1091.11
   b. ₹1200
   c. ₹1000
   d. ₹2000