SAMPLE PAPER-

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

General Instructions: Same as Sample Paper-1

SECTION-A

In this section, attempt any 16 questions out of Questions 1-20. Each question is of 1 mark weightage.

1. The value of $\tan^{-1}(1)+\sin^{-1}\left(\frac{-1}{2}\right)$ is **1**

(*a*) $\frac{3\pi}{5}$ (*b*) $\frac{2\pi}{7}$ (*c*) $\frac{\pi}{6}$ (*d*) $\frac{\pi}{12}$

2. If the function $f(x)=\begin{cases}\left(\frac{1-\cos 4x}{x^2}\right) & \text{if} \quad x<0\\ a & \text{if} \quad x=0\\ \left(\frac{\sqrt{x}}{\sqrt{16+\sqrt{x}}-4}\right) & \text{if} \quad x>0\end{cases}$ is continuous at $x=0$, the value of a is **1**

(*a*) $a=4$ (*b*) $a=6$ (*c*) $a=5$ (*d*) $a=8$

3. If $f(\theta)=\begin{bmatrix}\cos\theta & \sin\theta\\ -\sin\theta & \cos\theta\end{bmatrix}$, $f(\theta).f(-\theta)$ equals. **1**

(*a*) –I (*b*) I (*c*) 2 (*d*) 3

4. If $y=\tan^{-1}\left(\frac{\cos x+\sin x}{\cos x-\sin x}\right)$, then $\frac{dy}{dx}=$ **1**

(*a*) 2 (*b*) 3 (*c*) 1 (*d*) $\frac{1}{3}$

5. For all real values of x, the function: $f(x)=3x+\sin x$ is **1**

(*a*) strictly increasing (*b*) strictly decreasing

(*c*) increasing (*d*) decreasing

6. If $A=\begin{bmatrix}2 & 0 & 0\\ 0 & 2 & 0\\ 0 & 0 & 2\end{bmatrix}$, then |adj A| is equal to **1**

(*a*) 60 (*b*) 62 (*c*) 64 (*d*) None of these

7. Let a relation R in the set N of natural numbers be defined as $(x, y) \Leftrightarrow x^2-4xy+3y^2=0$, $\forall$ $x, y \in N$. **1**

The relation R is

(*a*) reflexive (*b*) symmetric (*c*) transitive (*d*) All of these

8. If $A = \begin{bmatrix} 2 & 3 \\ -1 & 2 \end{bmatrix}$, then $A^3 + 3A^2 - 4A + I$ is equal to **1**

(*a*) $\begin{bmatrix} -14 & -51 \\ -17 & -14 \end{bmatrix}$ (*b*) $\begin{bmatrix} -14 & 51 \\ -17 & -14 \end{bmatrix}$ (*c*) $\begin{bmatrix} -1 & -1 \\ -1 & 0 \end{bmatrix}$ (*d*) $\begin{bmatrix} 1 & 1 \\ 1 & 0 \end{bmatrix}$

9. The equation of the tangent to the curve $4x^2 + 9y^2 = 36$ at the point $(3\cos\theta, 2\sin\theta)$ is **1**

(*a*) $2x\cos\theta - 3y\sin\theta = 6$ (*b*) $2x\cos\theta + 3y\sin\theta = 6$

(*c*) $2x\sin\theta + 3y\cos\theta = 6$ (*d*) $2x\sin\theta - 3y\cos\theta = 6$

10. The value of $\cos\left[\cos^{-1}\left(\frac{-1}{2}\right) + \frac{\pi}{3}\right] + \sin\left[\frac{\pi}{6} - \sin^{-1}\left(\frac{-\sqrt{3}}{2}\right)\right]$ is **1**

(*a*) –1 (*b*) –2 (*c*) $\frac{1}{2}$ (*d*) 0

11. Let R = {(3, 3), (6, 6), (9, 9), (12, 12), (6, 12), (3, 9), (3, 12), (3, 6)} be a relation on the set A = {3, 6, 9, 12}. The relation is **1**

(*a*) reflexive only (*b*) reflexive and symmetric only

(*c*) reflexive and transitive only (*d*) None of these

12. If $y = a\sin mx - b\cos mx$, then $\frac{d^2y}{dx^2} + m^2y$ equals **1**

(*a*) –1 (*b*) 0 (*c*) 1 (*d*) None of these

13. If $y = e^{\sin x + \cos x}$, then $\frac{dy}{dx}$ equals **1**

(*a*) $\left[e^{\sin x + \cos x}\right](\cos x + \sin x)$ (*b*) $\left[e^{\cos x - \sin x}\right](\cos x - \sin x)$

(*c*) $\left[e^{\sin x + \cos x}\right](\cos x - \sin x)$ (*d*) None of these

14. If $y = x^{\sin x} \times (\tan x)^x$, then $\frac{dy}{dx}$ is given by **1**

(*a*) $x^{\tan x}(\sin x)^x\left[\cos x\log x + \frac{\sin x}{x} + \log\tan x + 2x\,\text{cosec}\,2x\right]$

(*b*) $x^{\sin x}(\tan x)^x\left[\cos x\log x + \frac{\sin x}{x} + \log\tan x + 2x\,\text{cosec}\;2x\right]$

(*c*) $\left(x^{\sin x} + \tan x^x\right)\left[\cos x\log x + \frac{\sin x}{x} + \log\tan x + 2x\,\text{cosec}\,2x\right]$

(*d*) None of these

15. If $y = \cos\left(\log x + e^x\right)$, then $\frac{dy}{dx} =$ **1**

(*a*) $-\sin\left[\log x + e^x\right] \times \left[\frac{1}{x} + e^x\right]$ (*b*) $-\sin\left[\frac{1}{\log x} + e^x\right] \times \left[x + e^x\right]$

(*c*) $\sin\left[\log x - e^x\right] \times \left[\frac{1}{x} - e^x\right]$ (*d*) None of these

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

(*a*) $ax + \sqrt{2}by - \sqrt{2}\left(a^2 + b^2\right) = 0$ (*b*) $\sqrt{2}bx - ay - ab = 0$

(*c*) $bx - \sqrt{2}ay + ab = 0$ (*d*) $\sqrt{2}ax + by + \sqrt{2}\left(a^2 + b^2\right) = 0$

17. If $A = \begin{bmatrix} 1 & -1 & 1 \\ 0 & 2 & -3 \\ 2 & 1 & 0 \end{bmatrix}$ and B = (adj A), and C = 5A, then $\frac{|adj\ B|}{|C|} =$ **1**

(*a*) 5 (*b*) 25 (*c*) -1 (*d*) 1

18. If $\sin(xy) - \cos(x - y) = y^2$, then $\frac{dy}{dx}$ is given by **1**

(*a*) $\frac{y\cos(xy) - \sin(x - y)}{x\cos(xy) + \sin(x - y) - 2y}$ (*b*) $-\left[\frac{y\cos(xy) - \sin(x + y)}{x\cos(xy) - \sin(x + y)}\right]$

(*c*) $\frac{y\cos(xy) + \sin(x - y)}{x\cos(xy) - \sin(x - y) - 2y}$ (*d*) $-\left[\frac{y\cos(xy) + \sin(x - y)}{x\cos(xy) - \sin(x - y) - 2y}\right]$

19. A factory owner wants to purchase two types of machines A and B for his factory. The machine A requires an area of 1000 m^2 and 12 skilled men for running it and its daily output is 50 units, whereas the machine B requires 1200 m^2 area and 8 skilled men, and its daily output is 40 units. If an area of 7600 m^2 and 72 skilled men be available to operate the machines, how many machines of each type should be bought to maximise the daily output? **1**

(*a*) $Z_{max} = 310$ at (4, 8) (*b*) $Z_{max} = 320$ at (4, 3) (*c*) $Z_{max} = 280$ at (4, 6) (*d*) $Z_{max} = 300$ at (4, 5)

20. A closed circular cylinder has volume 2156 cm^3. The radius of its base and height so that its total surface area is minimum are $\left[\text{Take } \pi = \frac{22}{7}\right]$ **1**

(*a*) $r = 6$ cm, $h = 8$ cm (*b*) $r = 5$ cm, $h = 9$ cm

(*c*) $r = 14$ cm, $h = 7$ cm (*d*) $r = 7$ cm, $h = 14$ cm

SECTION-B

In this section, attempt any 16 questions out of Questions 21-40. Each question is of 1 mark weightage.

21. Let $f: R \to R$ be a function defined by $f(x) = x^3 + 4$. Then f is **1**

(*a*) injective (*b*) surjective (*c*) bijective (*d*) None of these.

22. If $y = (\tan x)^{\tan x} \div (\sin x)^{\sin x}$, then $\frac{dy}{dx}$ equals **1**

(*a*) $\frac{(\tan x)^{\tan x}}{(\sin x)^{\sin x}}[\sec^2 x \log(\tan x) + \sec^2 x - (\cos x)\log(\sin x) - \cos x]$

(*b*) $\frac{(\sin x)^{\sin x}}{(\tan x)^{\tan x}}[\sec^2 x \log(\tan x) + \sec^2 x - (\cos x)\log(\sin x) - \cos x]$

(*c*) $\frac{(\tan x)^{\sin x}}{(\sin x)^{\tan x}}[\sec^2 x \log(\tan x) + \sec^2 x - (\cos x)\log(\sin x) - \cos x]$

(*d*) None of these

23. Corner points of the feasible region for an LPP are (0, 2), (3, 0), (6, 0) and (0, 5). Let F = $4x + 6y$ be the objective function. The minimum value of F occurs at **1**

(*a*) (0, 2) only (*b*) (3, 0) only

(*c*) The mid-point of the line segment joining the points (0, 2) and (3, 0) only.

(*d*) Any point on the line segment joining the points (0, 2) and (3, 0).

24. If $\begin{cases} y = \theta\sin\theta + \cos\theta \\ x = \theta\cos\theta - \sin\theta \end{cases}$ and, then $\frac{d^2y}{dx^2} =$ **1**

(*a*) $\text{cosec}^3\ \theta$ (*b*) $\theta\ \text{cosec}^3\ \theta$ (*c*) $-\frac{\text{cosec}^3\ \theta}{\theta}$ (*d*) None of these

25. If $(x-a)^2 + (y-b)^2 = c^2$, then $\frac{\left[1+\left(\frac{dy}{dx}\right)^2\right]^{\frac{3}{2}}}{\frac{d^2y}{dx^2}}$ equals to **1**

(*a*) $c^2 + 2$ (*b*) $c^2 + 3c$ (*c*) $2c$ (*d*) c

26. The intervals in which the function: $f(x) = 2x^3 - 8x^2 + 10x + 5$ is strictly increasing or S↑ are **1**

(*a*) $\left\{x \in (\infty, 1) \cup \left(\frac{1}{3}, \infty\right)\right\}$ (*b*) $\left\{x \in (\infty, 0) \cup \left(\frac{5}{3}, -\infty\right)\right\}$

(*c*) $\left\{x \in (0, \infty) \cup \left(\frac{1}{4}, \infty\right)\right\}$ (*d*) $\left\{x \in (-\infty, 1) \cup \left(\frac{5}{3}, \infty\right)\right\}$

27. The value of $2\sin^{-1}\left(\frac{\sqrt{3}}{2}\right) - \cos^{-1}\left(-\frac{1}{2}\right) + 3\tan^{-1}(1)$ is **1**

(*a*) $\frac{2\pi}{3}$ (*b*) $\frac{3\pi}{4}$ (*c*) $\frac{\pi}{4}$ (*d*) $\frac{\pi}{6}$

28. If $A = \begin{bmatrix} 3 & 5 \\ 2 & 0 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 17 \\ 0 & -10 \end{bmatrix}$, the value of |AB| is

(*a*) 20 (*b*) 48 (*c*) 55 (*d*) 100

29. The intervals in which the function: $f(x) = \sin x + \cos x$ on $[0, 2\pi]$ strictly decreases (S↓) are **1**

(*a*) $\left\{x \in \left(0, \frac{5\pi}{4}\right)\right\}$ (*b*) $\left\{x \in \left(\frac{\pi}{4}, \frac{5\pi}{4}\right)\right\}$

(*c*) $\left\{x \in \left(\frac{\pi}{4}, 0\right)\right\}$ (*d*) None of these

30. The relation R defined in the set A = {1, 2, 3, 4, 5, 6} as R = {(*x*, *y*) : *y* is divisible by *x*} is **1**

(*a*) Reflexive, transitive but not symmetric (*b*) Reflexive, symmetric but not transitive

(*c*) An equivalence relation (*d*) None of the above

31. The function $f(x)$ defined as: $f(x)=\begin{cases}\left(\frac{\sin x}{x}+\cos x\right) & \text{if} \quad x>0\\ 2 & \text{if} \quad x=0\\ \left(\frac{x^2}{1-\sqrt{1-x^2}}\right) & \text{if} \quad x<0\end{cases}$ is continuous at **1**

(*a*) $x = 0$ (*b*) $x = 1$ (*c*) $x = 2$ (*d*) $x = -1$

32. If $A=\begin{bmatrix}2 & 3 & 1\\ 1 & 2 & -1\\ 3 & 4 & 2\end{bmatrix}$ is a non-singular square matrix of order 3 × 3, then |adj A| equals **1**

(*a*) $|A|^2$ (*b*) $|A|$ (*c*) $|A|^3$ (*d*) $A|A|$

33. Minimum value of $Z = x - 7y + 190$ subject to the constraints: $x + y \le 8$, $x + y \ge 4$, $x \le 5$, $y \le 5$, $x \ge 0$, $y \ge 0$ equals. **1**

(*a*) $Z_{min} = 155$ at (0, 5) (*b*) $Z_{min} = 150$ at (2, 5)

(*c*) $Z_{min} = 160$ at (2, 3) (*d*) $Z_{min} = 170$ at (3, 5)

34. Volume of the greatest cylinder which can be inscribed in a given cone of height H and semi-vertical angle 30° is **1**

(*a*) $V=\frac{5\pi H^3}{81}$ (*b*) $\frac{\pi H^3}{81}$ (*c*) $\frac{2\pi H^3}{81}$ (*d*) $\frac{4\pi H^3}{81}$

35. If $A=\begin{bmatrix}1 & -2\\ 5 & 3\end{bmatrix}$, then $A + A^T$ equals **1**

(*a*) $\begin{bmatrix}2 & 3\\ 3 & 6\end{bmatrix}$ (*b*) $\begin{bmatrix}2 & -4\\ 10 & 6\end{bmatrix}$ (*c*) $\begin{bmatrix}2 & 4\\ -10 & 6\end{bmatrix}$ (*d*) None of these.

36. $\cos^{-1}\left(\cos\frac{7\pi}{6}\right)$ is equal to **1**

(*a*) $\frac{7\pi}{6}$ (*b*) $\frac{5\pi}{6}$ (*c*) $\frac{\pi}{3}$ (*d*) $\frac{\pi}{6}$

37. Let R be a relation on the set N defined by $\{(x, y) : x, y \in N, 2x + y = 41\}$. Then R is **1**

(*a*) reflexive (*b*) symmetric (*c*) transitive (*d*) None of these.

38. If $A=\begin{bmatrix}2 & 3\\ 1 & -2\end{bmatrix}$ and $A^{-1} = aA$, then the value of *a* is **1**

(*a*) 7 (*b*) – 7 (*c*) $\frac{1}{7}$ (*d*) $-\frac{1}{7}$

39. The equation of normal to the curve: $x^3 - 2x^2y + xy^2 - 2x + y = 1$ at (1, –1) is given by **1**

(*a*) $x - 2y = 5$ (*b*) $x + 2y + 1 = 0$ (*c*) $x + 2y = 7$ (*d*) $x - 2y = 6$

40. If $A = \begin{bmatrix} 3 & 2 \\ 1 & 1 \end{bmatrix}$, the values of a and b when $A^2 + aA + bI = 0$ are given by **1**

(*a*) $a = -4, b = 1$ (*b*) $a = -1, b = -4$ (*c*) $a = 4, b = -1$ (*d*) $a = 1, b = 4$

SECTION-C

In this section, attempt any 8 questions. Each question is of 1 mark weightage. Questions 46-50 are based on a Case Study.

41. An aeroplane can carry a maximum of 200 passengers. A profit of ₹ 1,000 is made on each executive class ticket and a profit of ₹ 600 is made on each economy class ticket. The airline reserves atleast 20 seats for executive class. However, atleast 4 times as many passengers prefer to travel by economy class than by the executive class. How many tickets of each type must be sold in order to maximise the profit of the airline? **1**

(*a*) Z_{max} = ₹ 1,30,000 at (40, 120) (*b*) Z_{max} = ₹ 1,36,000 at (40, 160)

(*c*) Z_{max} = ₹ 1,32,000 at (40, 120) (*d*) None of these

42. The slope of the tangent line to the curve: $y = \tan^2 x + 2 \tan x + 5$ at $x = \frac{\pi}{4}$ is **1**

(*a*) –8 (*b*) $-\frac{1}{8}$ (*c*) 8 (*d*) $\frac{1}{8}$

43. The absolute maximum and the absolute minimum value of the function: $f(x) = \sin x + \cos x$ on $[0, \pi]$ respectively are **1**

(*a*) $\sqrt{3}, 1$ (*b*) $\sqrt{2}, -2$ (*c*) $\sqrt{2}, -1$ (*d*) $-\sqrt{3}, 2$

44. A manufacturer has three machines I, II and III installed in his factory. Machine I and II are capable of being operated for atmost 12 hours whereas machine III must be operated for atleast 5 hours a day she produces only two items M and N each requiring the use of three machines. The number of hours required for producing I unit of each M and N on the three machines are given in the following table:

Items	Number of hours required on machines		
	I	II	III
M (x)	1	2	1
N (y)	2	1	1.25

She makes a profit of ₹ 600 and ₹ 400 on items M and N respectively. How many of each item should she produce so as to maximise her profit, assuming that she can sell all the items that she produced? **1**

(*a*) Z_{max} = ₹ 4,000 at (4, 4) (*b*) Z_{max} = ₹ 5,000 at (4, 3)

(*c*) Z_{max} = ₹ 4,400 at (4, 5) (*d*) Z_{max} = ₹ 4,200 at (4, 6)

45. If $f(\theta) = \begin{bmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{bmatrix}$, then $[f(\theta)]'$ is equal to **1**

(*a*) $f(\theta)$ (*b*) $f(-\theta)$ (*c*) $f(2\theta)$ (*d*) $f\left(\frac{\theta}{2}\right)$

Case Study

Two organisations A and B want to award their selected employees on the values of Honesty, Hard work and Punctuality. The organisation A wants to award ₹ x each, ₹ y each and ₹ z each for the three respective values of its 3, 2 and 1 employees respectively with a total award money of ₹ 2000.

Organisation B wants to spend ₹ 3000 to award its 4, 1 and 3 employees on the respective values (by giving the same award money to the three values as organisation A). The total amount of award for one prize on each value is ₹ 900.

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

46. What is the award money for Honesty? **1**

(a) ₹ 350 (b) ₹ 300 (c) ₹ 500 (d) ₹ 400

47. What is the award money for Punctuality? **1**

(a) ₹ 300 (b) ₹ 280 (c) ₹ 450 (d) ₹ 500

48. What is the award money for Hard work? **1**

(a) ₹ 500 (b) ₹ 100 (c) ₹ 300 (d) ₹ 550

49. If a matrix B is both symmetric and skew-symmetric, then $|B|$ is equal to **1**

(a) 1 (b) -1 (c) 0 (d) None of these

50. If P and Q are two matrices such that $PQ = Q$ and $QP = P$, then $|Q^2|$ is equal to **1**

(a) $|Q|$ (b) $|P|$ (c) 1 (d) 0

ANSWERS

Sample Paper

1. (*c*)	**2.** (*b*)	**3.** (*d*)	**4.** (*a*)	**5.** (*b*)	**6.** (*c*)	**7.** (*a*)	**8.** (*b*)
9. (*c*)	**10.** (*c*)	**11.** (*a*)	**12.** (*a*)	**13.** (*b*)	**14.** (*c*)	**15.** (*a*)	**16.** (*c*)
17. (*b*)	**18.** (*d*)	**19.** (*a*)	**20.** (*d*)	**21.** (*b*)	**22.** (*c*)	**23.** (*b*)	**24.** (*a*)
25. (*c*)	**26.** (*b*)	**27.** (*b*)	**28.** (*a*)	**29.** (*d*)	**30.** (*d*)	**31.** (*c*)	**32.** (*c*)
33. (*b*)	**34.** (*c*)	**35.** (*b*)	**36.** (*b*)	**37.** (*a*)	**38.** (*a*)	**39.** (*b*)	**40.** (*b*)
41. (*c*)	**42.** (*b*)	**43.** (*c*)	**44.** (*a*)	**45.** (*b*)	**46.** (*c*)	**47.** (*a*)	**48.** (*b*)
49. (*c*)	**50.** (*a*)						