## Section A (Compulsory)

1. If A and B are symmetric matrices of the same order, then AB – BA is a :

(1) symmetric matrix (2) zero matrix

(3) skew symmetric matrix (4) identity matrix

2. If A is a square matrix of order 4 and $|A| = 4$, then $|2A|$ will be :

(1) 8 (2) 64 (3) 16 (4) 4

3. If $[A]_{3\times2}\,[B]_{x\times y} = [C]_{3\times1}$, then :

(1) $x = 1, y = 3$ (2) $x = 2, y = 1$ (3) $x = 3, y = 3$ (4) $x = 3, y = 1$

4. If a function $f(x) = x^2 + bx + 1$ is increasing in the interval $[1, 2]$, then the least value of b is :

(1) 5 (2) 0 (3) $-2$ (4) $-4$

5. Two dice are thrown simultaneously. If X denotes the number of fours, then the expectation of X will be :

(1) $\frac{5}{9}$ (2) $\frac{1}{3}$ (3) $\frac{4}{7}$ (4) $\frac{3}{8}$

6. For the function $f(x) = 2x^3 - 9x^2 + 12x - 5$, $x \in [0, 3]$, match **List-I** with **List-II** :

| List-I | List-II |
|---|---|
| (A) Absolute maximum value | (I) 3 |
| (B) Absolute minimum value | (II) 0 |
| (C) Point of maxima | (III) $-5$ |
| (D) Point of minima | (IV) 4 |

Choose the **correct** answer from the options given below :

(1) (A) - (IV), (B) - (II), (C) - (I), (D) - (III) (2) (A) - (II), (B) - (III), (C) - (I), (D) - (IV)

(3) (A) - (IV), (B) - (III), (C) - (II), (D) - (I) (4) (A) - (IV), (B) - (III), (C) - (I), (D) - (II)

SPACE FOR ROUGH WORK

7. An objective function $Z = ax + by$ is maximum at points (8, 2) and (4, 6). If $a \geq 0$ and $b \geq 0$ and $ab = 25$, then the maximum value of the function is equal to :

(1) 60 (2) 50

(3) 40 (4) 80

8. The area of the region bounded by the lines $x + 2y = 12$, $x = 2$, $x = 6$ and x-axis is :

(1) 34 sq units

(2) 20 sq units

(3) 24 sq units

(4) 16 sq units

9. A die is rolled thrice. What is the probability of getting a number greater than 4 in the first and the second throw of dice and a number less than 4 in the third throw ?

(1) $\frac{1}{3}$ (2) $\frac{1}{6}$ (3) $\frac{1}{9}$ (4) $\frac{1}{18}$

10. The corner points of the feasible region determined by

$x + y \leq 8$, $2x + y \geq 8$, $x \geq 0$, $y \geq 0$

are A(0, 8), B(4, 0) and C(8, 0). If the objective function $Z = ax + by$ has its maximum value on the line segment AB, then the relation between a and b is :

(1) $8a + 4 = b$ (2) $a = 2b$

(3) $b = 2a$ (4) $8b + 4 = a$

11. If $t = e^{2x}$ and $y = \log_e t^2$, then $\frac{d^2y}{dx^2}$ is :

(1) 0 (2) 4t

(3) $\frac{4e^{2t}}{t}$ (4) $\frac{e^{2t}(4t-1)}{t^2}$

SPACE FOR ROUGH WORK

12. $\int \frac{\pi}{x^{n+1} - x} dx =$

(1) $\frac{\pi}{n} \log_e \left| \frac{x^n - 1}{x^n} \right| + C$

(2) $\log_e \left| \frac{x^n + 1}{x^n - 1} \right| + C$

(3) $\frac{\pi}{n} \log_e \left| \frac{x^n + 1}{x^n} \right| + C$

(4) $\pi \log_e \left| \frac{x^n}{x^n - 1} \right| + C$

13. The value of $\int_0^1 \frac{a - bx^2}{\left(a + bx^2\right)^2} dx$ is :

(1) $\frac{a - b}{a + b}$

(2) $\frac{1}{a - b}$

(3) $\frac{a + b}{2}$

(4) $\frac{1}{a + b}$

14. The second order derivative of which of the following functions is $5^x$ ?

(1) $5^x \log_e 5$

(2) $5^x (\log_e 5)^2$

(3) $\frac{5^x}{\log_e 5}$

(4) $\frac{5^x}{(\log_e 5)^2}$

15. The degree of the differential equation $\left(1 - \left(\frac{dy}{dx}\right)^2\right)^{3/2} = k \frac{d^2y}{dx^2}$ is :

(1) 1

(2) 2

(3) 3

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

SPACE FOR ROUGH WORK

## Section B1 (Mathematics)

16. Let R be the relation over the set A of all straight lines in a plane such that $l_1$ R $l_2 \Leftrightarrow l_1$ is parallel to $l_2$. Then R is :

(1) Symmetric
(2) An Equivalence relation
(3) Transitive
(4) Reflexive

17. The probability of not getting 53 Tuesdays in a leap year is :

(1) 2/7 (2) 1/7 (3) 0 (4) 5/7

18. The angle between two lines whose direction ratios are propotional to 1, 1, $-2$ and $(\sqrt{3}-1)$, $(-\sqrt{3}-1)$, $-4$ is :

(1) $\pi/3$ (2) $\pi$ (3) $\pi/6$ (4) $\pi/2$

19. If $(\vec{a}-\vec{b})\cdot(\vec{a}+\vec{b}) = 27$ and $|\vec{a}| = 2|\vec{b}|$, then $|\vec{b}|$ is :

(1) 3 (2) 2 (3) 5/6 (4) 6

20. If $\tan^{-1}\left(\frac{2}{3^{-x}+1}\right) = \cot^{-1}\left(\frac{3}{3^{x}+1}\right)$, then which one of the following is true ?

(1) There is no real value of x satisfying the above equation.
(2) There is one positive and one negative real value of x satisfying the above equation.
(3) There are two real positive values of x satisfying the above equation.
(4) There are two real negative values of x satisfying the above equation.

21. If A, B and C are three singular matrices given by $A = \begin{bmatrix} 1 & 4 \\ 3 & 2a \end{bmatrix}$, $B = \begin{bmatrix} 3b & 5 \\ a & 2 \end{bmatrix}$ and $C = \begin{bmatrix} a+b+c & c+1 \\ a+c & c \end{bmatrix}$, then the value of abc is :

(1) 15 (2) 30
(3) 45 (4) 90

SPACE FOR ROUGH WORK

22. The value of the integral $\int_{\log_e 2}^{\log_e 3} \frac{e^{2x}-1}{e^{2x}+1} dx$ is :

(1) $\log_e 3$

(2) $\log_e 4 - \log_e 3$

(3) $\log_e 9 - \log_e 4$

(4) $\log_e 3 - \log_e 2$

23. If $\vec{a}$, $\vec{b}$ and $\vec{c}$ are three vectors such that $\vec{a} + \vec{b} + \vec{c} = \vec{0}$, where $\vec{a}$ and $\vec{b}$ are unit vectors and $|\vec{c}| = 2$, then the angle between the vectors $\vec{b}$ and $\vec{c}$ is :

(1) $60^\circ$

(2) $90^\circ$

(3) $120^\circ$

(4) $180^\circ$

24. Let [x] denote the greatest integer function. Then match **List-I** with **List-II** :

| | List-I | | List-II |
|---|---|---|---|
| (A) | $\|x-1\| + \|x-2\|$ | (I) | is differentiable everywhere except at $x = 0$ |
| (B) | $x - \|x\|$ | (II) | is continuous everywhere |
| (C) | $x - [x]$ | (III) | is not differentiable at $x = 1$ |
| (D) | $x\|x\|$ | (IV) | is differentiable at $x = 1$ |

Choose the **correct** answer from the options given below :

(1) (A) - (I), (B) - (II), (C) - (III), (D) - (IV)

(2) (A) - (I), (B) - (III), (C) - (II), (D) - (IV)

(3) (A) - (II), (B) - (I), (C) - (III), (D) - (IV)

(4) (A) - (II), (B) - (IV), (C) - (III), (D) - (I)

25. The rate of change (in $cm^2/s$) of the total surface area of a hemisphere with respect to radius r at $r = \sqrt[3]{1.331}$ cm is :

(1) $66\pi$

(2) $6.6\pi$

(3) $3.3\pi$

(4) $4.4\pi$

26. The area of the region bounded by the lines $\frac{x}{7\sqrt{3}\,a} + \frac{y}{b} = 4$, $x = 0$ and $y = 0$ is :

(1) $56\sqrt{3}\,ab$

(2) $56a$

(3) $ab/2$

(4) $3ab$

27. If A is a square matrix and I is an identity matrix such that $A^2 = A$, then $A(I-2A)^3 + 2A^3$ is equal to :

(1) $I + A$

(2) $I + 2A$

(3) $I - A$

(4) A

SPACE FOR ROUGH WORK

$\cos\theta = \frac{|a||b|}{a.b}$

$\cos\theta = \frac{2}{2}$

$A(I-2A)^3 + 2A^3$

$A(I^3 - 2A^3) + 2A^2 A$

$A - 2A + 2AA + 2A$

$A$

28. Match **List-I** with **List-II** :

| | List-I | | List-II |
|---|---|---|---|
| (A) | Integrating factor of $xdy - (y + 2x^2)dx = 0$ | (I) | $\frac{1}{x}$ |
| (B) | Integrating factor of $(2x^2 - 3y)dx = xdy$ | (II) | $x$ |
| (C) | Integrating factor of $(2y + 3x^2)dx + xdy = 0$ | (III) | $x^2$ |
| (D) | Integrating factor of $2xdy + (3x^3 + 2y)dx = 0$ | (IV) | $x^3$ |

Choose the **correct** answer from the options given below :

(1) (A) - (I), (B) - (III), (C) - (IV), (D) - (II)

(2) (A) - (I), (B) - (IV), (C) - (III), (D) - (II)

(3) (A) - (II), (B) - (I), (C) - (III), (D) - (IV)

(4) (A) - (III), (B) - (IV), (C) - (II), (D) - (I)

29. If the function $f : \mathbb{N} \to \mathbb{N}$ is defined as $f(n) = \begin{cases} n-1, & \text{if } n \text{ is even} \\ n+1, & \text{if } n \text{ is odd} \end{cases}$, then

(A) f is injective

(B) f is into

(C) f is surjective

(D) f is invertible

Choose the **correct** answer from the options given below :

(1) (B) only

(2) (A), (B) and (D) only

(3) (A) and (C) only

(4) (A), (C) and (D) only

30. $\int_0^{\frac{\pi}{2}} \frac{1 - \cot x}{\text{cosec } x + \cos x} dx =$

(1) 0

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

(3) $\infty$

(4) $\frac{\pi}{12}$

SPACE FOR ROUGH WORK

31. If the random variable X has the following distribution :

| X | 0 | 1 | 2 | otherwise |
|---|---|---|---|---|
| P(X) | k | 2k | 3k | 0 |

Match **List-I** with **List-II** :

| List-I | List-II |
|---|---|
| (A) k | (I) $\frac{5}{6}$ |
| (B) $P(X < 2)$ | (II) $\frac{4}{3}$ |
| (C) E(X) | (III) $\frac{1}{2}$ |
| (D) $P(1 \leq X \leq 2)$ | (IV) $\frac{1}{6}$ |

Choose the **correct** answer from the options given below :

(1) (A) - (I), (B) - (II), (C) - (III), (D) - (IV)

(2) (A) - (IV), (B) - (III), (C) - (II), (D) - (I)

(3) (A) - (I), (B) - (II), (C) - (IV), (D) - (III)

(4) (A) - (III), (B) - (IV), (C) - (I), (D) - (II)

32. For a square matrix $A_{n\times n}$

(A) $|\text{adj } A| = |A|^{n-1}$

(B) $|A| = |\text{adj } A|^{n-1}$

(C) $A(\text{adj } A) = |A|$

(D) $|A^{-1}| = \frac{1}{|A|}$

Choose the **correct** answer from the options given below :

(1) (B) and (D) only

(2) (A) and (D) only

(3) (A), (C) and (D) only

(4) (B), (C) and (D) only

SPACE FOR ROUGH WORK

$K+2K+3K+0=1$
$6K=1$
$K=1/6$
$A^{-1}=\frac{1(\text{Adj}A)}{|A|}$

$K+2K+3K=1$
$6K=1$
$K=1/6$

$2K+3K$
$\frac{2}{6}+\frac{3}{6}=\frac{5}{6}$

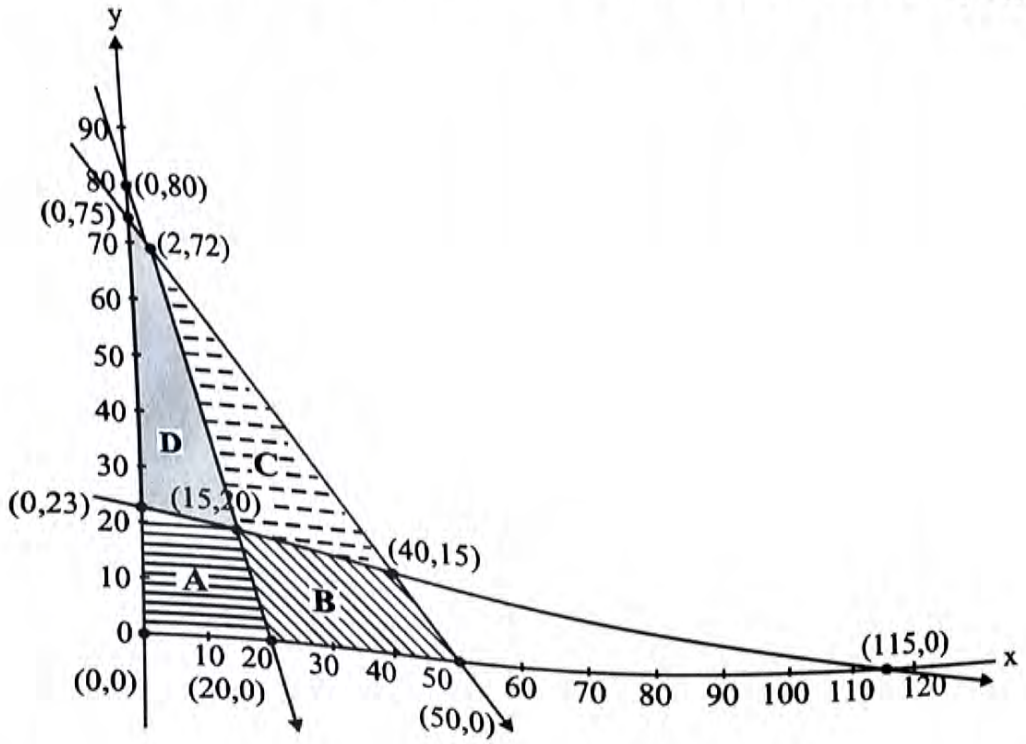
33. The matrix $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ is a :

(A) scalar matrix
(B) diagonal matrix
(C) skew-symmetric matix
(D) symmetric matrix

Choose the **correct** answer from the options given below :

(1) (A), (B) and (D) only
(2) (A), (B) and (C) only
(3) (A), (B), (C) and (D)
(4) (B), (C) and (D) only

34. The feasible region represented by the constraints $4x + y \geq 80$, $x + 5y \geq 115$, $3x + 2y \leq 150$, $x, y \geq 0$ of an LPP is




(1) Region A
(2) Region B
(3) Region C
(4) Region D

35. The area of the region enclosed between the curves $4x^2 = y$ and $y = 4$ is :

(1) 16 sq. units
(2) $\frac{32}{3}$ sq. units
(3) $\frac{8}{3}$ sq. units
(4) $\frac{16}{3}$ sq. units

SPACE FOR ROUGH WORK

36. $\int e^x\left(\frac{2x+1}{2\sqrt{x}}\right)dx =$

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

(2) $-e^x\sqrt{x} + C$

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

(4) $e^x\sqrt{x} + C$

37. If f(x), defined by $f(x) = \begin{cases} kx+1 & \text{if } x \le \pi \\ \cos x & \text{if } x > \pi \end{cases}$ is continuous at $x = \pi$, then the value of k is :

(1) 0

(2) $\pi$

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

(4) $-\frac{2}{\pi}$

38. If $P = \begin{bmatrix} -1 \\ 2 \\ 1 \end{bmatrix}$ and $Q = [2 \quad -4 \quad 1]$ are two matrices, then $(PQ)'$ will be :

(1) $\begin{bmatrix} 4 & 5 & 7 \\ -3 & -3 & 0 \\ 0 & -3 & -2 \end{bmatrix}$

(2) $\begin{bmatrix} -2 & 4 & 2 \\ 4 & -8 & -4 \\ -1 & 2 & 1 \end{bmatrix}$

(3) $\begin{bmatrix} 5 & 5 & 2 \\ 7 & 6 & 7 \\ -9 & -7 & 0 \end{bmatrix}$

(4) $\begin{bmatrix} -2 & 4 & 8 \\ 7 & 5 & 7 \\ -8 & -2 & 6 \end{bmatrix}$

SPACE FOR ROUGH WORK

**39.** $\Delta = \begin{vmatrix} 1 & \cos x & 1 \\ -\cos x & 1 & \cos x \\ -1 & -\cos x & 1 \end{vmatrix}$

(A) $\Delta = 2(1 - \cos^2 x)$

(B) $\Delta = 2(2 - \sin^2 x)$

(C) Minimum value of $\Delta$ is 2

(D) Maximum value of $\Delta$ is 4

Choose the **correct** answer from the options given below :

(1) (A), (C) and (D) only

(2) (A), (B) and (C) only

(3) (A), (B), (C) and (D)

(4) (B), (C) and (D) only

**40.** $f(x) = \sin x + \frac{1}{2}\cos 2x$ in $\left[0, \frac{\pi}{2}\right]$

(A) $f'(x) = \cos x - \sin 2x$

(B) The critical points of the function are $x = \frac{\pi}{6}$ and $x = \frac{\pi}{2}$

(C) The minimum value of the function is 2

(D) The maximum value of the function is $\frac{3}{4}$

Choose the **correct** answer from the options given below :

(1) (A), (B) and (D) only

(2) (A), (B) and (C) only

(3) (A), (B), (C) and (D)

(4) (B), (C) and (D) only

**41.** The direction cosines of the line which is perpendicular to the lines with direction ratios 1, – 2, – 2 and 0, 2, 1 are :

(1) $\frac{2}{3}, -\frac{1}{3}, \frac{2}{3}$

(2) $-\frac{2}{3}, -\frac{1}{3}, \frac{2}{3}$

(3) $\frac{2}{3}, -\frac{1}{3}, -\frac{2}{3}$

(4) $\frac{2}{3}, \frac{1}{3}, \frac{2}{3}$

SPACE FOR ROUGH WORK

**42.** Let X denote the number of hours you play during a randomly selected day. The probability that X can take values x has the following form, where c is some constant.

$$P(X=x)=\begin{cases}0.1 & , \text{ if } x=0\\ cx & , \text{ if } x=1 \text{ or } x=2\\ c(5-x), & \text{if } x=3 \text{ or } x=4\\ 0 & , \text{ otherwise}\end{cases}$$

Match **List-I** with **List-II** :

| List-I | List-II |
|---|---|
| (A) c | (I) 0.75 |
| (B) $P(X \le 2)$ | (II) 0.3 |
| (C) $P(X = 2)$ | (III) 0.55 |
| (D) $P(X \ge 2)$ | (IV) 0.15 |

Choose the **correct** answer from the options given below :

(1) (A) - (I), (B) - (II), (C) - (III), (D) - (IV)

(2) (A) - (IV), (B) - (III), (C) - (II), (D) - (I)

(3) (A) - (I), (B) - (II), (C) - (IV), (D) - (III)

(4) (A) - (III), (B) - (IV), (C) - (I), (D) - (II)

**43.** If $\sin y = x \sin(a+y)$, then $\frac{dy}{dx}$ is :

(1) $\frac{\sin^2 a}{\sin(a+y)}$

(2) $\frac{\sin(a+y)}{\sin^2 a}$

(3) $\frac{\sin(a+y)}{\sin a}$

(4) $\frac{\sin^2(a+y)}{\sin a}$

**44.** The unit vector perpendicular to each of the vectors $\vec{a}+\vec{b}$ and $\vec{a}-\vec{b}$, where $\vec{a}=\hat{i}+\hat{j}+\hat{k}$ and $\vec{b}=\hat{i}+2\hat{j}+3\hat{k}$, is :

(1) $\frac{1}{\sqrt{6}}\hat{i}+\frac{2}{\sqrt{6}}\hat{j}+\frac{1}{\sqrt{6}}\hat{k}$

(2) $-\frac{1}{\sqrt{6}}\hat{i}+\frac{1}{\sqrt{6}}\hat{j}-\frac{1}{\sqrt{6}}\hat{k}$

(3) $-\frac{1}{\sqrt{6}}\hat{i}+\frac{2}{\sqrt{6}}\hat{j}+\frac{2}{\sqrt{6}}\hat{k}$

(4) $-\frac{1}{\sqrt{6}}\hat{i}+\frac{2}{\sqrt{6}}\hat{j}-\frac{1}{\sqrt{6}}\hat{k}$

**SPACE FOR ROUGH WORK**

P(0) = 0.1
P(1 or 2) = c(1 or 2)
P(3 or 4) = c(5-3 or 4)
P(others) = 0

$1 = 0.1 + c(1) + c(2) + c(5-3) + c(5-4)$
$1 = 0.1 + 3c + c$
$1 = 0.1 + 6c \quad 6c = 0.9 \quad c = \frac{0.9}{6}$

45. The distance between the lines $\vec{r} = \hat{i} - 2\hat{j} + 3\hat{k} + \lambda(2\hat{i} + 3\hat{j} + 6\hat{k})$ and $\vec{r} = 3\hat{i} - 2\hat{j} + 1\hat{k} + \mu(4\hat{i} + 6\hat{j} + 12\hat{k})$ is :

(1) $\frac{\sqrt{28}}{7}$ (2) $\frac{\sqrt{199}}{7}$ (3) $\frac{\sqrt{328}}{7}$ (4) $\frac{\sqrt{421}}{7}$

46. If $f(x) = 2\left(\tan^{-1}(e^x) - \frac{\pi}{4}\right)$, then f(x) is :

(1) even and is strictly increasing in $(0, \infty)$

(2) even and is strictly decreasing in $(0, \infty)$

(3) odd and is strictly increasing in $(-\infty, \infty)$

(4) odd and is strictly decreasing in $(-\infty, \infty)$

47. For the differential equation $(x \log_e x)dy = (\log_e x - y)dx$

(A) Degree of the given differential equation is 1.

(B) It is a homogeneous differential equation.

(C) Solution is $2y \log_e x + A = (\log_e x)^2$, where A is an arbitrary constant

(D) Solution is $2y \log_e x + A = \log_e (\log_e x)$, where A is an arbitrary constant

Choose the **correct** answer from the options given below :

(1) (A) and (C) only (2) (A), (B) and (C) only

(3) (A), (B) and (D) only (4) (A) and (D) only

48. There are two bags. Bag-1 contains 4 white and 6 black balls and Bag-2 contains 5 white and 5 black balls. A die is rolled, if it shows a number divisible by 3, a ball is drawn from Bag-1, else a ball is drawn from Bag-2. If the ball drawn is not black in colour, the probability that it was not drawn from Bag-2 is :

(1) $\frac{4}{9}$ (2) $\frac{3}{8}$ (3) $\frac{2}{7}$ (4) $\frac{4}{19}$

49. Which of the following ***cannot*** be the direction ratios of the straight line $\frac{x-3}{2} = \frac{2-y}{3} = \frac{z+4}{-1}$ ?

(1) $2, -3, -1$ (2) $-2, 3, 1$

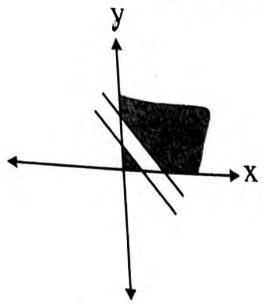
(3) $2, 3, -1$ (4) $6, -9, -3$

SPACE FOR ROUGH WORK

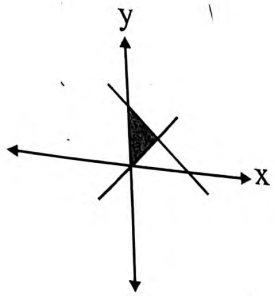
**50.** Which one of the following represents the correct feasible region determined by the following constraints of an LPP ?

$x + y \geq 10,\ 2x + 2y \leq 25,\ x \geq 0,\ y \geq 0$

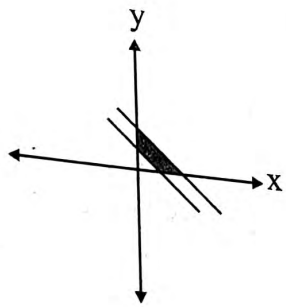
(1)



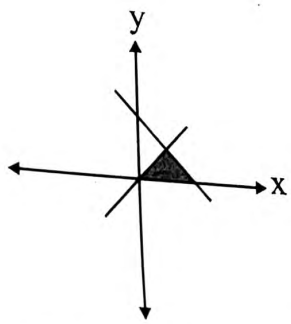

(2)



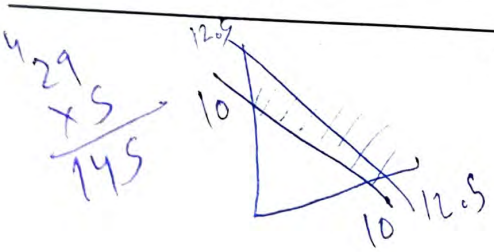

(3)




(4)




SPACE FOR ROUGH WORK



## Section B2 (Applied Mathematics)



51. The least non-negative remainder when $3^{51}$ is divided by 7 is :

(1) 2 (2) 3 (3) 6 (4) 5

52. If $\begin{bmatrix} 5x+8 & 7 \\ y+3 & 10x+12 \end{bmatrix} = \begin{bmatrix} 2 & 3y+1 \\ 5 & 0 \end{bmatrix}$, then the value of $5x + 3y$ is equal to :

(1) $-1$ (2) 8 (3) 2 (4) 0

53. There are 6 cards numbered 1 to 6, one number on one card. Two cards are drawn at random without replacement. Let X denote the sum of the numbers on the two cards drawn. Then $P(X > 3)$ is :

(1) $\frac{14}{15}$ (2) $\frac{1}{15}$

(3) $\frac{11}{12}$ (4) $\frac{1}{12}$

54. Which of the following are components of a time series ?

(A) Irregular component
(B) Cyclical component
(C) Chronological Component
(D) Trend Component

Choose the **correct** answer from the options given below :

(1) (A), (B) and (D) only
(2) (A), (B) and (C) only
(3) (A), (B), (C) and (D)
(4) (B), (C) and (D) only

55. The following data is from a simple random sample :

15, 23, x, 37, 19, 32

If the point estimate of the population mean is 23, then the value of x is :

(1) 12 (2) 30 (3) 21 (4) 24

56. For an investment, if the nominal rate of interest is 10% compounded half yearly, then the effective rate of interest is :

(1) 10.25%
(2) 11.25%
(3) 10.125%
(4) 11.025%

SPACE FOR ROUGH WORK

57. A mixture contains apple juice and water in the ratio 10 : x. When 36 litres of the mixture and 9 litres of water are mixed, the ratio of apple juice and water becomes 5 : 4. The value of x is :

(1) 4 (2) 4.4 (3) 5 (4) 8

58. For $I = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$, if X and Y are square matrices of order 2 such that $XY = X$ and $YX = Y$, then $(Y^2 + 2Y)$ equals to :

(1) $2Y$ (2) $I + 3X$ (3) $I + 3Y$ (4) $3Y$

59. A coin is tossed K times. If the probability of getting 3 heads is equal to the probability of getting 7 heads, then the probability of getting 8 tails is :

(1) $\frac{5}{512}$ (2) $\frac{45}{2^{21}}$ (3) $\frac{45}{1024}$ (4) $\frac{210}{2^{21}}$

60. If 95% confidence interval for the population mean was reported to be 160 to 170 and $\sigma = 25$, then size of the sample used in this study is :

(Given $Z_{0.025} = 1.96$)

(1) 96 (2) 125 (3) 54 (4) 81

61. Two pipes A and B together can fill a tank in 40 minutes. Pipe A is twice as fast as pipe B. Pipe A alone can fill the tank in :

(1) 1 hour (2) 2 hours

(3) 80 minutes (4) 20 minutes

62. An even number is the determinant of

(A) $\begin{bmatrix} 1 & -1 \\ -1 & 5 \end{bmatrix}$ (B) $\begin{bmatrix} 13 & -1 \\ -1 & 15 \end{bmatrix}$ (C) $\begin{bmatrix} 16 & -1 \\ -11 & 15 \end{bmatrix}$ (D) $\begin{bmatrix} 6 & -12 \\ 11 & 15 \end{bmatrix}$

Choose the **correct** answer from the options given below :

(1) (A), (B) and (D) only

(2) (A), (B) and (C) only

(3) (A), (B), (C) and (D)

(4) (B), (C) and (D) only

**SPACE FOR ROUGH WORK**

63. Match **List-I** with **List-II** :

| List-I Function | List-II Derivative w.r.t. x |
|---|---|
| (A) $\frac{5^x}{\log_e 5}$ | (I) $5^x(\log_e 5)^2$ |
| (B) $\log_e 5$ | (II) $5^x \log_e 5$ |
| (C) $5^x \log_e 5$ | (III) $5^x$ |
| (D) $5^x$ | (IV) 0 |

Choose the **correct** answer from the options given below :

(1) (A) - (I), (B) - (II), (C) - (III), (D) - (IV)

(2) (A) - (I), (B) - (III), (C) - (II), (D) - (IV)

(3) (A) - (I), (B) - (II), (C) - (IV), (D) - (III)

(4) (A) - (III), (B) - (IV), (C) - (I), (D) - (II)

64. A random variable X has the following probability distribution :

| X | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| P(X) | k | 2k | 2k | 3k | $k^2$ | $2k^2$ | $7k^2 + k$ |

Match the options of **List-I** to **List-II** :

| List-I | List-II |
|---|---|
| (A) k | (I) $\frac{7}{10}$ |
| (B) $P(X < 3)$ | (II) $\frac{53}{100}$ |
| (C) $P(X > 2)$ | (III) $\frac{1}{10}$ |
| (D) $P(2 < X < 7)$ | (IV) $\frac{3}{10}$ |

Choose the **correct** answer from the options given below :

(1) (A) - (I), (B) - (II), (C) - (III), (D) - (IV)

(2) (A) - (I), (B) - (III), (C) - (II), (D) - (IV)

(3) (A) - (III), (B) - (IV), (C) - (II), (D) - (I)

(4) (A) - (III), (B) - (IV), (C) - (I), (D) - (II)

**SPACE FOR ROUGH WORK**

65. For which one of the following purposes is CAGR (Compounded Annual Growth Rate) ***not*** used ?

(1) To calculate and communicate the average growth of a single investment

(2) To understand and analyse the donations received by a non-government organisation

(3) To demonstrate and compare the performance of investment advisors

(4) To compare the historical returns of stocks with a savings account

66. A flower vase costs ₹ 36,000. With an annual depreciation of ₹ 2,000, its cost will be ₹ 6,000 in _____ years.

(1) 10 (2) 15 (3) 17 (4) 6

67. Arun's speed of swimming in still water is 5 km/hr. He swims between two points in a river and returns back to the same starting point. He took 20 minutes more to cover the distance upstream than downstream. If the speed of the stream is 2 km/hr, then the distance between the two points is :

(1) 3 km (2) 1.5 km (3) 1.75 km (4) 1 km

68. If $e^y = x^x$, then which of the following is true ?

(1) $y\frac{d^2y}{dx^2} = 1$

(2) $\frac{d^2y}{dx^2} - y = 0$

(3) $\frac{d^2y}{dx^2} - \frac{dy}{dx} = 0$

(4) $y\frac{d^2y}{dx^2} - \frac{dy}{dx} + 1 = 0$

69. The probability of a shooter hitting a target is 3/4. How many minimum number of times must he fire so that the probability of hitting the target at least once is more than 90% ?

(1) 1 (2) 2

(3) 3 (4) 4

SPACE FOR ROUGH WORK

70. Match **List-I** with **List-II** :

| | List-I | | List-II |
|---|---|---|---|
| (A) | Distribution of a sample leads to becoming a normal distribution | (I) | Central Limit Theorem |
| (B) | Some subset of the entire population | (II) | Hypothesis |
| (C) | Population mean | (III) | Sample |
| (D) | Some assumptions about the population | (IV) | Parameter |

Choose the **correct** answer from the options given below.

(1) (A) - (I), (B) - (II), (C) - (III), (D) - (IV)

(2) (A) - (I), (B) - (III), (C) - (IV), (D) - (II)

(3) (A) - (I), (B) - (II), (C) - (IV), (D) - (III)

(4) (A) - (III), (B) - (IV), (C) - (I), (D) - (II)

71. Ms. Sheela creates a fund of ₹ 1,00,000 for providing scholarships to needy children. The scholarship is provided in the beginning of the year. This fund earns an interest of r % per annum. If the scholarship amount is taken as ₹ 8,000, then r =

(1) $8\frac{1}{2}\%$

(2) $8\frac{16}{23}\%$

(3) $8\frac{17}{25}\%$

(4) $8\frac{2}{5}\%$

SPACE FOR ROUGH WORK

72. A person wants to invest an amount of ₹ 75,000. He has two options A and B yielding 8% and 9% return respectively on the invested amount. He plans to invest at least ₹ 15,000 in Plan A and at least ₹ 25,000 in Plan B. Also he wants that his investment in Plan A is less than or equal to his investment in Plan B. Which of the following options describes the given LPP to maximize the return (where x and y are investments in Plan A and Plan B respectively) ?

(1) maximize $Z = 0.08x + 0.09y$
$x \geq 15000$
$y \geq 25000$
$x + y \geq 75000$
$x \leq y$
$x, y \geq 0$

(2) maximize $Z = 0.08x + 0.09y$
$x \geq 15000$
$y \leq 25000$
$x + y \geq 75000$
$x \leq y$
$x, y \geq 0$

(3) maximize $Z = 0.08x + 0.09y$
$x \geq 15000$
$y \geq 25000$
$x + y \leq 75000$
$x \geq y$
$x, y \geq 0$

(4) maximize $Z = 0.08x + 0.09y$
$x \geq 15000$
$y \geq 25000$
$x + y \leq 75000$
$x \leq y$
$x, y \geq 0$

73. In a 700 m race, Amit reaches the finish point in 20 seconds and Rahul reaches in 25 seconds. Amit beats Rahul by a distance of :

(1) 120 m

(2) 150 m

(3) 140 m

(4) 100 m

74. For the given five values 12, 15, 18, 24, 36; the three-year moving averages are :

(1) 15, 25, 21

(2) 15, 27, 19

(3) 15, 19, 26

(4) 15, 19, 30

SPACE FOR ROUGH WORK

019 E/B

75. A property dealer wishes to buy different houses given in the table below with some down payments and balance in EMI for 25 years. Bank charges 6% per annum compounded monthly.

$$\left( \text{Given } \frac{(1.005)^{300} \times 0.005}{(1.005)^{300} - 1} = 0.0064 \right)$$

| Property type | Price of the property (in ₹) | Down Payment (in ₹) |
|---|---|---|
| P | 45,00,000 | 5,00,000 |
| Q | 55,00,000 | 5,00,000 |
| R | 65,00,000 | 10,00,000 |
| S | 75,00,000 | 15,00,000 |

Match **List-I** with **List-II** :

| List-I Property Type | List-II EMI amount (in ₹) |
|---|---|
| (A) P | (I) 25,600 |
| (B) Q | (II) 38,400 |
| (C) R | (III) 32,000 |
| (D) S | (IV) 35,200 |

Choose the **correct** answer from the options given below :

(1) (A) - (I), (B) - (II), (C) - (III), (D) - (IV)

(2) (A) - (I), (B) - (III), (C) - (IV), (D) - (II)

(3) (A) - (I), (B) - (II), (C) - (IV), (D) - (III)

(4) (A) - (III), (B) - (IV), (C) - (I), (D) - (II)

SPACE FOR ROUGH WORK

**76.** The corner points of the feasible region for an L.P.P. are (0, 10), (5, 5), (5, 15) and (0, 30). If the objective function is $Z = \alpha x + \beta y$, $\alpha, \beta > 0$, the condition on $\alpha$ and $\beta$ so that maximum of Z occurs at corner points (5, 5) and (0, 20) is :

(1) $\alpha = 5\beta$ (2) $5\alpha = \beta$ (3) $\alpha = 3\beta$ (4) $4\alpha = 5\beta$

**77.** The solution set of the inequality $|3x| \geq |6 - 3x|$ is :

(1) $(-\infty, 1]$
(2) $[1, \infty)$
(3) $(-\infty, 1) \cup (1, \infty)$
(4) $(-\infty, -1) \cup (-1, \infty)$

**78.** If the matrix $\begin{bmatrix} 0 & -1 & 3x \\ 1 & y & -5 \\ -6 & 5 & 0 \end{bmatrix}$ is skew-symmetric , then the value of $5x - y$ is :

(1) 12 (2) 15 (3) 10 (4) 14

**79.** A company is selling a certain commodity 'x'. The demand function for the commodity is linear. The company can sell 2000 units when the price is ₹ 8 per unit and it can sell 3000 units when the price is ₹ 4 per unit . The Marginal revenue at $x = 5$ is :

(1) ₹ 79.98
(2) ₹ 15.96
(3) ₹ 16.04
(4) ₹ 80.02

**80.** If the lengths of the three sides of a trapezium other than the base are 10 cm each, then the maximum area of the trapezium is :

(1) 100 $cm^2$
(2) $25\sqrt{3}$ $cm^2$
(3) $75\sqrt{3}$ $cm^2$
(4) $100\sqrt{3}$ $cm^2$

**81.** Three defective bulbs are mixed with 8 good ones. If three bulbs are drawn one by one with replacement, the probabilities of getting exactly 1 defective, more than 2 defective, no defective and more than 1 defective respectively are :

(1) $\frac{27}{1331}, \frac{576}{1331}, \frac{243}{1331}$ and $\frac{512}{1331}$
(2) $\frac{27}{1331}, \frac{243}{1331}, \frac{576}{1331}$ and $\frac{512}{1331}$
(3) $\frac{576}{1331}, \frac{27}{1331}, \frac{512}{1331}$ and $\frac{243}{1331}$
(4) $\frac{243}{1331}, \frac{576}{1331}, \frac{512}{1331}$ and $\frac{27}{1331}$

SPACE FOR ROUGH WORK

82. If $A = \begin{bmatrix} 2 & 4 \\ 4 & 3 \end{bmatrix}$, $X = \begin{bmatrix} n \\ 1 \end{bmatrix}$, $B = \begin{bmatrix} 8 \\ 11 \end{bmatrix}$

and $AX = B$, then the value of n will be :

(1) 0

(2) 1

(3) 2

(4) not defined

83. The equation of the tangent to the curve $x^{\frac{5}{2}} + y^{\frac{5}{2}} = 33$ at the point (1, 4) is :

(1) $x + 8y - 33 = 0$

(2) $12x + y - 8 = 0$

(3) $x + 8y - 12 = 0$

(4) $x + 12y - 8 = 0$

84. A random variable X has the following probability distribution :

| X | – 2 | – 1 | 0 | 1 | 2 |
|---|---|---|---|---|---|
| P(X) | 0.2 | 0.1 | 0.3 | 0.2 | 0.2 |

The variance of X will be :

(1) 0.1

(2) 1.42

(3) 1.89

(4) 2.54

85. A Multinational company creates a sinking fund by setting a sum of ₹ 12,000 annually for 10 years to pay off a bond issue of ₹ 72,000. If the fund accumulates at 5% per annum compound interest, then the surplus after paying for bond is :

(Use $(1.05)^{10} \approx 1.6$)

(1) ₹ 78,900

(2) ₹ 68,500

(3) ₹ 72,000

(4) ₹ 1,44,000

SPACE FOR ROUGH WORK