

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 $[A]_{3 \times 2}$, $[B]_{x \times y} = [C]_{3 \times 1}$, 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) - (III)

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

$(0,8) (4,0)$
 AB
 $4 + 6 = 8$
 $a(4) + b(6) = a(8) + b(2)$
 $4a + 6b = 8a + 2b$
 $4a - 4b = 8$
 $a - b = 2$
 $a = b + 2$
 $2b = 4$
 $b = 2$
 $a = 4$
 $5 \times 8 + 5 \times 2$
 $40 + 10 = 50$
 $5 \times 4 + 5 \times 6$
 $20 + 30 = 50$
 $x \ y$
 $0 \ 8$
 $4 \ 0$
 $12 \ 0$

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 $\int_0^1 \frac{a - bx^2}{(a + bx^2)^2} dx$ 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

$y = 5^x \log_e 5$
 $y' = 5^x \cdot \frac{1}{5}$

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

$x^2 - x$
 $1 - \left(\frac{dy}{dx} \right)^2$

$\pi i + k$

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° (2) 90°
 (3) 120° (4) 180°

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 $r = \sqrt[3]{1.331} \text{ cm}$ is :

- (1) 66π (2) 6.6π (3) 3.3π (4) 4.4π

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

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

$$\cos \theta = \frac{2}{\sqrt{5}}$$

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

$$A(I^3 - 6I^2A + 12IA^2 - 8A^3) + 2A^3$$

$$A(I - 2A)$$

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 $f : \mathbb{N} \rightarrow \mathbb{N}$ 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. $\int_0^{\frac{\pi}{2}} \frac{1 - \cot x}{\operatorname{cosec} x + \cos x} dx =$

- (1) 0
 (2) $\frac{\pi}{4}$
 (3) ∞
 (4) $\frac{\pi}{12}$

SPACE FOR ROUGH WORK

$$2x \frac{dy}{dx} + (3x^2 + 2y) = 0$$

$$2x \left(\frac{dy}{dx} \right) + 2y = -3x^2$$

$$\frac{1}{x}$$

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

$\frac{4}{9} \times \frac{5}{9} = \frac{20}{81}$
 $k + 2k + 3k + 0 = 1$
 $6k = 1$
 $k = \frac{1}{6}$
 $A^{-1} = \frac{1(\text{Adj } A)}{|A|}$

$k + 2k + 3k = 1$
 $6k = 1$
 $k = \frac{1}{6}$

$2k + 3k$
 $2 + 3 = 5$

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

(A) scalar matrix

(C) skew-symmetric matrix

(B) diagonal matrix

(D) symmetric matrix

Choose the correct answer from the options given below :

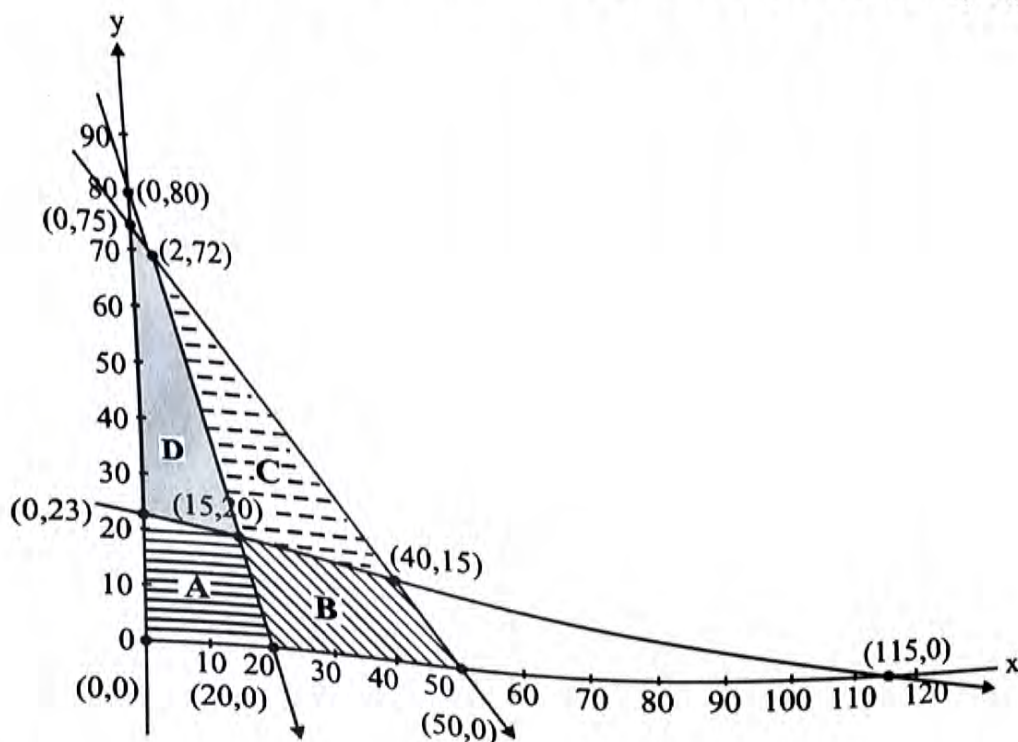
(1) (A), (B) and (D) only

(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

$4x^2 = y$ and $y = 4$

$4x^2 = 4 \Rightarrow x^2 = 1 \Rightarrow x = \pm 1$

$\int_{-1}^1 (4 - 4x^2) dx = 4x - \frac{4x^3}{3} \Big|_{-1}^1 = 4(1) - \frac{4(1)^3}{3} - \left(4(-1) - \frac{4(-1)^3}{3}\right) = 4 - \frac{4}{3} + 4 - \frac{4}{3} = 8 - \frac{8}{3} = \frac{24}{3} - \frac{8}{3} = \frac{16}{3}$

Area = $\frac{16}{3}$ sq. units

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

(1) 0

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

(2) π

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

38. If $P = \begin{bmatrix} -1 \\ 2 \\ 1 \end{bmatrix}$ and $Q = \begin{bmatrix} 2 & -4 & 1 \end{bmatrix}$ 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

$\begin{bmatrix} 2 & 4 & -1 \\ 4 & -8 & 2 \\ -1 & 2 & 1 \end{bmatrix} \begin{bmatrix} 2 & -4 & 1 \end{bmatrix} \begin{bmatrix} 2 & -4 & 1 \end{bmatrix}$
 $\begin{bmatrix} 2 & 4 & -1 \\ 4 & -8 & 2 \\ -1 & 2 & 1 \end{bmatrix}$
 $a_{11} \quad a_{12}$
 30
 $kx+1 =$

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

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

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

(C) Minimum value of Δ is 2

(D) Maximum value of Δ 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

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

(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) $P(X \leq 2)$	(II) 0.3
(C) $P(X = 2)$	(III) 0.55
(D) $P(X \geq 2)$	(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

$P(0) = 0.1$
 $P(1 \text{ or } 2) = c(1 \text{ or } 2)$
 $P(3 \text{ or } 4) = c(5-3 \text{ or } 4)$
 $P(\text{other}) = 0$

$1 = 0.1 + c(1) + c(2) + c(5-3) + c(5-4)$
 $1 = 0.1 + 3c + 2c + c$
 $1 = 0.1 + 6c$

319 E/B

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

$$B_1 - 4 \text{ white} \quad \frac{dy}{dx} = \frac{\log_e x - y}{x \log_e x}$$

$$B_2 - 5 \text{ white} \quad P(1) = \frac{4}{10} \quad P(B_1) = \frac{4}{10}$$

A → Not b

$$P(2) = \frac{5}{10} \quad P(B_2) = \frac{5}{10}$$

$$a_1 - a_2 = \frac{2 \times 4}{30} = \frac{8}{15}$$

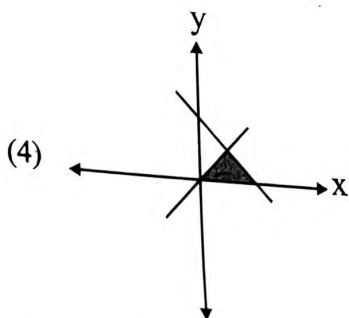
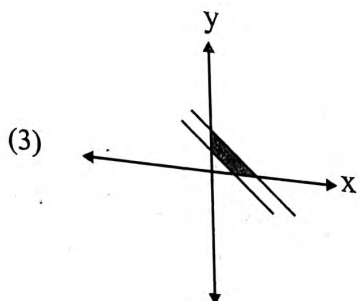
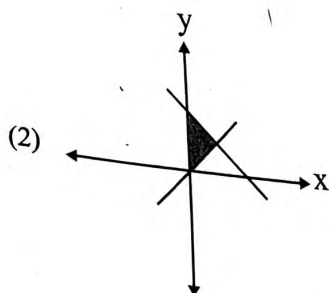
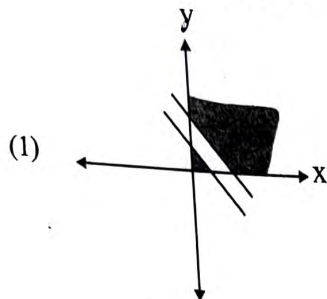
$$-2 - 0 - 2 = (-2i - 2k)$$

$$P(1/6) = \frac{2}{6 \times 3} = \frac{2}{18} = \frac{1}{9}$$

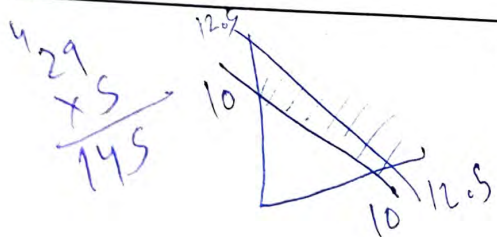
3	2	2	3	6
1	4	4	6	12

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

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



SPACE FOR ROUGH WORK



Section B2 (Applied Mathematics)

319 E/B

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

(3) 6

(4) 5

(1) 2

(2) 3

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

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

(3) 140 m

(2) 150 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

(3) 15, 19, 26

(2) 15, 27, 19

(4) 15, 19, 30

SPACE FOR ROUGH WORK

19 E/B

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 α and β 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) $25\sqrt{3} \text{ cm}^2$
 (3) $75\sqrt{3} \text{ cm}^2$ (4) $100\sqrt{3} \text{ cm}^2$
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