Section : **Common**

Q.1 $\int\left(\frac{1}{\log_e t}-\frac{1}{(\log_e t)^2}\right)dt$ is equal to

(1) $\frac{1}{\log_e t}+C$, where C is constant of integration

(2) $\frac{t}{\log_e t}+C$, where C is constant of integration

(3) $-\frac{t}{\log_e t}+C$, where C is constant of integration

(4) $-\frac{1}{\log_e t}+C$, where C is constant of integration

Options 1. 1
2. 2
3. 3
4. 4

Q.2 A random variable X has the following probability distribution:

X	0	1	2	3	4	5	6	7	8
P(X)	a	3a	5a	7a	9a	11a	13a	15a	17a

Then the values of 'a' and $P(0<X<5)$ respectively are:

(1) $\frac{1}{81},\frac{8}{27}$
(2) $\frac{1}{81},\frac{4}{9}$
(3) $0,0$
(4) $\frac{1}{9},\frac{4}{9}$

Options 1. 1
2. 2
3. 3
4. 4

Q.3 The area (in sq. units) of the region bounded by $y=2x+3$, the x-axis, and the ordinates $x=-2, x=2$ is equal to

(1) 12
(2) $\frac{49}{4}$
(3) $\frac{25}{2}$
(4) 25

Options 1. 1
2. 2
3. 3
4. 4

Q.4 Match List-I with List-II

List-I Differential equation	List-II Degree
(A) $\frac{d^2y}{dx^2}+\sqrt{\frac{dy}{dx}}-y=0$	(I) 6
(B) $\sqrt{\frac{d^3y}{dx^3}}-\sqrt[12]{\frac{d^2y}{dx^2}}=0$	(II) not defined
(C) $\left(\frac{d^2y}{dx^2}\right)^2+\frac{dy}{dx}+e^{\frac{dy}{dx}}=x^2$	(III)3
(D) $\sqrt[3]{\frac{dy}{dx}}-\frac{d^2y}{dx^2}=e^x$	(IV) 2

Choose the correct answer from the options given below:
(1) (A)-(IV), (B)-(I), (C)-(II), (D)-(III)
(2) (A)-(IV), (B)-(III), (C)-(I), (D)-(II)
(3) (A)-(IV), (B)-(I), (C)-(III), (D)-(II)
(4) (A)-(I), (B)-(III), (C)-(IV), (D)-(II)

Options 1. 1

2. 2
3. 3
4. 4

Q.5

If $A = \begin{bmatrix} 1 & 0 & 0 \\ 0 & -1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$, then A^{-1} is equal to:

(1) $\begin{bmatrix} -1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & -1 \end{bmatrix}$

(2) $\begin{bmatrix} -1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$

(3) $\begin{bmatrix} 1 & 0 & 0 \\ 0 & -1 & 0 \\ 0 & 0 & -1 \end{bmatrix}$

(4) $\begin{bmatrix} 1 & 0 & 0 \\ 0 & -1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$

Options 1. 1
2. 2
3. 3
4. 4

Q.6

The function $f(x) = \frac{x}{2} + \frac{2}{x},\ x \neq 0$ is increasing on:

(A) $(-\infty, -2)$
(B) $(-2, 2)$
(C) $(2, \infty)$
(D) $(-1, 1)$

Choose the correct answer from the options given below:

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

Options 1. 1
2. 2
3. 3
4. 4

Q.7

If the corner points of the bounded feasible region of an LPP with objective function maximize $Z = 2x + 3y$ are $(0, 0), (1, 2)$ and $(1, 1)$, then its optimal value is

(1) 0
(2) 7
(3) 8
(4) 10

Options 1. 1
2. 2
3. 3
4. 4

Q.8

If $A = \begin{bmatrix} a & 4 & -5 \\ d & b & -6 \\ 5 & e & c \end{bmatrix}$ is a skew symmetric matrix, then value of $a + b + c + d + e$ is equal to

(1) 10
(2) -10
(3) -2
(4) 2

Options 1. 1
2. 2
3. 3
4. 4

Q.9

If $A = \begin{bmatrix} 1 & 2 & 1 \\ 2 & 3 & 1 \\ 0 & 0 & 1 \end{bmatrix}$, then $|\text{adj}(3A^T)|^2$ is equal to

(1) 3^6

(2) 3^9
(3) 3^{12}
(4) 3^{18}

Options 1. 1
2. 2
3. 3
4. 4

Q.10 The absolute maximum value of the function $f(x) = 4x - \frac{1}{2}x^2$ in the interval $\left[-2, \frac{9}{2}\right]$ is

(1) 10
(2) 9
(3) 8
(4) 6

Options 1. 1
2. 2
3. 3
4. 4

Q.11 The objective function of an LPP is $Z = ax + by$. If the maximum value of the objective function is 180, which occurs at two points $(15, 15)$ and $(0, 20)$, then which one of the following is true?

(1) $a = 3, b = 9$
(2) $a = 9, b = 3$
(3) $a = 6, b = 6$
(4) $a = 4, b = 8$

Options 1. 1
2. 2
3. 3
4. 4

Q.12 If P, Q and R are matrices of order $2 \times 3, 3 \times 5$ and 5×3 respectively. Then which of the following are valid?

(A) PQR
(B) PRQ
(C) QR
(D) RQ
(E) PR

Choose the correct answer from the options given below:
(1) (A),(C),(D) only
(2) (B),(C),(D) only
(3) (A),(B),(C),(D) only
(4) (A),(B),(D),(E) only

Options 1. 1
2. 2
3. 3
4. 4

Q.13 The general solution of the differential equation $\frac{dy}{dx} = xy + x + y + 1$ is

(1) $\log_e |y| = x + y + C$, where C is constant of integration

(2) $\log_e |y + 1| = \frac{1}{2}x^2 + x + C$, where C is constant of integration

(3) $\log_e |x + 1| = \frac{1}{2}y^2 + y + C$, where C is constant of integration

(4) $\log_e |x| = \frac{1}{2}y^2 + y + C$, where C is constant of integration

Options 1. 1
2. 2
3. 3
4. 4

Q.14 $\int_0^2 x(2 - x)^n dx$ is equal to

(1) $\frac{2^{n+2}(n+1)}{(n+2)(n+3)}$

(2) $\frac{2^{n+2}(n+2)}{(n+1)(n+3)}$

(3) $\frac{2^{n+2}}{(n+1)(n+2)}$

(4) $\frac{2^{n+1}}{(n+1)(n+2)}$

Options 1. 1
2. 2
3. 3
4. 4

Q.15 Let $e^y(x+1)=1$. Then which of the following are TRUE

(A) $\frac{d^2y}{dx^2}=-\frac{1}{(x+1)^2}$

(B) $\frac{d^2y}{dx^2}=\left(\frac{dy}{dx}\right)^2$

(C) $\left.\frac{d^2y}{dx^2}\right|_{x=0}=-1$

(D) $\left.\frac{d^2y}{dx^2}\right|_{x=0}=1$

(E) $\left.\frac{d^2y}{dx^2}\right|_{x=1}=\frac{1}{4}$

Choose the correct answer from the options given below:
(1) (B),(D),(E) only
(2) (A),(C) only
(3) (B),(C) only
(4) (A),(D),(E) only

Options 1. 1
2. 2
3. 3
4. 4

Section : **Applied Mathematics**

Q.16 Which of the following statements about the Sinking Fund are correct?

(A) It is a fund established by a business entity by setting aside revenue over a period of time to fund a future capital expense.

(B) It is a fund established by a business entity by setting aside revenue over a period of time to fund a future repayment of a long-term debt.

(C) It is set up for any purpose that it may serve.

(D) It is a fund that is accumulated for the purpose of paying off a financial obligation at some future designated date.

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. (C) and (D) only

Options 1. 1
2. 2
3. 3
4. 4

Q.17 Question: Arrange the following as per statistical inferences:

(A) Data Analysis

(B) Population

(C) Making Inferences

(D) Data Collection

Choose the correct answer from the options given below:

1. (A), (B), (C), (D)
2. (A), (C), (B), (D)
3. (B), (D), (A), (C)
4. (A), (B), (D), (C)

Options 1. 1
2. 2
3. 3
4. 4

Q.18 Question: When two independent small samples of sizes n_1 and n_2 with means $\bar{x}_1$ and $\bar{x}_2$ respectively are drawn from populations with identical population variances, the test-statistic is computed as:

1. $t = \frac{\bar{x}_1 - \bar{x}_2}{S_p\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$, where S_p is pooled standard deviation.
2. $t = \frac{\bar{x}_1 - \bar{x}_2}{S_p\sqrt{\frac{1}{n_1} - \frac{1}{n_2}}}$, where S_p is pooled standard deviation.
3. $t = \frac{\bar{x}_1 + \bar{x}_2}{S_p\sqrt{\frac{1}{n_1} - \frac{1}{n_2}}}$, where S_p is pooled standard deviation.
4. $t = \frac{\bar{x}_1 + \bar{x}_2}{\sqrt{\frac{1}{n_1} - \frac{1}{n_2}}}$, where S_p is pooled standard deviation.

Options 1. 1
2. 2
3. 3
4. 4

Q.19 Question: A manufacturing unit makes two models, 'classic' and 'supreme' of the scooter.

Each piece of the classic model requires 9 labour hours for assembling and 1 labour hour for finishing.

Each piece of supreme model requires 12 labour hours for assembling and 3 labour hour for finishing.

Maximum labour hours available for assembling and finishing are 180 and 30 respectively.

Profit is Rs. 10000 on each classic piece and Rs. 15000 on each supreme piece.

Which option describes the LPP to maximize profit Z (where x and y are classic and supreme pieces)?

1. Max Z = 10 x + 15 y, subject to 3x + 4y \le 180, x + 3y \le 30, x \ge 0, y \ge 0.
2. Max Z = 10000 x + 15000 y, subject to 9x + y \le 180, 12x + 3y \le 30, x \ge 0, y \ge 0.
3. Max Z = 10000 x + 15000 y, subject to 3x + 4y \ge 180, 12x + 3y \ge 30, x \ge 0, y \ge 0.
4. Max Z = 10000 x + 15000 y, subject to 3x + 4y \le 60, x + 3y \le 30, x \ge 0, y \ge 0.

Options 1. 1
2. 2
3. 3
4. 4

Q.20 Question: When data of the variable is collected at distinct time intervals for a specified period of time, it is called

1. Cross-sectional data
2. Time series data
3. Pooled data
4. Constant data

Options 1. 1
2. 2
3. 3
4. 4

Q.21 Question: If $x^2 - y^2 = 1$, then which of the following is correct?

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

(B) $(x^2-1)\left(\frac{d^2y}{dx^2}\right)^2 = x^2$

(C) $(x^2-1)^3\left(\frac{d^2y}{dx^2}\right)^2 = x^2$

(D) $(x^2-1)^3\left(\frac{d^2y}{dx^2}\right)^2 = 1$

Choose the correct answer from the options given below:

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

Options 1. 1
2. 2
3. 3
4. 4

Q.22 Question: Which of the following is incorrect about the Linear Programming Problem (LPP)?

1. If the feasible region R of a Linear Programming Problem (LPP) is bounded, then the objective function has both a maximum and a minimum value in R.

2. An LPP can have no solution or more than one optimal solution.

3. If two corner points of the feasible region are both optimal solutions of the same type, then any point on the line segment joining these two points is also an optimal solution of the same type.

4. If the feasible region is unbounded, then a minimum value of the objective function always exists.

Options 1. 1
2. 2
3. 3
4. 4

Q.23 Question: On which of the following components, the pattern and behavior of the data in any time series is based?

(A). Secular trend component

(B). Seasonal component

(C). Cyclical component

(D). Regular 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. (C) and (D) only

Options 1. 1
2. 2
3. 3
4. 4

Q.24 Question: Which of the following statements are correct about the Compound Annual Growth Rate (CAGR)?

(A) It can be used to compare historical returns on different investment portfolios.

(B) It helps smooth returns when growth rates are expected to be volatile and inconsistent.

(C) It is unable to track the performance of various business measures of one or multiple companies alongside one another.

(D) It can be used to calculate the average growth of a single investment.

Choose the correct answer from the options given below:

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

Options 1. 1
2. 2
3. 3
4. 4

Q.25 Question: In a box containing 100 bulbs, 10 are defective. The probability that out of a

sample of 5 bulbs, none is defective is:

1. $\frac{1}{10}$
2. $\left(\frac{9}{10}\right)^5$
3. $\left(\frac{1}{2}\right)^5$
4. $\frac{9}{10}$

Options 1. 1
2. 2
3. 3
4. 4

Q.26 Question: Which of the following is NOT correct about the Central Limit Theorem?

1. When the sample size increases, the mean of the sample of data becomes close to the mean

of the overall population.
2. When the sample size increases, the sampling distribution of the mean approaches a

normal distribution, regardless of the shape of the parent population.
3. A sample size of less than 30 is considered to be sufficient to hold the Central Limit Theorem.
4. A sample size of 30 or more is considered to be sufficient to hold the Central Limit Theorem.

Options 1. 1
2. 2
3. 3
4. 4

Q.27 Question: Let A, B, C, D and E be matrices of $2 \times n, 3 \times k, 2 \times p,$

$2 \times p$ and 3×3 respectively.

Choose the correct statement(s) from the following:

(A) $EB + DB$ will be defined if $k = 3, p = n$.

(B) $E(3 \times 3) \cdot B(3 \times k) \rightarrow (3 \times k) \rightarrow n \times 3$.

(C) If $n = p = 2$, then the order of the matrix $5A^2 - 3C$ is 2×2.

(D) If $n = p$, then the order of the matrix $5A^2 - 3C$ is 2×3.

Choose the correct answer from the options given below:

1. (A) and (D) only

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

Options 1. 1
2. 2
3. 3
4. 4

Q.28 Question: The speed of a motorboat in still water and that of the current of water is in a ratio of 27:5.

The boat goes along the current from point A to point B in 3 hours 40 minutes.

How much time will it take to come back from B to A?

1. 5 hours 20 minutes
2. 5 hours 40 minutes
3. 3 hours 20 minutes
4. 6 hours 20 minutes

Options 1. 1
2. 2
3. 3
4. 4

Q.29 Let $A = [a_{ij}]$ be a square matrix of order 2 with elements either 0 or 1. Then the difference between the possible number of singular and non-singular matrices is

1. 4
2. 5
3. 6
4. 3

Options 1. 1
2. 2
3. 3
4. 4

Q.30 Question: Let P, I and n be the principal of the loan, the total interest on the principal

and number of months in the loan period respectively, then the EMI by Flat Rate Method is:

1. $\frac{P}{I+n}$
2. $\frac{P+I}{n}$
3. $P+\frac{I}{n}$
4. $\frac{I-P}{n}$

Options 1. 1
2. 2
3. 3
4. 4

Q.31 Match List `1 with List 2.

List-1 (Matrix)	List-2 (Determinants)
Matrix (A) $= \begin{bmatrix} 1 & 7 \\ -3 & 5 \end{bmatrix}$	24
Matrix (B) $= \begin{bmatrix} -2 & 5 \\ -3 & -3 \end{bmatrix}$	32
Matrix (C) $= \begin{bmatrix} -12 & 8 \\ -16 & 8 \end{bmatrix}$	21
Matrix (C) $= \begin{bmatrix} -12 & 8 \\ -16 & 8 \end{bmatrix}$	26

\[\text{Choose the correct answer from the options given below:} \]
1. (A)-(IV), (B)-(III), (C)-(I), (D)-(II)
2. (A)-(IV), (B)-(III), (C)-(II), (D)-(I)
3. (A)-(IV), (B)-(II), (C)-(I), (D)-(III)
4. (A)-(III), (B)-(IV), (C)-(I), (D)-(II)

Options 1. 1

2. 2
3. 3
4. 4

Q.32 Question: Let a pair of dice be thrown and the random variable X

be the sum of the numbers that appear on the two dice.

Match List-I with List-II

List I List II

X Probability,P(X)

(A) 4 (I) 1/6

(B) 5 (II) 5/36

(C) 6 (III) 1/12

(D) 7 (IV) 1/9

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)-(II),(D)-(I)

Options 1. 1
2. 2
3. 3
4. 4

Q.33 The general solution of the differential equation $e^x dy + (ye^x + 2x)dx = 0$ is

1.$xe^y + x^2 = C$, where C is constant of integration
2.$xe^y + y^2 = C$, where C is constant of integration
3.$ye^x + x^2 = C$, where C is constant of integration
4.$ye^y + x^2 = C$, where C is constant of integration

Options 1. 1
2. 2
3. 3
4. 4

Q.34 A shopkeeper has 300 Kg millet, a part of which he sells at 10 \% profit. The remaining quantity

of millet was of poor quality, and he sold it at a 5 \% loss. In the whole transaction, he made

a profit of 7 \%. The quantity of the millet sold at 5 \% loss is:

1. 50 Kg
2. 60 Kg
3. 100 Kg
4. 30 Kg

Options 1. 1
2. 2
3. 3
4. 4

Q.35 For the system $\begin{bmatrix} 2 & -3 \\ -4 & 6 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 5 \\ -10 \end{bmatrix}$, which of the following statements are correct?

(A) The system has no solution.

(B) The system is consistent.

(C) It has infinitely many solutions.

(D) It has a unique solution.

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

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

Options 1. 1
2. 2
3. 3

4. 4

Q.36 If the integral $I = \int \left\{ \log_e(\log_e x)^2 + \frac{\alpha}{\log_e x} \right\} dx = x \log_e(\log_e x)^2 + C,$ where C is constant of integration. Then the value of α is :

1. 0
2. -1
3. -2
4. 2

Options 1. 1
2. 2
3. 3
4. 4

Q.37 The interval in which the function $g(x) = x^2 e^{-x}$ is increasing is:

1. $(-\infty, \infty)$
2. $(-2, 0)$
3. $(2, \infty)$
4. $(0, 2)$

Options 1. 1
2. 2
3. 3
4. 4

Q.38 The number of tangents to the curve $xy - 3y + 2 = 0$ having slope 2 is:

1. 0
2. 1
3. 2
4. Infinite

Options 1. 1
2. 2
3. 3
4. 4

Q.39 Which of the following statements are NOT correct about Standard Normal Distribution?

(A) The probability curve of the Standard Normal Distribution is a bell-shaped curve.

(B) The Standard Normal variate (Z) score describes the position of each data point in terms of its distance from the mean, when measured in standard deviation units.

(C) The Z-score is negative if the data point lies above the mean, and positive if it lies below the mean.

(D) There is a 95.45 \% probability of randomly selecting a score between $\mu - \sigma$ and $\mu + \sigma$, when σ is standard deviation and μ is mean.

Choose the correct answer from the options given below:

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

Options 1. 1
2. 2
3. 3
4. 4

Q.40 A random variable X has the following probability distribution:

X	0	1	2	3
P(X)	0.1	0.2	0.3	0,4

The variance of the X will be :

1. 1
2. 2
3. 2.3
4. 1.2

Options 1. 1
2. 2
3. 3
4. 4

Q.41 A coin is tossed twice and outcomes are recorded. If the random variable X represents the number of heads in the experiment, then the expectation of X will be:

1. 0
2. 1
3. 1/2
4. 1/3

Options 1. 1
2. 2
3. 3
4. 4

Q.42 If A is an invertible matrix of order 3 and the determinant of A is 9, then the determinant of A^{-1} is:

1. 1
2. 9
3. 0
4. 1/9

Options 1. 1
2. 2
3. 3
4. 4

Q.43 If the matrix $\begin{bmatrix} 0 & 7 & -12 \\ -7 & 0 & -5 \\ 2a & 5 & 3b \end{bmatrix}$ is skew-symmetric, then the value of $(4a + 3b)$ is:

1. 24
2. 12
3. 0
4. -12

Options 1. 1
2. 2
3. 3
4. 4

Q.44 If r_{eff} = effective rate of interest, r = nominal rate of interest and m = number of conversion periods per year, the relationship between nominal rate and effective rate of interest is:

1. $r_{eff} = \left(1 - \frac{r}{m}\right)^m - 1$
2. $r_{eff} = \left(1 + \frac{r}{m}\right)^m - 1$
3. $r_{eff} = \left(1 - \frac{1}{r}\right)^m + 1$
4. $r_{eff} = \left(1 + \frac{m}{r}\right)^m - 1$

Options 1. 1
2. 2
3. 3
4. 4

Q.45 The non-negative remainder when 7^{30} is divided by 5 is:

1. 1
2. 4
3. 2
4. 3

Options 1. 1
2. 2
3. 3
4. 4

Q.46 On 1st April 2024, person 'X' purchased a machinery costing ₹ 65000 and spent ₹ 10000 on its installation. The estimated effective life of the machinery is 5 years with a scrap value of ₹ 10000. The annual depreciation using the straight-line method with the accounting year ending on 31st March 2025 is:

1. ₹ 10000
2. ₹ 15000
3. ₹ 13000
4. ₹ 5000

Options 1. 1
2. 2
3. 3
4. 4

Q.47 At 6 \% converted quarterly, the present value of a perpetuity of ₹ 900 payable at the end of each quarter is:

1. ₹ 40000
2. ₹ 42000
3. ₹ 60000
4. ₹ 6000

Options 1. 1
2. 2
3. 3
4. 4

Q.48 For the given five values 15, 24, 18, 33, 42, the three years moving averages are:

1. 19, 22, 33
2. 19, 25, 31
3. 19, 30, 31
4. 19, 25, 33

Options 1. 1
2. 2
3. 3
4. 4

Q.49 Two pipes can fill a cistern in 8 and 12 hours respectively. The pipes are opened simultaneously, and it takes 12 minutes more to fill the cistern due to leakage. If the cistern is full, what will be the time taken by the leakage to empty it?

1. 84 hours
2. 72 hours
3. 108 hours
4. 120 hours

Options 1. 1
2. 2
3. 3
4. 4

Q.50 If $a > b$ and $c < 0$, then which of the following is NOT correct?

(A) $ac < bc$

(B) $a + c < b + c$

(C) $a - c < b - c$

(D) $ac > bc$

Choose the correct answer from the options given below:

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

Options 1. 1
2. 2
3. 3
4. 4

Section : **Core Mathematics**

Q.51 A vector of magnitude 8 units in the direction perpendicular to both the vectors $\hat{i}+\hat{j}+\hat{k}$ and $2\hat{i}+\hat{k}$ is

(1) $8(\hat{i}+\hat{j}-2\hat{k})$
(2) $\frac{8}{\sqrt{6}}(-\hat{i}+\hat{j}+2\hat{k})$
(3) $\frac{8}{\sqrt{6}}(\hat{i}+\hat{j}-2\hat{k})$
(4) $\frac{8}{\sqrt{6}}(\hat{i}-\hat{j}+2\hat{k})$

Options 1. 1
2. 2
3. 3
4. 4

Q.52 Match List-I with List-II

List-I	List-II
(A) Angle between $\hat{i}-\hat{j}$ and $\hat{i}+\hat{j}$	(I) π
(B) Angle between $\hat{i}-\hat{j}+\hat{k}$ and $-\hat{i}+\hat{j}-\hat{k}$	(II) $\frac{3\pi}{4}$
(C) Angle between $\hat{i}+\hat{j}$ and $-\hat{i}$	(III) $\frac{\pi}{4}$
(D) Angle between $\hat{i}+\hat{k}$ and $\hat{k}$	(IV) $\frac{\pi}{2}$

Choose the correct answer from the options given below:
(1) (A) - (IV), (B) - (I), (C) - (II), (D) - (III)
(2) (A) - (IV), (B) - (II), (C) - (III), (D) - (I)
(3) (A) - (IV), (B) - (III), (C) - (II), (D) - (I)
(4) (A) - (I), (B) - (II), (C) - (III), (D) - (IV)

Options 1. 1
2. 2
3. 3
4. 4

Q.53 The sum of two positive numbers is 60. If the sum of their squares is minimum, then the absolute value of the difference of their cubes is

(1) 0
(2) 56000
(3) 11500
(4) 87750

Options 1. 1
2. 2
3. 3
4. 4

Q.54 The area (in sq. units) of the region $\{(x,y) : 3x^2 \le y \le |x|\}$ is equal to:

(1) $\frac{1}{54}$
(2) $\frac{1}{9}$
(3) $\frac{1}{27}$
(4) $\frac{1}{36}$

Options 1. 1
2. 2
3. 3
4. 4

Q.55 If the lines $\frac{1-x}{3}=\frac{3y-6}{k}=\frac{3-z}{-2}$ and $\frac{1-x}{2k}=\frac{y-5}{3}=\frac{6-z}{5}$ are perpendicular, then k is equal to:

(1) $\frac{10}{7}$

(2) $\frac{10}{9}$

(3) $-\frac{10}{9}$

(4) $-\frac{10}{7}$

Options 1. 1
2. 2
3. 3
4. 4

Q.56 The area (in sq. units) of the region bounded by the curve $y=\sin x, -2\pi \le x \le 2\pi$ and the x-axis is:

(1) 0
(2) 4
(3) 8
(4) 16

Options 1. 1
2. 2
3. 3
4. 4

Q.57 For what value of k, the following system of equations has infinitely many solutions?
$x+2y=5, 3x+ky=15$

(1) 1
(2) 6
(3) -3
(4) 3

Options 1. 1
2. 2
3. 3
4. 4

Q.58 Match List-I with List-II

List-I	List-II
(A) $\sin^{-1}(-1)$	(I) $\frac{5\pi}{6}$
(B) $\cot^{-1}(-1)$	(II) $-\frac{\pi}{2}$
(C) $\sec^{-1}\left(-\frac{2}{\sqrt{3}}\right)$	(III) $\frac{\pi}{4}$
(D) $\tan^{-1}(1)$	(IV) $\frac{3\pi}{4}$

Choose the correct answer from the options given below:
(1) (A)-(II), (B)-(IV), (C)-(I), (D)-(III)
(2) (A)-(II), (B)-(III), (C)-(I), (D)-(IV)
(3) (A)-(I), (B)-(IV), (C)-(II), (D)-(III)
(4) (A)-(I), (B)-(III), (C)-(II), (D)-(IV)

Options 1. 1
2. 2
3. 3
4. 4

Q.59 $\int \frac{\cos x-\sin x}{1+\sin 2x}dx$ is equal to

(1) $\frac{1}{\cos x+\sin x}+C$, where C is constant of integration

(2) $\frac{-1}{\cos x+\sin x}+C$, where C is constant of integration

(3) $\frac{1}{1+\sin 2x}+C$, where C is constant of integration

(4) $\frac{1}{1-\sin 2x}+C$, where C is constant of integration

Options 1. 1
2. 2
3. 3
4. 4

Q.60 Let L be the set of all lines in a plane and R be the relation on set L defined by $R=\{(L_1,L_2):L_1\perp L_2\}$. Then R is

(A) an equivalence Relation
(B) a symmetric Relation
(C) not a transitive Relation
(D) a reflexive Relation

Choose the correct answer from the options given below:
(1) (A) only
(2) (B) and (C) only
(3) (B) and (D) only
(4) (B), (C) and (D) only

Options 1. 1
2. 2
3. 3
4. 4

Q.61 The optimal value of the objective function of the LPP, Minimize $Z=3x-2y$ subject to constraints $x+y\geq 10, 3x+5y\geq 15, x\geq 0, y\geq 0,$ is equal to:

(1) 30
(2) -20
(3) -6
(4) 15

Options 1. 1
2. 2
3. 3
4. 4

Q.62 Match List-I with List-II

Let $f: A\to B$ be a function given by $f(x)=x^2$

List-I Domain and Co-domain	List-II Kind
(A) $A=\mathbb{R}$ and $B=\mathbb{R}$	(I) f is both one-one and onto
(B) $A=\mathbb{R}$ and $B=[0,\infty]$	(II) f is one-one but not onto
(C) $A=B=[0,\infty]$	(III) f is not one-one but onto
(D) $A=[0,\infty], B=\mathbb{R}$	(IV) f is neither one-one nor onto

Choose the correct answer from the options given below:
(1) $(A)-(III),(B)-(IV),(C)-(II),(D)-(I)$
(2) $(A)-(IV),(B)-(III),(C)-(I),(D)-(II)$
(3) $(A)-(IV),(B)-(III),(C)-(II),(D)-(I)$
(4) $(A)-(III),(B)-(IV),(C)-(I),(D)-(II)$

Options 1. 1
2. 2
3. 3
4. 4

Q.63 The direction cosines of a line equally inclined with the co-ordinate axes are:

(1) $(1,1,1)$

(2) $\left(\frac{1}{3},\frac{1}{3},\frac{1}{3}\right)$

(3) $\left(\pm\frac{1}{\sqrt{3}},\pm\frac{1}{\sqrt{3}},\pm\frac{1}{\sqrt{3}}\right)$

(4) $\left(\frac{1}{\sqrt{2}},\frac{1}{\sqrt{2}},\frac{1}{\sqrt{2}}\right)$

Options 1. 1
2. 2
3. 3
4. 4

Q.64 Let $f(x)=\begin{cases}\frac{|x|}{x}, & x\neq 0\\ 1, & x=0\end{cases}$, and $g(x)=\begin{cases}x\sin\frac{1}{x}, & x\neq 0\\ 0, & x=0\end{cases}$. Then at the origin, which one is true?

(1) $f(x)$ is continuous, but $g(x)$ is not continuous
(2) $g(x)$ is continuous, but $f(x)$ is not continuous
(3) Both $f(x)$ and $g(x)$ are continuous
(4) Neither $f(x)$ nor $g(x)$ is continuous

Options 1. 1
2. 2
3. 3
4. 4

Q.65 If A is a square matrix and I is an identity matrix of same order such that $A^2=A$, then $(2I+A)^2-5A$ is:

(1) O
(2) $4I$
(3) $5A$
(4) $2I$

Options 1. 1
2. 2
3. 3
4. 4

Q.66 The general solution of the differential equation $\frac{dy}{dx}=e^{x+y}$ is:

(1) $e^x+e^y=C$, where C is an arbitrary constant
(2) $e^x+e^{-y}=C$, where C is an arbitrary constant
(3) $e^x-e^{-y}=C$, where C is an arbitrary constant
(4) $e^x-e^y=C$, where C is an arbitrary constant

Options 1. 1
2. 2
3. 3
4. 4

Q.67 If A and B are square matrices of order 3 such that $|A|=3$ and $|B|=-1$, then $|3AB|$ is:

(1) -9
(2) -81
(3) -3
(4) -27

Options 1. 1
2. 2
3. 3
4. 4

Q.68 A man is known to speak truth 3 out of 4 times. He throws a die and reports that it is four. The probability that it is actually four is:

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

Options 1. 1
2. 2
3. 3
4. 4

Q.69 Match List-I with List-II

List-I	List-II
(A) Point of minima of $f(x) = \|x+1\|$	(I) 1
(B) Minimum value of $f(x) = \|x\|$	(II) -1
(C) Maximum value of $f(x) = 1 - x^2$	(III) 2
(D) Minimum value of $f(x) = 2 + \sin^2 x$	(IV) 0

Choose the correct answer from the options given below:

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

Options 1. 1
2. 2
3. 3
4. 4

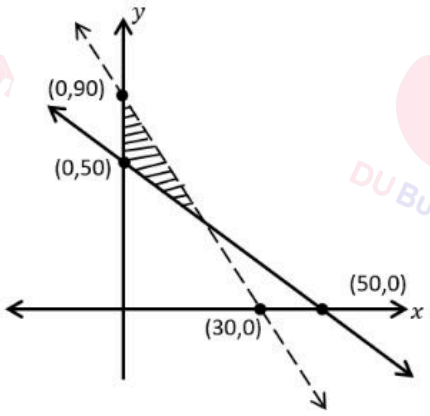
Q.70 If $f(x) = x^3 e^{-x}$, then the value of $f''(1)$ is equal to

(1) $\frac{1}{e}$
(2) $-\frac{1}{e}$
(3) $\frac{13}{e}$
(4) $\frac{11}{e}$

Options 1. 1
2. 2
3. 3
4. 4

Q.71

The feasible region of the linear programming problem is represented below:



The constraints of this LPP are

1. $x + y \geq 50, 3x + y \geq 90, x, y \geq 0$
2. $x + y < 50, 3x + y \leq 90, x, y \geq 0$
3. $x + y \geq 50, 3x + y \leq 90, x, y \geq 0$
4. $x + y \geq 50, 3x + y < 90, x, y \geq 0$

Options 1. 1
2. 2
3. 3
4. 4

Q.72 Let $\begin{vmatrix} x & 2 \\ 18 & x \end{vmatrix} = \begin{vmatrix} -4 & -2 \\ -8 & -4 \end{vmatrix}$. Then:

(A) $x = -4$
(B) $x = -6$
(C) $x = 4$
(D) $x = 6$

Choose the correct answer from the options given below:

(1) (A) and (C) only

(2) (C) only

(3) (D) only

(4) (B) and (D) only

Options 1. 1
2. 2
3. 3
4. 4

Q.73 The shortest distance between the lines $\vec{r} = (\hat{i} + 2\hat{j} + 3\hat{k}) + \lambda(2\hat{i} + 3\hat{j} + 4\hat{k})$ and $\vec{r} = (2\hat{i} + 4\hat{j} + 5\hat{k}) + \mu(3\hat{i} + 4\hat{j} + 5\hat{k})$ is equal to:

(1) $\frac{1}{\sqrt{2}}$

(2) $\frac{1}{\sqrt{3}}$

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

(4) $\frac{1}{\sqrt{6}}$

Options 1. 1
2. 2
3. 3
4. 4

Q.74 Let $\vec{a}, \vec{b}$ be two vectors such that $|\vec{a}| = 2, |\vec{b}| = 3, \vec{a} \cdot \vec{b} = 4$. Then $|\vec{a} - \vec{b}|$ is equal to:

(1) 0

(2) $\sqrt{5}$

(3) 5

(4) 1

Options 1. 1
2. 2
3. 3
4. 4

Q.75 $\int_0^1 \tan^{-1}\left(\frac{2x-1}{1+x-x^2}\right)dx$ is equal to:

(1) -1

(2) 0

(3) 1

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

Options 1. 1
2. 2
3. 3
4. 4

Q.76 If A and B are two events such that $P(A|B) = P(B|A)$, and $A \cap B \neq \emptyset$, then:

(1) $P(A) = 1$

(2) $P(A) = P(B)$

(3) $P(B) = 1$

(4) $P(A \cap B) = 0$

Options 1. 1
2. 2
3. 3
4. 4

Q.77 If $y = \cos^{-1}\left(\frac{1-x^2}{1+x^2}\right), 0 < x < 1$, then $\frac{dy}{dx}$ is equal to:

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

(2) $-\frac{2}{\sqrt{1-x^2}}$

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

(4) $\frac{2}{\sqrt{1-x^2}}$

Options 1. 1
2. 2
3. 3
4. 4

Q.78 Which of the following statements is/are true?

(A) B^TAB is a skew-symmetric matrix if A is symmetric matrix
(B) B^TAB is a symmetric matrix if A is symmetric matrix
(C) B^TAB is a symmetric matrix if A is skew-symmetric matrix
(D) B^TAB is a skew-symmetric matrix if B is skew-symmetric matrix
(E) B^TAB is a symmetric matrix if B is symmetric matrix
Choose the correct answer from the options given below:
(1) (A) and (C) only
(2) (A) and (E) only
(3) (B) only
(4) (D) and (E) only

Options 1. 1
2. 2
3. 3
4. 4

Q.79 $\int_{-5/2}^{5/2}|x|dx$ is equal to:

(1) $\frac{25}{4}$

(2) 0

(3) $\frac{5}{2}$

(4) $-\frac{5}{2}$

Options 1. 1
2. 2
3. 3
4. 4

Q.80 If $x=\frac{1-t}{1+t}$ and $y=\frac{2t}{1+t}$, then $\frac{d^2y}{dx^2}$ is equal to:

(1) $\frac{1}{1+t^2}$

(2) 0

(3) -1

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

Options 1. 1
2. 2
3. 3
4. 4

Q.81 The length of the line segment joining the points with position vectors $2\hat{i}-2\hat{j}+3\hat{k}$ and $5\hat{i}+2\hat{j}+3\hat{k}$ is:

(1) 2

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

Options 1. 1
2. 2
3. 3
4. 4

Q.82 If A and B are independent events such that $P(A|B) = \frac{1}{3}$ and $P(B) = \frac{1}{2}$, then the value of $P(A \cap B)$ is equal to:

(1) $\frac{1}{3}$
(2) $\frac{1}{6}$
(3) $\frac{1}{12}$
(4) $\frac{1}{2}$

Options 1. 1
2. 2
3. 3
4. 4

Q.83 The probability of not getting 53 Sundays in a leap year is:

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

Options 1. 1
2. 2
3. 3
4. 4

Q.84 Let $A = \begin{bmatrix} 2 & -3 & 4 \\ 0 & 1 & 5 \\ -4 & 2 & 3 \end{bmatrix}$, and a_{ij} be any element of A, $i, j \in \{1, 2, 3\}$, then which of the following are TRUE?

(A) Minor of $a_{23} = 16$

(B) Minor of $a_{23} = -8$

(C) Cofactor of $a_{23} = -16$

(D) Cofactor of $a_{23} = 8$

(E) Cofactor of $a_{13} = 4$

Choose the correct answer from the options given below:
(1) (A) and (C) only
(2) (B) and (C) only
(3) (B), (D) and (E) only
(4) (A), (C) and (E) only

Options 1. 1
2. 2
3. 3
4. 4

Q.85 The integrating factor of the differential equation $x^2 \frac{dy}{dx} + xy = \log_e x$ is equal to:

(1) e^x
(2) $e^{x^2/2}$
(3) x
(4) $\log_e x$

Options 1. 1
2. 2
3. 3
4. 4