Section : **Common**

Q.1 If m and n are respectively the order and degree of the differential equation

$\left(\frac{d^2y}{dx^2}\right)^2 + \left(\frac{dy}{dx}\right)^3 + y = 4x,$

then the value of $(m+n)$ is:

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

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

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

X	2	3	4	5
P(X)	5/k	7/k	9/k	11/k

Then the value of k/4 is

1.8
2. 16
3. 32
4.64

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

Q.3 Let A be a matrix such that $A = \begin{bmatrix} 1 & 2 \\ -2 & 3 \end{bmatrix}$ Then which of the following are TRUE?

(A) A is a non-singular matrix

(B) $A^T = A$

(C) A is not an invertible matrix

(D) A is not a skew-symmetric matrix

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

1.(A) and (D) only

2.(B) and (C) only

3.(A) and (C) only

4.(C) and (D) only

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

Q.4 If the system of equations $2x + 5y = 7,\ 6x + \lambda y = 28$ is inconsistent, then

1. $\lambda \neq 15$
2. $\lambda = 12$
3. $\lambda = -12$
4. $\lambda = 15$

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

Q.5 For the function $f(x) = x^x,\ x > 0,$ which of the following are TRUE?

(A) $f'(x) = x^x(1 + \log x)$

(B) $x = e$ is the critical point

(C) f is increasing in $\left(\frac{1}{e}, \infty\right)$

(D) f is increasing in $(0, \infty)$

Choose the correct answer from the options given below:

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

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

Q.6 If $y = \sqrt{ax+b}$, then $y\frac{d^2y}{dx^2} + \left(\frac{dy}{dx}\right)^2 =$

1.) 0
2.) 1
3.) 2
4.) 4

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

Q.7 The corner points of a bounded feasible region are $(0,5), (6,1), (17,2)$ and $(4,29)$.
If the maximum value of the objective function $z = px + qy$, where $p > 0$ and $q > 0$, occurs at two points $(17,2)$ and $(4,29)$, then the relation between p and q is:

1. $2p = 3q$
2. $13p = 27q$
3. $q = 3p$
4. $p = 3q$

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

Q.8 The area of the region bounded by the line y = 2x and the x-axis between x = -2 and x = 2 is

1. 8 sq.units
2. 4 sq.units
3. 16 sq.units
4. 0 sq.units

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

Q.9 If $\int \frac{\sqrt{x}}{\left(\sqrt{3-x}+\sqrt{x}\right)}dx$ is equal to

1. $\frac{1}{2}$
2. $\frac{1}{2}$
3. 1
4. 0

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

Q.10 If the points (a, b), (c, d) and (a + c, b + d) are collinear, then

1. ab = cd
2. ac = bd
3. ab = bc
4. ad = bc

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

Q.11 $\int \sqrt{1+\frac{x^2}{9}}\,dx$ is equal to
(Where C is an arbitrary constant)

1. $\frac{1}{9}\left[\frac{9}{2}\log\left|x+\sqrt{x^2+9}\right| + \frac{x}{2}\sqrt{x^2+9}\right] + C$
2. $3\left[\frac{9}{2}\log\left|x+\sqrt{x^2+9}\right| + \frac{x}{2}\sqrt{x^2+9}\right] + C$
3. $\left[\frac{9}{2}\log\left|x+\sqrt{x^2+9}\right| + \frac{x}{2}\sqrt{x^2+9}\right] + C$
4. $\frac{1}{3}\left[\frac{9}{2}\log\left|x+\sqrt{x^2+9}\right| + \frac{x}{2}\sqrt{x^2+9}\right] + C$

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

Q.12 If $A = [a_{ij}]$ is a skew-symmetric matrix of order n, then

1. $a_{ij} = 1/a_{ji}$ for all i, j

2. $a_{ij} = 0$ for $i = j$
3. $a_{ij} = 0$ for all i, j
4. $a_{ij} \neq 0$ for $i = j$

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

Q.13 The particular solution of the differential equation $x\,dy = (2x^2 + 1)\,dx,\ x \neq 0$, given that $y = 1$ when $x = 1$ is:

1. $y = x + \log|x|$
2. $y = 2 + \log|x|$
3. $y = x^2 + \log|x|$
4. $y = x^2 + \log|x| + 1$

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

Q.14 If the feasible region of an LPP is bounded and the corresponding objective function is Z = 5x - 9y, then the objective
function attains:
1. only maximum value in the feasible region
2. only minimum value in the feasible region
3. both maximum and minimum values in the feasible region
4. neither maximum nor minimum value in the feasible region

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

Q.15 The function $f(x) = 4x^3 - 7x^2$ has point(s) of local minima at:

1. $x = 0$
2. $x = 0, -\frac{7}{6}$
3. $x = \frac{7}{6}$
4. $x = \frac{7}{6}$

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

Section : **Applied Mathematics**

Q.16 Match List 1 with List 2.

List 1 Differential equation	List 2 Sum of order and degree
(A) $\frac{d^2y}{dx^2} + \frac{dy}{dx} + 3y = \sin x$	I. 2
(B) $\frac{dy}{dx} = \sin(x + y)$	II. 3
(C) $\sqrt{1 + \left(\frac{dy}{dx}\right)^2} = \frac{d^2y}{dx^2}$	III. 4
(D) $x^2\left(\frac{d^2y}{dx^2}\right)^3 + y\left(\frac{dy}{dx}\right)^4 + y^3 = 0$	IV. 5

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

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

Q.17 The solution set of the linear inequation $|4x - 3| \leq \frac{3}{4}$ is:

1. $\left(\frac{9}{16}, \frac{15}{16}\right)$
2. $\left(-\frac{15}{16}, \frac{9}{16}\right)$

3. $\left[\frac{9}{16}, \frac{15}{16}\right]$
4. $\left[-\frac{15}{16}, \frac{9}{16}\right]$

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

Q.18 Ajesh purchased a printer ₹ 15,000. The printer is estimated to have a scrap value of ₹ 3,000 after a span of 6 years. Then the book value of the printer at the end of 3 years will be:-

1. ₹ 2,000
2. ₹ 4,000
3. ₹ 9,000
4. ₹ 11,000

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

Q.19 The effective rate, which is equivalent to a nominal rate of 12\% compounded semi-annually, is

1. 13.16\%
2. 13.36\%
3. 12.36\%
4. 12.16\%

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

Q.20 Two percent of the bolts manufactured in a factory are found to be defective. Using the Poisson distribution, the probability that in a sample of 100 bolts chosen at random, exactly two will be defective, is: [Given $e^{-2} = 0.135$]

1. 0.5
2. 1
3. 0.135
4. 0.27

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

Q.21 If $e^y(x+1) = 1$ and $\frac{d^2y}{dx^2} = k\left(\frac{dy}{dx}\right)^2$, then k is equal to

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

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

Q.22 The marks obtained by five students in a test of Applied Mathematics carrying 100 marks are 49, 58, 67, 92, 99. Then the point estimate of the population mean is

1. 73
2. 69
3. 67
4. 91.25

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

Q.23 Let X denote the number of hours a student studies on a selected day. The probability distribution of X is given by (where k is some unknown constant)

$$P(X = x_i) = \begin{cases} 0.5, & \text{if } x_i = 0 \\ kx_i, & \text{if } x_i = 1 \\ k(4 - x_i), & \text{if } x_i = 2 \text{ or } 3 \\ 0, & \text{otherwise} \end{cases}$$

Then the value of k is

(1) $k = \frac{1}{4}$

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

(3) $k = \frac{1}{8}$

(4) $k = \frac{1}{2}$

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

Q.24 The first m-year moving average of the data 10, 20, 30, 40, 50 is 30. The value of m is:

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

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

Q.25 If the matrix $\begin{bmatrix} -1 & x-y & 4 \\ 2 & 0 & 5 \\ x+y & z & 6 \end{bmatrix}$ is symmetric, then $x + 3y + 2z$ is equal to

(1) 16

(2) 18

(3) 14

(4) 10

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

Q.26 A man plans to take a housing loan of Rs 99,53,000 from a bank costing 18\% per annum compounded monthly. The loan is to be paid back in 30 years in equal monthly installments (EMI). The EMI by reducing balance method is:

[Given $(1.015)^{-360} = 0.0047$]

1. Rs. 1,82,500
2. Rs. 1,50,000
3. Rs. 1,75,000
4. Rs. 2,04,500

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

Q.27 Consider the following hypothesis $H_0 : \mu = 315$ and $H_a : \mu \neq 315$. A sample of 60 provided a sample mean of 324.6. The standard deviation (σ) is 14 and level of significance $\alpha = 0.05$. Then the confidence interval is:

[Given: $Z_{\alpha/2}\frac{14}{\sqrt{60}} = 3.54$]

1. (321.06, 328.14)
2. (320.06, 327.14)
3. (322.06, 327.14)
4. (321.06, 327.14)

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

Q.28 Match List 1 with List 2.

List 1	List 2
(A): Perpetuity	(I): A person deposits a fixed amount every year in his bank account to renovate his house after 10 yrs.
(B): EMI	(II): A person deposits an amount regularly in his bank account and withdraws in case of need.

(C): Sinking Fund (III): A fixed amount is debited from the bank account of a person, every month, against a personal loan.

(D): Saving Account (IV): A person purchased a house and rents it out.

Choose the correct answer from the options given below:

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

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

Q.29 The value of $\begin{vmatrix} x & x+y & x+y+z \\ 2x & 3x+2y & 4x+3y+2z \\ 3x & 6x+3y & 10x+6y+3z \end{vmatrix}$ is

1. 0
2. x
3. x^2
4. x^3

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

Q.30 A startup company invested ₹ 5,00,000 in shares for 4 years. The value of the investment was: ₹ 5,50,000 at the end of first year, ₹ 5,25,000 at the end of third year, and on maturity, the final value stood ₹ 6,25,000. The CAGR on the investment will be: [Given : $(1.25)^{\frac{1}{4}} = 1.06$]

1. 10.7\%
2. 6\%
3. 5\%
4. 12.2\%

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

Q.31 Let f be a function defined by $f(x) = 2x^3 - 3x^2 - 36x + 2$, then which of the following are correct ?

(A) The critical points of $f(x)$ are -2 and 3.

(B) The function $f(x)$ increases in the interval $(3, \infty)$

(C) The function $f(x)$ decreases in the interval (-2, 3)

(D) The function $f(x)$ increases in the interval (-2, 3)

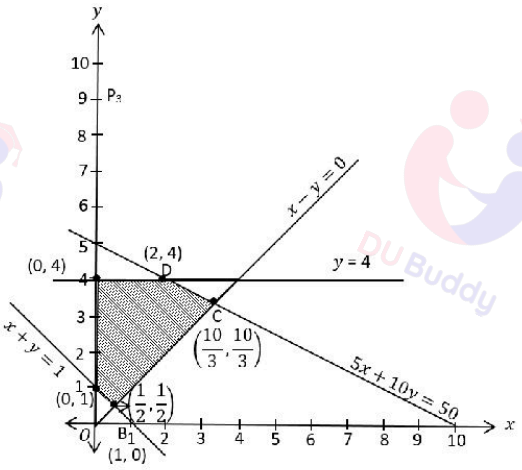
Choose the correct answer from the options given below:

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

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

Q.32

As per the below-mentioned graph of shaded bounded feasible region of the LPP, the maximum value of the objective function $z = 2x + y$ is



1. 8
2. 4
3. 10
4. $\frac{3}{2}$

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

Q.33 If the difference between mean and variance of a Binomial distribution is 1 and the difference of their squares is 5, then the probability of success is

1. $\frac{2}{3}$
2. $\frac{1}{3}$
3. $\frac{2}{5}$
4. $\frac{3}{5}$

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

Q.34 Based on the data available for the production (y_i in thousand tons) of a cloth factory for 7 years (x_i) using the method of least squares, the straight line trend is given by $y = a + bx$ with $\sum y_i = 608, \sum x_i = 0, \sum x_i y_i = 116, \sum x_i^2 = 28$. Then, the increase in production per year is:

1. 86,860 tons
2. 4,143 tons
3. 1,16,000 tons
4. 6,08,000 tons

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

Q.35 If $A = \begin{bmatrix} 5 & 6 \\ 3 & 2 \end{bmatrix}$, then which of the following is correct?

(A) $|A|$ is positive

(B) $|adjA| = -8$

(C) Cofactor of 3 is 6

(D) $|2A| = -32$

Choose the correct answer from the options given below:

1. (B) and (D) only

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

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

Q.36 A Linear Programming Problem (LPP) consists of which of the following components?
(A) Decision variables
(B) The graphical compliment
(C) The objective function
(D) The linear constraints
Choose the correct answer from the options given below:
1. (A) and (C) only
2. (A) only
3. (C) and (D) only
4. (A), (C) and (D) only

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

Q.37 The integral value of k for which the system of linear equations
$kx + y + 2z = 0$
$ky = x - 3z$
$2x + y + kz = 0$
has a non-zero solution is:
1. 2
2. 1
3. 3
4. 5

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

Q.38 A company purchased a machine for ₹ 15,00,000 and its effective life is estimated to be 10 years. A sinking fund is created for replacing the machine at the end of its effective life when its scrap value is ₹ 2,42,000. What amount company should provide at the end of every year out of profits for the sinking fund if it accumulates an interest of 5\% per annum? [Given: $(1.05)^{10} = 1.629$]
1. ₹ 62,900
2. ₹ 1,00,000
3. ₹ 1,20,000
4. ₹ 1,06,290

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

Q.39 A small start-up started making wafers and distributing them to the retailers. After a week, average sales per week were found to be 150 packets. So, to increase the sales, a strategy was used to change the packaging and add a chocolate worth Rs. 5 as a free gift with the pack. After this, a sample of 17 shops was taken, which showed that sales went up with mean 165 and a standard deviation of 25. Check whether the strategy was effective @5\%, level of significance? [Given $t_{16}(0.05) = 2.12$]
1. Strategy was effective as null hypothesis is accepted
2. Strategy was effective as null hypothesis is rejected
3. Strategy was not effective as null hypothesis is accepted
4. Strategy was not effective as null hypothesis is rejected

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

Q.40 The remainder, when 5^{60} is divided by 7, is:

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

Options 1. 1
2. 2

3. 3
4. 4

Q.41 A man rows 15 km upstream in 5 hours and 25 km downstream in 5 hours each time, then the speed of the stream is
1. 2 km / hour
2. 5 km / hour
3. 3 km / hour
4. 1 km / hour

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

Q.42 Which of the following statements are correct?
(A) Inverse of a matrix, if it exists, is unique
(B) $(kA)' = -kA'$ (where k is any real number)
(C) For an invertible matrix A, $(A^{-1})^{-1} = A$
(D) For an invertible matrix A, $(A')^{-1} = (A^{-1})'$

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

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

Q.43 The average cost function for a commodity is given by $AC = 0.05x^2 - 5x + 1000 + \frac{3000}{x}$ in terms of output x. The fixed cost is:

1. 1000
2. 3000
3. 5
4. 0.05

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

Q.44 Solution of the differential equation $y \log_e y\, dx - x\, dy = 0$ is (Where c is an arbitrary constant)

1. $|y| = |c \log_e(xy)|$
2. $|x| = |cy|$
3. $|x| = |c \log_e y|$
4. $|y| = |c \log_e x|$

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

Q.45 Components of Time Series are:
(A) Secular Trend Component
(B) Seasonal Component
(C) Moving Average Component
(D) Cyclical Component

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

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

Q.46 Which of the following statements are correct?

(A) The mean and variance of the Poisson distribution are equal.

(B) The mean and variance of a Binomial distribution are equal.

(C) An unbiased die is thrown again and again until two sixes are obtained, then the probability of obtaining the second six in the 3rd throw is $\frac{5}{108}$.

(D) If the variance of a Poisson distribution is 2, then $P(X = 2) = 2e^{-2}$.

Choose the correct answer from the options given below:

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

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

Q.47 From a container full of milk, 10 liters (l) was drawn and replaced by water. This process is repeated one more time. The ratio of quantity of milk and water left in the container is 4:5. Then the capacity of the container is:

1. 20 l
2. 40l
3. 30l
4. 60l

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

Q.48 Two pipes A and B can fill a tank in 20 minutes and 30 minutes respectively. Both pipes A and B are opened together for some time and then pipe B is turned off. If the tank is filled in 15 minutes, then time for which the pipe B works is:

1. $15\frac{1}{2}$ minutes
2. $7\frac{1}{2}$ minutes
3. $8\frac{1}{2}$ minutes
4. $6\frac{1}{2}$ minutes

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

Q.49 The value of $\int \frac{(x^4 - x)^{1/4}}{x^5} dx$ is equal to (where C is an arbitrary constant):

1. $\frac{4}{15}\left(1 - \frac{1}{x^3}\right)^{5/4} + C$
2. $\frac{4}{15}\left(1 + \frac{1}{x^3}\right)^{5/4} + C$
3. $\frac{4}{15}\left(1 - \frac{1}{x^3}\right)^{4/5} + C$
4. $\frac{4}{15}\left(1 + \frac{1}{x^3}\right)^{4/5} + C$

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

Q.50 'A' can run 1km in 5 minutes 20 seconds and 'B' can run the same distance in 6 minutes. How many meters start can 'A' give 'B' in a kilometer race so that they finish the race together?

1. 14.4 meter
2. 11.1 meter
3. 111.1 meter
4. 144.1 meter

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

Section : Core Mathematics

Q.51 The projection of the vector $2\hat{i} - \hat{j} + 3\hat{k}$ on the vector $3\hat{i} + 2\hat{j} + 6\hat{k}$ is:

1. $\frac{22}{7}$
2. $\frac{26}{49}$
3. $\frac{22}{49}$
4. $-\frac{22}{7}$

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

Q.52 For the relation $R = \{(a, b) : a \leq b\}$ in R, which of the following is correct?

1. It is reflexive and symmetric but not transitive
2. It is reflexive, symmetric and transitive
3. It is reflexive and transitive but not symmetric
4. It is neither reflexive nor symmetric nor transitive

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

Q.53 The area of the region bounded by the curve $y = \sin x$ and the x-axis between $x = \pi/2$ and $x = 3\pi/2$ is:

1. 1 sq. units
2. π sq. units
3. -1 sq. units
4. 2 sq. units

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

Q.54 Let P and Q be any two invertible matrices of the same order. Then
Match List-I with List-II

List-I	List-II
Matrix	Equivalent matrix
$(A)\ (PQ)^{-1}$	$(I)\ Q^{-1}P$
$(B)\ (P^{-1}Q)^{-1}$	$(II)\ QP^{-1}$
$(C)\ (PQ^{-1})^{-1}$	$(III)\ Q^{-1}P^{-1}$
$(D)\ (P^{-1}Q^{-1})^{-1}$	$(IV)\ QP$

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

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

Q.55 If $y = \log_e(\sec(e^{x^2}))$, then $\frac{dy}{dx} =$

1. $x^2 e^{x^2} \tan(e^{x^2})$
2. $2xe^{x^2} \tan(e^{x^2})$
3. $e^{x^2} \tan(e^{x^2})$
4. $xe^{x^2} \tan(e^{x^2})$

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

Q.56 $\int \frac{dx}{\sqrt{5 - 4x - x^2}}$ is equal to:

1. $\sin^{-1}\left(\frac{x+2}{3}\right) + C$: C is an arbitrary constant
2. $\sin^{-1}(x + 2) + C$: C is an arbitrary constant
3. $3\sin^{-1}\left(\frac{x+2}{3}\right) + C$: C is an arbitrary constant

4. $-\sin^{-1}(x+2)+C$: C is an arbitrary constant

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

Q.57 A vector $\vec{a}$ of magnitude $3\sqrt{2}$ making an angle of $\frac{\pi}{3}$ with $\hat{i}$, $\frac{\pi}{4}$ with $\hat{j}$ and an acute angle θ with $\hat{k}$, is:

1. $3\sqrt{2}\left(\frac{1}{\sqrt{2}}\hat{i}+\frac{1}{\sqrt{2}}\hat{j}+\frac{1}{\sqrt{2}}\hat{k}\right)$
2. $3\sqrt{2}\left(\frac{1}{2}\hat{i}+\frac{1}{\sqrt{2}}\hat{j}+\frac{1}{2}\hat{k}\right)$
3. $3\sqrt{2}\left(\frac{1}{\sqrt{2}}\hat{i}+\frac{1}{\sqrt{2}}\hat{j}+\frac{1}{\sqrt{2}}\hat{k}\right)$
4. $3\sqrt{2}\left(\frac{1}{2}\hat{i}-\frac{1}{2}\hat{j}+\frac{1}{2}\hat{k}\right)$

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

Q.58 The objective function of an LPP is $z=ax+\beta y,\ (a,\beta>0)$ that has to be maximized/minimized subject to the constraints $x+y\le 2,\ x\ge 0,\ y\ge 0$.
Then $\max(z)-\min(z)$ is equal to:

1. $2\max\{a,\beta\}$
2. $|a-\beta|$
3. 0
4. $\max\{a,\beta\}$

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

Q.59 Let $\vec{a}=3\hat{i}+\hat{j}-4\hat{k}$ and $\vec{b}=6\hat{i}+5\hat{j}-2\hat{k}$ be two vectors.
Then a vector perpendicular to both $\vec{a}$ and $\vec{b}$ with magnitude 3 units is:

1. $2\hat{i}+2\hat{j}-\hat{k}$
2. $2\hat{i}-2\hat{j}+\hat{k}$
3. $-(2\hat{i}-2\hat{j}+\hat{k})$
4. $-(2\hat{i}+2\hat{j}-\hat{k})$

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

Q.60 Match List-I with List-II

List-I (Integral)	List-II (Value)
(A) $\int_{-1}^{1}(\|x\|+1)dx$	(I) 0
(B) $\int_{-2}^{2}\|x+1\|dx$	(II) 2
(C) $\int_{-1}^{1}3\|x\|^2dx$	(III) 5
(D) $\int_{-1}^{1}x\|x\|dx$	(IV) 3

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

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

Q.61 Match List-I with List-II

List-I	List-II
Function	Points of discontinuity
(A) $f(x)=\frac{x^2+1}{x}$	(I) x=4

(B) $f(x)=\frac{|x-1|}{x-1}$ (II) x=2

(C) $f(x)=\{x-1, \text{ if } x<2;\ x+1, \text{ if } x\geq 2\}$ (III) x=0

(D) $f(x)=\frac{1-x}{x-4}$ (IV) x=1

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

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

Q.62 The shortest distance between the lines $\vec{r}_1=\hat{i}+\hat{j}+\lambda(2\hat{i}-\hat{j}+\hat{k})$ and $\vec{r}_2=2\hat{i}+\hat{j}-\hat{k}+\mu(4\hat{i}-2\hat{j}+2\hat{k})$ is:

1. $\frac{\sqrt{66}}{6}$
2. $6\sqrt{66}$
3. $\sqrt{66}$
4. 6

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

Q.63 If $A=\begin{bmatrix}1 & 2\\ 4 & 5\end{bmatrix}$ then

Match List-I with List-II

List-I	List-II
(A) $\det(A)$	(I) $-\frac{1}{3}$
(B) $\det(A^{-1})$	(II) -12
(C) $\det(2A)$	(III) -3
(D) $\det(3A^T)$	(IV) -27

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

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

Q.64 The function $f(x)=4-3x+3x^2-x^3$ is (Here $\mathbb{R}$ is the set of real numbers)

(1) decreasing on $\mathbb{R}$

(2) increasing on $\mathbb{R}$

(3) increasing on $(0,\infty)$

(4) neither increasing nor decreasing on $(-\infty,0)$

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

Q.65 If $A=\begin{bmatrix}1 & 2 & 3\\ -4 & -5 & -6\end{bmatrix}$, $B=\begin{bmatrix}2 & -3\\ 4 & -5\\ 2 & -1\end{bmatrix}$ and $BA=[b_{ij}]$, then $(b_{23}-b_{31})$ is equal to

1. 22
2. 26
3. 16
4. 27

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

Q.66 Consider the differential equation $x\,dy = (y + 2x^3)\,dx$. Then which of the following are TRUE?

(A) It is a homogeneous differential equation.

(B) Product of the order and degree of the differential equation is one.

(C) Integrating factor is x.

(D) General solution of the differential equation is $y = x^3 + Cx$, where C is an arbitrary constant.

Choose the correct answer from the options given below:

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

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

Q.67 Let $A = [a_{ij}]$ be a square matrix of order 3 with $|A| = 2$ and let $C = [C_{ij}]$, where C_{ij} is the cofactor of a_{ij} in A.

Then $|C|$ is equal to:

(1) 2

(2) 4

(3) 8

(4) 1

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

Q.68 $\int \frac{\log_e x}{(1+\log_e x)^2}\,dx$ is equal to

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

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

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

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

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

Q.69 The area of the smaller region of the circle $x^2 + y^2 = 8$ cut off by the line $x = 2$ is

(1) $2(\pi - 2)$ sq units

(2) 8π sq units

(3) $(3\pi + 2)$ sq units

(4) $2(3\pi + 2)$ sq units

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

Q.70 60\% members of a committee favour a certain proposal and 40\% members oppose the proposal.

A member is selected and let the random variable $X = 0$ if he opposes and $X = 1$ if he is in favour.

Then the variance of the random variable X is

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

(2) $\frac{6}{5}$

(3) $\frac{6}{25}$

(4) $\frac{3}{10}$

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

Q.71 The Cartesian equation of the line passing through the point $(1, 2, -1)$ and parallel to the line $5x - 25 = 14 - 7y = 35z$ is

(1) $\frac{x-1}{7} = \frac{y-2}{5} = \frac{z+1}{1}$

(2) $\frac{x-1}{7} = \frac{y-2}{-5} = \frac{z+1}{1}$

(3) $x - 1 = y - 2 = z + 1$

(4) $\frac{x-1}{5}=\frac{y-2}{7}=\frac{z+1}{35}$

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

Q.72 For a square matrix A of order 3, if $|A|=2$, then $|\text{adj}(2A)|=$

1. 16
2. 64
3. 32
4. 256

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

Q.73 Let $\vec{a}=\hat{i}+4\hat{j}+2\hat{k}$, $\vec{b}=3\hat{i}-2\hat{j}+7\hat{k}$, and $\vec{c}=2\hat{i}+\hat{j}+4\hat{k}$.
A vector $\vec{d}$ which is perpendicular to both $\vec{a}$ and $\vec{b}$ and satisfies $\vec{c}\cdot\vec{d}=14$ is:

1. $64\hat{i}+2\hat{j}-28\hat{k}$
2. $64\hat{i}-2\hat{j}-28\hat{k}$
3. $64\hat{i}+2\hat{j}+28\hat{k}$
4. $32\hat{i}+\hat{j}+14\hat{k}$

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

Q.74 If $\frac{d}{dx}[ax^3+ax^2+ax+1]=9x^2+6x+3$, then a is equal to:

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

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

Q.75 The value of $-cosec^2(\cot^{-1}y)+\sec^2(\tan^{-1}x)$ is equal to:

1. x^2+y^2
2. x^2-y^2
3. $2+x^2+y^2$
4. $2+x^2-y^2$

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

Q.76 Two persons A and B throw a die alternately till one of them gets a 'three' and wins the game.
The probability of A's winning if A starts first is:

1. $\frac{6}{11}$
1. $\frac{1}{6}$
1. $\frac{5}{6}$
1. $\frac{5}{11}$

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

Q.77 If A and B are independent events, then which of the following is not true?

1. A' and B' are independent
2. A and B' are independent
3. A' and B are independent
4. A and B are mutually exclusive

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

Q.78 The sum of order and degree of the differential equation $\left(x^2\frac{d^2y}{dx^2}\right)^{\frac{3}{4}} = 5\left(\frac{dy}{dx}\right)^2 - 3$ is equal to:

1. 1
2. 9
3. 5
4. 7

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

Q.79 Let $f(x) = x^2 + \frac{250}{x}$ be any function defined on $\mathbb{R} - \{0\}$, where $\mathbb{R}$ is the set of real numbers. Then which of the following are TRUE?

(A) $f'(x) = 2x - \frac{250}{x^2}$

(B) $x = 5$ is the only critical point of $f(x)$

(C) Minimum value of $f(x)$ is 75

(D) Maximum value of $f(x)$ is 50

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

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

Q.80 The sum of the x coordinates of the corner points of the feasible region for the LPP:
Minimize $z = 3x + 2y$subject to constraints $x + y \leq 14,\ x \geq 4,\ x \leq 8,\ y \geq 0$ is

1. 30
2. 20
3. 34
4. 24

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

Q.81 The probability that a leap year selected at random will have 53 Mondays is

1. $\frac{1}{7}$
1. $\frac{2}{7}$
1. $\frac{3}{7}$
1. $\frac{4}{7}$

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

Q.82 The range of the function $f(x) = 4x^2 + 12x + 7,\ x \in \mathbb{R}$ is

(1) $[-2, \infty)$

(2) $[0, \infty)$

(3) $\mathbb{R}$

(4) $(-2, \infty)$

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

Q.83 The value of k for which the system of equations

$x + y + z = 1$

$x - ky + z = 1$

$x - y + z = 1$
has more than one solution is:
(1) only 1
(2) only -1
(3) 1 and -1 only
(4) any real number

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

Q.84 The edge of a cube is increasing at a rate of 7 cm/s.The rate of change of area of the cube when edge of the cube is 3 cm is:

(1) 42 cm^2/s
(2) 168 cm^2/s
(3) 84 cm^2/s
(4) 252 cm^2/s

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

Q.85 If the lines $\frac{x-5}{5\lambda+2} = \frac{2-y}{5} = \frac{1-z}{-1}$ and $x = \frac{y+1/2}{2\lambda} = \frac{z-1}{3}$ are perpendicular, then the value of λ is equal to

1. -1

2. 1

3. 5

4. 1/5

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