

Section : Common

Q.1

$$\int \frac{e^{2x} - e^{-2x}}{e^{2x} + e^{-2x}} dx$$

is equal to:

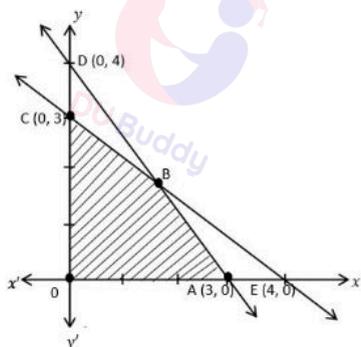
1.  $\frac{1}{2} \log |e^{2x} - e^{-2x}| + C$ , where  $C$  is an arbitrary constant.
2.  $\log |e^{2x} - e^{-2x}| + C$ , where  $C$  is an arbitrary constant.
3.  $\frac{1}{2} \log |e^{2x} + e^{-2x}| + C$ , where  $C$  is an arbitrary constant.
4.  $\log |e^{2x} + e^{-2x}| + C$ , where  $C$  is an arbitrary constant.

Options 1. 1

2. 2
3. 3
4. 4

Q.2

Linear inequalities corresponding to the shaded feasible region OABCO in the given figure are



1.  $4x + 3y \leq 12, 3x + 4y \leq 12, x \geq 0, y \geq 0$
2.  $4x + 3y \geq 12, 3x + 4y \geq 12, x \geq 0, y \geq 0$
3.  $4x + 3y \leq 12, 3x + 4y \geq 12, x \geq 0, y \geq 0$
4.  $4x + 3y \geq 12, 3x + 4y \leq 12, x \geq 0, y \geq 0$

Options 1. 1

2. 2
3. 3
4. 4

Q.3 Match List-I with List-II

List-I

(A) The degree of differential equation  $\frac{d^3y}{dx^3} = e^{\frac{dy}{dx}}$

(B) The order of differential equation  $\left(\frac{dy}{dx}\right)^2 + \frac{d^3y}{dx^3} = 0$

(C) The sum of order and degree of differential equation  $\frac{d}{dx} \left(\frac{d^2y}{dx^2}\right) + \left(\frac{dy}{dx}\right)^5 = x$

(D) The number of arbitrary constants in the general solution of a differential equation of order 2

List-II  
(I)  
2  
(II)  
4  
(III)  
not defined  
(IV)  
3

Choose the correct answer from the options given below:

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

Options 1. 1

2. 2
3. 3
4. 4

Q.4

If  $\begin{bmatrix} 3 & 1 \\ 2 & 1 \end{bmatrix} A \begin{bmatrix} 2 & 1 \\ 1 & 1 \end{bmatrix} = \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$ ,

then matrix 'A' is

1.  $\begin{bmatrix} 1 & 1 \\ 0 & 0 \end{bmatrix}$
2.  $\begin{bmatrix} -1 & 1 \\ 3 & -4 \end{bmatrix}$
3.  $\begin{bmatrix} 1 & -1 \\ -3 & 4 \end{bmatrix}$
4.  $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

Options 1. 1

2. 2
3. 3
4. 4

Q.5

For the function  $f(x) = -2x^3 + 3x^2 + 36x - 10$ , which of the following is/are true?

- (A)  $f$  is increasing in  $(-\infty, -2)$
- (B)  $f$  is increasing in  $(-2, 3)$
- (C)  $f$  is decreasing in  $(-\infty, -2)$
- (D)  $f$  is decreasing in  $(3, \infty)$

Choose the correct answer from the options given below:

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

Options 1. 1

2. 2
3. 3
4. 4

Q.6

If  $y = \frac{1}{\sqrt[3]{1-x^3}}$ , then  $\frac{dy}{dx}$  is equal to:

1.  $x(1-x^3)^{-\frac{4}{3}}$
2.  $x^2(1-x^3)^{-\frac{4}{3}}$
3.  $(1-x^3)^{-\frac{4}{3}}$
4.  $-x^2(1-x^3)^{-\frac{4}{3}}$

Options 1. 1

2. 2
3. 3
4. 4

Q.7

If  $x$  is real, the minimum value of  $x^2 - 8x + 20$  is:

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

Options 1. 1

2. 2
3. 3
4. 4

Q.8

If  $A$  is a square matrix of order 3 and  $|A| = 5$ , then the value of  $|-AA^T|$  is:

1. 25
2. - 25
3. 5
4. - 5

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

Q.9 Consider an LPP: Maximise  $Z = 50x + 15y$  subjected to constraints

$$\begin{aligned}x + y &\leq 60, \\5x + y &\leq 100, \\x, y &\geq 0.\end{aligned}$$

If the maximum value of  $Z$  occurs at  $x = a$  and  $y = \beta$ , then the value of  $a + \beta$  is:

1. 10
2. 60
3. 50
4. 40

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

Q.10 If the matrix  $\begin{bmatrix} 2 & -1 & 3 \\ \lambda & 0 & 7 \\ -1 & 1 & 4 \end{bmatrix}$  is not invertible, then the value of  $\lambda$  is:

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

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

Q.11 If the matrix  $\begin{bmatrix} 3 & 2a & -5 \\ 4 & 0 & b \\ -5 & 3 & 10 \end{bmatrix}$  is symmetric, then the value of  $5a + 2b$  is:

1. 6
2. 10
3. 16
4. 20

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

Q.12 The solution of the differential equation  $y dx + (x - y^2) dy = 0$  is:

1.  $3xy + x^3 = C$  :  $C$  is an arbitrary constant
2.  $3xy + y^3 = C$  :  $C$  is an arbitrary constant
3.  $3xy - y^3 = C$  :  $C$  is an arbitrary constant
4.  $3xy - x^3 = C$  :  $C$  is an arbitrary constant

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

Q.13 The value of  $\int_0^1 \log_e\left(\frac{1}{x} - 1\right) dx$  is:

1. 1

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

Options 1. 1

2. 2
3. 3
4. 4

Q.14 Area of the region bounded by  $y = x^2$  and the line  $y = 16$  is

1.  $\frac{256}{3}$  square units
2.  $\frac{128}{3}$  square units
3.  $\frac{64}{3}$  square units
4.  $\frac{32}{3}$  square units

Options 1. 1

2. 2
3. 3
4. 4

Q.15 The probability distribution of a random variable  $x$  is,  $P(x) = \frac{k}{2^x}$ ,  $x = 0, 1, 2, 3$ . Then

Match List-I with List-II

- | List-I             | List-II              |
|--------------------|----------------------|
| (A) k              | (I) $\frac{2}{15}$   |
| (B) $P(x=1)$       | (II) $\frac{1}{5}$   |
| (C) $P(1 < x < 3)$ | (III) $\frac{8}{15}$ |
| (D) $P(x \geq 2)$  | (IV) $\frac{4}{15}$  |

Choose the correct answer from the options given below:

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

Options 1. 1

2. 2
3. 3
4. 4

Section : Applied Mathematics

Q.16 Calculate Three yearly moving averages for the following data

Year	2016	2017	2018	2019	2020	2021
Production ( thousand tonnes )	200	220	231	254	202	243
1.	217	229	233	218		
2.	217	235	229	233		
3.	235	229	233	218		
4.	235	229	233	218		

Options 1. 1

2. 2
3. 3
4. 4

Q.17 A machine costing Rs.50,000 has a useful life of 4 years .The estimated scrap value is Rs 10,000 . The rate of depreciation per annum is:

1. 20%
2. 30%
3. 25%
4. 15%

Options 1. 1

2. 2
3. 3
4. 4

Q.18 For the linear programming problem,  
Minimize ( Z ) =  $60x + 30y$   
subject to:  $2x - y \geq -5$ ;  $3x + y \geq 3$ ;  $2x - 3y \leq 12$ ;  $x, y \geq 0$   
the optimal value of z is

1. 360
2. 150
3. 60
4. No Minimum value of Z

Options 1. 1

2. 2
3. 3
4. 4

Q.19

If  $A = \begin{bmatrix} 0 & x^2 - 6 & -3 \\ -x & 0 & -8 \\ x^2 - 2x & 8 & 0 \end{bmatrix}$  is a skew symmetric matrix, then the value(s) of  $x$  is/ are -

- (A) 3
- (B) -3
- (C) -2
- (D) -1

Choose the \textbf{correct} answer from the options given below:

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

Options 1. 1

2. 2
3. 3
4. 4

Q.20 If CAGR stands for Compound Annual Growth Rate, F.V stands for final value of an investment, P.V stands for present value of an investment and  $n$  is the number of years then

1.  $CAGR = \left(\frac{F.V}{P.V}\right)^{\frac{1}{n}} - 1$
2.  $CAGR = \left(\frac{P.V}{F.V}\right)^{\frac{1}{n}} - 1$
3.  $CAGR = \left(\frac{F.V}{P.V}\right)^n - 1$
4.  $CAGR = \left(\frac{P.V}{F.V}\right)^n - 1$

Options 1. 1

2. 2
3. 3
4. 4

Q.21 If maximum value of  $f(x) = 2x^3 + 3x^2 - 6ax + 10$  occurs at  $x = -3$ , then the value of  $a$  is \_\_\_\_\_

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

Options 1. 1

2. 2
3. 3
4. 4

Q.22

If  $A = \begin{bmatrix} 1 & 2 \\ 0 & 3 \end{bmatrix}$ , then  $|A \text{ adj} A|$  is

1. 3
2. 6
3. 9
4. 12

Options 1. 1

2. 2
3. 3
4. 4

Q.23 A machine costing Rs 3,00,000 will have its scrap value of Rs 50,000. The company at present plans to put Rs 36,650 per annum at the end of each year in a sinking fund at the rate 5% per annum for the replacement of the machine after its useful life. Suppose the new machine will cost Rs 4,00,000 at that time, then the useful life (approx.) of the machine is:

[Given:  $(1.4775)^{\frac{1}{8}} \approx 1.05$ ]

1. 6.5 yrs
2. 8.5 yrs
3. 7 yrs
4. 8 yrs

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

Q.24 If the sum and difference of squares of mean and variance of a Binomial distribution is  $\frac{225}{256}$  and  $\frac{63}{256}$  respectively, the

$P(X \geq 2)$  is:

1.  $\frac{81}{256}$
2.  $\frac{9}{16}$
3.  $\frac{5}{32}$
4.  $\frac{9}{256}$

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

Q.25 The effective rate per annum equivalent to a nominal rate of 8% compounded semi-annually is

1. 8.24%
2. 8.33%
3. 8.16%
4. 8.06%

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

Q.26 If  $A$  is a square matrix such that  $A^2 = A$  and  $I$  is the identity matrix of the same order as  $A$  then  $(I + 2A)^3 - 6A$  is equal to

1.  $I + 26A$
2.  $20A$
3.  $I + 20A$
4.  $26A$

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

Q.27 If  $x_1, x_2, x_3, \dots, x_n$  are  $n$  observations in a sample then which of following is/are TRUE?

- (A) The mean  $\bar{x}$  has  $n$  degree of freedom
- (B) The mean  $\bar{x}$  has  $(n - 1)$  degree of freedom
- (C) The standard deviation of the sample has  $(n - 1)$  degree of freedom
- (D) The standard deviation of the sample has  $n$  degree of freedom

Choose the \textbf{correct} answer from the options given below:

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

Options 1. 1  
2. 2  
3. 3

Q.28

A and B are two independent events. The probability that both events A and B occur is  $\frac{1}{6}$  and the probability that neither of them occur is  $\frac{1}{3}$ . If  $P(A) = x$ ,  $P(B) = y$  then the value of  $x + y$  is.

1.  $\frac{1}{6}$
2.  $\frac{5}{6}$
3.  $\frac{2}{6}$
4.  $\frac{4}{6}$

Options 1. 1

2. 2
3. 3
4. 4

Q.29

The area bounded by the  $x$ -axis and the parabola  $y = 3x - x^2$  is:

1.  $\frac{27}{2}$  Sq.unit
2.  $\frac{9}{2}$  Sq.unit
3.  $\frac{15}{2}$  Sq.unit
4.  $\frac{11}{2}$  Sq.unit

Options 1. 1

2. 2
3. 3
4. 4

Q.30

A pair of dice is thrown until the sum of numbers appeared is a perfect square or a non-perfect square sum appeared five times in succession. If random variable  $X$  denotes the number of non perfect square sums appeared. then  $P(X > 0)$  is

1.  $\frac{7}{36}$
2.  $\frac{29}{36}$
3. 1
4.  $\frac{1}{2}$

Options 1. 1

2. 2
3. 3
4. 4

Q.31

$\int e^{(x \log 5)} e^x dx$ , is:

Where  $c$  is the constant of integration.

1.  $\frac{5^x}{\log 5} e^x + C$
2.  $5^x e^x + C$
3.  $(5e)^x \log(5e) + C$
4.  $\frac{(5e)^x}{\log(5e)} + C$

Options 1. 1

2. 2
3. 3
4. 4

Q.32

The maximum value of  $Z$  for the linear programming problem maximize  $Z = x + y$  subject to the constraints  $x + 4y \leq 8$ ,  $2x + 3y \leq 12$ ,  $3x + y \leq 9$ ,  $x \geq 0$ ,  $y \geq 0$  is:

1.  $3\frac{10}{11}$
2.  $3\frac{9}{11}$

3.  $4\frac{10}{11}$   
 4.  $4\frac{9}{11}$

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

Q.33 Solution of the inequality  $\frac{2x+3}{4x-5} \geq 0$  is

1.  $\left(-\frac{3}{2}, \frac{5}{4}\right)$   
 2.  $\left(-\infty, -\frac{3}{2}\right] \cup \left[\frac{5}{4}, \infty\right)$   
 3.  $\left[-\frac{3}{2}, \frac{5}{4}\right)$   
 4.  $\left(-\infty, -\frac{3}{2}\right] \cup \left(\frac{5}{4}, \infty\right)$

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

Q.34 The probability distribution of a random discrete variable is given

X            -1   0   1   2   3

P(X)        0.1   p   0.3   q   r

If it is known that  $P(X=1)$  is the mean of  $P(X=0)$  and  $P(X=2)$ .

Then the value of r is:

1. 0  
 2. 0.1  
 3. 0.2  
 4. 0.3

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

Q.35 Data available for profit (₹ Thousands) of a company as

Year            2004   2005   2006   2007   2008   2009   2010

Profit(000)    114   130   126   144   138   156   164

Based on the above data using least square method the trend value for the year '2007' is

1. 147.64  
 2. 138.86  
 3. 130.57  
 4. 131.22

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

Q.36 If  $y = e^{\frac{1}{2}\log(1+\tan^2 x)}$ , then  $\frac{d^2y}{dx^2}$  is equal to:

1.  $\sec x$   
 2.  $\frac{1}{2} \left( \frac{1}{1+\tan^2 x} \right) e^{\log(1+\tan^2 x)}$   
 3.  $\sec x (\sec^2 x + \tan^2 x)$   
 4.  $\sec x \tan x$

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

Q.37 Which of the given values of x and y make the following pair of matrices equal?

$$\begin{bmatrix} 2x-1 & 4 \\ y-1 & 3+2x \end{bmatrix} \text{ and } \begin{bmatrix} 0 & y-2 \\ 5 & 4 \end{bmatrix}$$

1.  $x = \frac{1}{4}, y = 6$

2.  $x = \frac{1}{2}, y = 6$

3.  $x = 6, y = \frac{1}{2}$

4.  $x = 2, y = 6$

Options 1. 1

2. 2

3. 3

4. 4

Q.38

If under pure competition demand and supply functions are given by  $p = \sqrt{10 - x}$  and  $p = \frac{1}{2}(x - 2)$  respectively, where  $p$  is price per unit and  $x$  is quantity, then the consumer surplus is:

1.  $\frac{2}{3}[11 - 10\sqrt{10}]$

2.  $\frac{10}{3}[1 - 2\sqrt{10}]$

3.  $\frac{2}{3}[10\sqrt{10} - 26]$

4.  $\frac{2}{3}[11 + 10\sqrt{10}]$

Options 1. 1

2. 2

3. 3

4. 4

Q.39 The ratio of the speeds of a motor boat and that of the current of water is 26:4. The boat goes certain distance against the current in 6 hrs. The time taken by the boat to come back is \_\_\_\_\_

1. 3 hrs 48 minutes

2. 4 hrs 24 minutes

3. 4 hrs 42 minutes

4. 3 hrs 56 minutes

Options 1. 1

2. 2

3. 3

4. 4

Q.40 In a kilometer race P runs at 10 m/sec, Q runs at 5 m/sec then which of the following statement(s) is/ are correct ?

(A) P wins the race in 100 sec

(B) Q wins the race in 100 sec

(C) P defeats Q by 500 m

(D) Q defeats P by 500 m

Choose the \textbf{correct} answer from the options given below:

1. (A) only

2. (A) and (C) only

3. (B) and (D) only

4. (D) only

Options 1. 1

2. 2

3. 3

4. 4

Q.41 The unit's digit of  $2^{2025}$  is

1. 1

2. 2

3. 3

4. 4

Options 1. 1

2. 2

3. 3

4. 4

Q.42 Three pipes A, B & C fill a tank in 3 hours working simultaneously. The pipe C is twice as faster as B and B is twice as fast as A. The time taken by pipe A alone to fill the tank is:

1. 27 hours

- 2. 81 hours
- 3. 12 hours
- 4. 21 hours

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

Q.43 The value of  $\int_{-a}^a f(x)dx$  where  $f(x) = \frac{7^x}{1+7^x}$ , is:

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

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

Q.44 Mameesh took a loan of Rs 9,00,800 from bank at an interest rate of 6% per annum for 10 years. If she has to pay the loan back with the help of equal monthly installments (EMI). Then, the EMI using reduced balance method is (approx):

(Given:  $(1.005)^{-120} = 0.5496$ )

- 1. Rs 12,000
- 2. Rs 9,000
- 3. Rs 10,000
- 4. Rs 9,820

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

Q.45 Match List-1 with List-2

List-1

- A fire in a factory causing production delay for some time is
- Technological progress is
- The rise in prices before big festival is example of
- Rise and fall of share market is

List-2

- Secular trend
- Seasonal trend
- Irregular trend
- Cyclic trend

Choose the Correct answer from the options given below :-

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

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

Q.46 The amount of money needed to ensure for a prize of Rs 5000 at the beginning of each year indefinitely if money is worth 5% compounded annually is:

- 1. 1,07,500
- 2. 1,10,000
- 3. 1,02,500
- 4. 1,05,000

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

Q.47 For 95% confidence interval for a population mean reported to be 132 to 142 with standard deviation  $\sigma = 17.85$  then the sample size used in this case, is:

[Given that:  $Z_{.0125} = 1.96$ ]

- 1. 36
- 2. 49
- 3. 64

4. 81

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

Q.48 400 g of apple vinegar has 40% apple juice in it. The amount of apple juice, which should be added to make it 60% in apple vinegar, is:

1. 100 g
2. 200 g
3. 150 g
4. 170 g

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

Q.49 A random sample of size 16 has 53 as mean. The sum of the squares of the deviations taken from mean is 150. If the population mean is 56 then the value of  $t$ -test statistic is:

1.  $-3.79$
2.  $-5.79$
3.  $-4.79$
4.  $-2.79$

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

Q.50 If  $a_{ij} = i + 3j$ , then the matrix of order 2 with elements as  $a_{ij}$  is

1.  $\begin{bmatrix} 4 & 7 \\ 5 & 12 \end{bmatrix}$
2.  $\begin{bmatrix} 3 & 7 \\ 5 & 12 \end{bmatrix}$
3.  $\begin{bmatrix} 4 & 7 \\ 5 & 8 \end{bmatrix}$
4.  $\begin{bmatrix} 3 & 7 \\ 5 & 14 \end{bmatrix}$

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

Section : Core Mathematics

Q.51 If  $A$  is a skew-symmetric matrix of order 5, then  $|adj A|$  is equal to

1.  $-1$
2.  $0$
3.  $5$
4.  $-5$

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

Q.52 Relation  $R$  on the set  $A = \{1, 2, \dots, 15\}$  defined as  $R = \{(x, y) : y - 4x = 0\}$  is

1. Reflexive and transitive
2. Neither Reflexive nor symmetric
3. Reflexive but not symmetric
4. Not Reflexive but symmetric

- Options 1. 1  
2. 2  
3. 3

Q.53 Let  $\vec{a}$  and  $\vec{b}$  be unit vectors. If  $\sqrt{3}\vec{a} - \vec{b}$  is a unit vector, then the angle between  $\vec{a}$  and  $\vec{b}$  is

1.  $\frac{\pi}{6}$
2.  $\frac{\pi}{4}$
3.  $\frac{\pi}{3}$
4.  $\frac{\pi}{2}$

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

Q.54 A problem in mathematics is given to three students whose chances of solving it are  $\frac{1}{2}, \frac{1}{3}, \frac{1}{4}$  respectively. The probability that the problem is solved is

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

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

Q.55 If  $x, y$  and  $z$  are real numbers such that  $x + y + z = 0$ , then the value of

$$\begin{vmatrix} 3x & -x+y & -x+z \\ x-y & 3y & z-y \\ x-z & y-z & 3z \end{vmatrix}$$

is

1.  $3(xy + yz + zx)$
2.  $xy + yz + zx$
3. 0
4. 1

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

Q.56 The domain of  $y = \cos^{-1}(x^2 - 4)$  is

1.  $[0, \pi]$
2.  $[-\sqrt{5}, -\sqrt{3}] \cup [\sqrt{3}, \sqrt{5}]$
3.  $[-\sqrt{5}, -\sqrt{3}] \cap [-\sqrt{5}, \sqrt{3}]$
4.  $[-1, 1]$

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

Q.57 The integrating factor of the differential equation  $\frac{dy}{dx} = x + xy$  is:

1.  $e^{-\frac{x^2}{2}}$
2.  $e^{-\frac{x^2}{2}}$
3.  $e^{\frac{x^2}{2}}$
4.  $e^{\frac{x^2}{2}}$

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

Q.58 The area (in sq. units) of the region bounded by the line  $2y + x = 8$ , the x-axis and the lines  $x = 2$  and  $x = 4$  is

1. 19
2. 5
3. 2
4.  $\frac{3}{2}$

Options 1. 1

2. 2
3. 3
4. 4

Q.59 In a college, 30% students fail in Physics, 25% fail in Mathematics and 10% fail in both. One student is chosen at random. The probability that she fails in Physics if she has failed in Mathematics is

1.  $\frac{2}{5}$
2.  $\frac{1}{5}$
3.  $\frac{9}{10}$
4.  $\frac{3}{10}$

Options 1. 1

2. 2
3. 3
4. 4

Q.60 An urn contains 5 red and 5 black balls. A ball is drawn at random, its color is noted and is returned to the urn. Moreover, 2 additional balls of the same color are put in the urn and then a ball is drawn at random. The probability that the second drawn ball is red, is:

1.  $\frac{5}{12}$
2.  $\frac{1}{2}$
3.  $\frac{1}{3}$
4.  $\frac{1}{4}$

Options 1. 1

2. 2
3. 3
4. 4

Q.61 If  $A(3, 2)$ ,  $B(1, -1)$  and  $C(2, 1)$  are three vertices of a parallelogram ABCD, then its area (in sq. units) is equal to

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

Options 1. 1

2. 2
3. 3
4. 4

Q.62 Which of the following statements are true?

- (A) If  $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$ , then  $x, y, z$  are called direction ratios of  $\vec{r}$ .
- (B) For any two vectors  $\vec{a}$  and  $\vec{b}$ ,  $\vec{a} + \vec{b} = \vec{b} + \vec{a}$ .
- (C)  $\vec{a} \perp \vec{b}$  if and only if  $\vec{a} \times \vec{b} = \vec{0}$ .
- (D) Projection of  $\vec{b}$  on  $\vec{a}$  is  $\frac{\vec{a} \cdot \vec{b}}{|\vec{a}|^2}$ .

Choose the correct answer from the options given below:

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

Options 1. 1

2. 2
3. 3
4. 4

Q.63

If  $A = \begin{bmatrix} 1 & 0 \\ 3 & 1 \end{bmatrix}$  and  $A^4 = \begin{bmatrix} 1 & 0 \\ k & 1 \end{bmatrix}$ , then the value of  $k$  is:

1. 81
2. 27
3. 12
4. 36

Options 1. 1

2. 2
3. 3
4. 4

Q.64

$\int_0^1 \frac{dx}{\sqrt{1+x} - \sqrt{x}}$  is equal to

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

Options 1. 1

2. 2
3. 3
4. 4

Q.65

The area (in sq. units) of a triangle formed by vertices O, A, and B where  $\vec{OA} = \hat{i} + 2\hat{j} + 3\hat{k}$  and  $\vec{OB} = -3\hat{i} - 2\hat{j} + \hat{k}$  is

- (1)  $3\sqrt{5}$
- (2)  $4\sqrt{5}$
- (3)  $6\sqrt{5}$
- (4)  $2\sqrt{5}$

Options 1. 1

2. 2
3. 3
4. 4

Q.66

$\int_{-1}^1 \frac{x^3 + |x| + 1}{x^2 + 2|x| + 1} dx$  is equal to

- (1)  $\frac{1}{2} \log_e 2 - 1$
- (2)  $2 \log_e 2$
- (3)  $2 \log_e 2 - 2$
- (4)  $4 \log_e 2$

Options 1. 1

2. 2
3. 3
4. 4

Q.67

If  $x = a(\cos t + \log \tan \frac{t}{2})$ ,  $y = a \sin t$ , then value of  $\frac{dy}{dx}$  at  $t = \pi/4$  is

- (1) 0
- (2) 1

(3) - 1

(4) 2

Options 1. 1

2. 2

3. 3

4. 4

Q.68

The area (in sq. units) of the region bounded by the curve  $y = \cos x$  between  $x = -\frac{\pi}{2}$ ,  $x = \frac{\pi}{2}$  and the x-axis is

(1) 0

(2) 3

(3) 2

(4) 1

Options 1. 1

2. 2

3. 3

4. 4

Q.69

If the direction ratios of two lines are  $a, b, c$  and  $(b - c), (c - a), (a - b)$  respectively, then the angle between these lines is:

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

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

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

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

Options 1. 1

2. 2

3. 3

4. 4

Q.70

If  $y = \sin^{-1} x$ , then  $(1 - x^2) \frac{d^2y}{dx^2}$  is equal to

(1)  $-x \frac{dy}{dx}$

(2)  $x \frac{dy}{dx}$

(3)  $\frac{y}{x} \frac{dy}{dx}$

(4)  $\frac{-y}{x} \frac{dy}{dx}$

Options 1. 1

2. 2

3. 3

4. 4

Q.71

For any events  $A$  and  $B$  of a sample space  $S$ , which of the following statements are TRUE?

(A)  $P(S|B) = 1$

(B)  $P(A \cap B) = P(A) + P(B) + P(A \cup B)$

(C)  $P(\bar{A}|B) = 1 - P(A|B)$

(D)  $P(A|B) = \frac{P(A \cap B)}{P(B)}$ ,  $P(B) \neq 0$

Choose the correct answer from the options given below:

1. (A) and (B) only

2. (A), (C) and (D) only

3. (B) and (C) only

4. (C) and (D) only

Options 1. 1

2. 2

3. 3

4. 4

Q.72

The foot of the perpendicular drawn from the point  $(1, 6, 3)$  to the line  $\frac{x}{1} = \frac{y-1}{2} = \frac{z-2}{3}$  is:

1.  $(-1, -1, 1)$

2. (1, 2, 3)
3. (1, 3, 5)
4. (1, -3, 5)

Options 1. 1

2. 2
3. 3
4. 4

Q.73 If the function  $f(x) = \begin{cases} \frac{\sin 3x}{x}, & \text{if } x \neq 0 \\ \frac{3k}{2}, & \text{if } x = 0 \end{cases}$  is continuous at  $x = 0$ , then the value of  $k$  is:

1.  $\frac{2}{3}$
2. 4
3. 2
4. 9

Options 1. 1

2. 2
3. 3
4. 4

Q.74 The value of  $\int_{-\pi/2}^{\pi/2} (x^5 + x^3 \cos x) dx$  is:

1. 0
2. -1
3.  $\pi$
4. 1

Options 1. 1

2. 2
3. 3
4. 4

Q.75 A function  $f : \mathbb{R} \rightarrow \mathbb{R}$  defined by  $f(x) = \frac{x}{x^2 + 1}$  is (where  $\mathbb{R}$  is the set of real numbers):

1. one-one but not onto
2. onto but not one-one
3. neither one-one nor onto
4. both one-one and onto

Options 1. 1

2. 2
3. 3
4. 4

Q.76 The matrix  $A = \begin{bmatrix} 0 & 0 & 5 \\ 0 & 5 & 0 \\ 5 & 0 & 0 \end{bmatrix}$  is a:

- (A) Diagonal matrix
- (B) Scalar matrix
- (C) Square matrix
- (D) Symmetric matrix

Choose the correct answer from the options given below:

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

Options 1. 1

2. 2
3. 3
4. 4

Q.77 If  $A$  is an invertible matrix of order 3, then Match List-I with List-II

- | List-I                   | List-II      |
|--------------------------|--------------|
| (A) $ \text{adj } A $    | (I) $8 A $   |
| (B) $ A(\text{adj } A) $ | (II) $ A ^2$ |

(C)  $|2A|$       (III)  $\frac{1}{|A|}$

(D)  $|A^{-1}|$       (IV)  $|A|^3$

Choose the correct answer from the options given below:

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

Options 1. 1

2. 2
3. 3
4. 4

Q.78 Consider a closed cylinder of radius  $r$  with a fixed surface area.  
The volume of the cylinder is maximum when its height is:

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

Options 1. 1

2. 2
3. 3
4. 4

Q.79 The function  $f(x) = 2\log_e(x-2) - x^2 + 4x + 1$ , ( $x > 2$ ) is increasing on the interval:

1. (1, 2)
2. (2, 6)
3. (2, 3)
4. (3,  $\infty$ )

Options 1. 1

2. 2
3. 3
4. 4

Q.80 The value of  $\lambda$  so that the lines  $\frac{1-x}{3} = \frac{7y-14}{2\lambda} = \frac{z-3}{2}$  and  $\frac{7-7x}{3\lambda} = \frac{y-5}{1} = \frac{6-z}{5}$  are at right angle, is:

1.  $\frac{70}{11}$
2.  $\frac{10}{11}$
3.  $\frac{11}{70}$
4.  $\frac{11}{10}$

Options 1. 1

2. 2
3. 3
4. 4

Q.81 The solution of the differential equation  $\frac{dy}{dx} = \frac{x+y}{x-y}$  is

1.  $y = \frac{x}{2} \log_e(x^2 + y^2) + C$  :  $C$  is an arbitrary constant
2.  $y = \sqrt{x^2 + y^2} + C$  :  $C$  is an arbitrary constant
3.  $y = \frac{1}{2} \log_e(x^2 + y^2) + C$  :  $C$  is an arbitrary constant
4.  $\tan^{-1} \frac{y}{x} = \frac{1}{2} \log_e(x^2 + y^2) + C$  :  $C$  is an arbitrary constant

Options 1. 1



Q.85

The value of  $\lambda$  for which the two vectors  $(2\hat{i} - \hat{j} + 2\hat{k})$  and  $(3\hat{i} + \lambda\hat{j} + \hat{k})$  are perpendicular, is:

- 1. 4
- 2. 8
- 3. 6
- 4. 1

Options

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

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