

Q1. If  $\sin^{-1} \frac{1}{\sqrt{2}}$ , then the value of  $\cos^{-1} \frac{1}{\sqrt{2}}$  is equal to

- (a) 4
- (b) 12
- (c) 24
- (d) 30

Q2. If  $A$  and  $B$  are square matrices of the same order, then  $(A+B)^2$  is equal to

- (a)
- (b)
- (c)
- (d)

Q3. The function,  $f(x) = x^3 - 3x^2 + 2x$ , has a local maxima at

- (a)
- (b)
- (c)
- (d)

Q4. The general solution of the differential equation  $\frac{dy}{dx} + y = e^{-x}$  is

- (a)  $y = e^{-x} + C$ , Where  $C$  is constant of integration
- (b)  $y = e^{-x} - C$ , Where  $C$  is constant of integration
- (c)  $y = e^{-x} + C$ , Where  $C$  is constant of integration
- (d)  $y = e^{-x} - C$ , Where  $C$  is constant of integration

Q5. If corner points of the bounded feasible region are  $(0,0)$ ,  $(3,0)$ ,  $(2,1)$  and  $(0,2)$  and objective function is  $Z = 2x + 3y$ , then the maximum value of  $Z$  is

- (a) 12
- (b) 21
- (c) 27
- (d) 17

Q6. The area (in sq. units) of the region bounded by the curve  $y = x^2$ ,  $x$ -axis and ordinates  $x = 1$  and  $x = 2$  is.

- (a) 1
- (b) 2
- (c) 3
- (d)

Q7. The function  $f(x) = x^3 - 3x^2 + 2x$  is increasing on

- (a)
- (b)
- (c)
- (d)

Q8. If  $\sin^{-1} \frac{1}{\sqrt{2}}$ , Then  $\cos^{-1} \frac{1}{\sqrt{2}}$  is equal to

- (a)
- (b)
- (c)
- (d)

Q9. Let the degree and order of the differential equation  $\frac{d^2y}{dx^2} + \frac{dy}{dx} + y = e^x$  be  $m$  and  $n$  respectively. Then

- (A)
- (B)
- (C)
- (D)

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

- (a) (A) and (B) only
- (b) (A) and (D) only
- (c) (B) and (C) only
- (d) (B) and (D) only

Q10. A random variable has the following probability distribution:

X	0	1	2	3	4	5	6	7
	0							

The value of is equal to

- (a)
- (b)
- (c)
- (d)

Q11. If the system of equations

does not possess a unique solution, then is equal to

- (a) 1
- (b)
- (c)
- (d) -1

Q12. The value of which of the following integrals is zero?

- (A)
- (B)
- (C)
- (D)

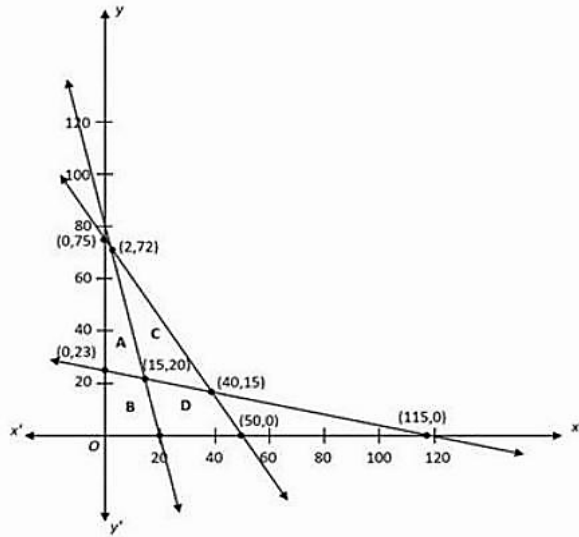
Choose the **correct** answer from the options given below:

- (a) (B) and (D) only
- (b) (A), (B) and (C) only
- (c) (B) only
- (d) (C) and (D) only

Q13. is equal to

- (a) , Where is constant of integration
- (b) , Where is constant of integration
- (c) , Where is constant of integration
- (d) , Where is constant of integration

Q14. In the given figure, feasible region represented by the constraints is



- (a) Region
- (b) Region
- (c) Region
- (d) Region

Q15. If  $A$  and  $B$  are invertible matrices of same order, then which one of the following is NOT true?

- (a)
- (b)
- (c)
- (d)

Q16. One person speaks truth in 60% of the cases and another person in 80% of the cases. They are likely to agree in stating the same fact in

- (a) 48% of the cases
- (b) 40% of the cases
- (c) 52% of the cases
- (d) 56% of the cases

Q17.  $\int \frac{1}{x^2} dx$  is equal to

- (a)  $-\frac{1}{x} + C$ , Where  $C$  is constant of integration
- (b)  $\frac{1}{x} + C$ , Where  $C$  is constant of integration
- (c)  $-\frac{1}{x^2} + C$ , Where  $C$  is constant of integration
- (d)  $\frac{1}{x^2} + C$ , Where  $C$  is constant of integration

Q18. Match **List-I** with **List-II**

List-I	List-II
<b>Function</b>	<b>Property</b>
(A)	(I) continuous but not differentiable at
(B)	(II) continuous but not differentiable at
(C)	(III) discontinuous at
(D)	(IV) continuous but not differentiable at

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

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

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

Q19. The area (in sq. units) of the region bounded by the line and is

- (a) 9  
 (b)  
 (c) 18  
 (d)

Q20. The function , where denotes the greatest integer function, is continuous at

- (A) 2.9  
 (B) 5  
 (C) -3  
 (D) 6.5

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

- (a) (A), (B) and (C) only  
 (b) (B), (C) and (D) only  
 (c) (A) and (D) only  
 (d) (C) and (D) only

Q21. The area (in sq. units) of the region enclosed by the ellipse is

- (a)  
 (b)  
 (c)  
 (d)

Q22. If matrices and , then is equal to

- (a) [14]  
 (b)  
 (c)  
 (d)

Q23. If are three mutually perpendicular unit vectors, then is equal to

- (a) 3  
 (b) 9  
 (c)  
 (d) 0

Q24. The general solution of the differential equation

- (a) , Where is constant of integration  
 (b) , Where is constant of integration  
 (c) , Where is constant of integration  
 (d) , Where is constant of integration

Q25. Consider the function . Then

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

List-I	List-II
(A) Point of local Maxima	(I) 1
(B) Point of local Minima	(II) -1
(C) Local maximum value	(III) 2
(D) Local minimum value	(IV) -2

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

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

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

Q26. The projection of the vector  $\vec{a}$  on the vector  $\vec{b}$  is

- (a)
- (b)
- (c) 0
- (d)

Q27. A die is thrown three times. If the first throw is a five, the probability of getting 14 as the sum is

- (a)
- (b)
- (c)
- (d)

Q28. If the points  $A$  and  $B$  are collinear, then the value of  $k$  is

- (a)
- (b)
- (c)
- (d)

Q29. The feasible region associated with the inequality  $x + y \leq 1$  is

- (a) Open half plane containing the origin
- (b) Open half plane not containing the origin
- (c) Closed half plane containing the origin
- (d) Closed half plane not containing the origin

Q30. If  $A$  and  $B$  are matrices of same order, then  $A + B$  is always

- (a) a symmetric matrix
- (b) a skew symmetric matrix
- (c) neither a symmetric matrix nor a skew-symmetric matrix
- (d) a null matrix

Q31. The value of  $\sin^{-1}(\sin \frac{3\pi}{4})$  is

- (a)
- (b)
- (c)
- (d)

Q32. Let  $f(x) = x^2 - 4x + 4$ , where  $x \in [0, 4]$ . then which of the following are true?

- (A)
- (B)
- (C) minimum value of  $f(x)$  is 1
- (D) maximum value of  $f(x)$  is 4

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

- (a) (A) and (D) only
- (b) (A), (B) and (C) only
- (c) (B), (C) and (D) only
- (d) (C) and (D) only

Q33.  $\sin^{-1}(\frac{1}{\sqrt{2}})$  is equal to

- (a)
- (b)
- (c)
- (d)

Q34. If  $\sin^{-1}(\frac{1}{\sqrt{2}}) = \frac{\pi}{4}$ , then the value of  $\cos^{-1}(\frac{1}{\sqrt{2}})$  at  $x = \frac{\pi}{4}$  is

- (a)
- (b)
- (c)
- (d)

Q35. In which of the following intervals, the function  $f(x) = \sin^{-1}(x)$  is decreasing?

- (a)
- (b)

(c)

(d)

Q36. Match **List-I** with **List-II**

List-I	List-II
(A) Angle between and	(I) 0
(B) Angle between and	(II)
(C) Angle between and	(III)
(D) Angle between and	(IV)

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

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

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

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

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

Q37. Which of the following statements are correct?

(A) If and are independent events then

(B) If and are mutually exclusive events, then

(C) The conditional probability of an event , given the occurrence of the event is given by

(D) If E and F be the events associated with the sample space S of an experiment, then

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

(a) (A) and (C) only

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

(c) (B) and (D) only

(d) (C) and (D) only

Q38. Match **List-I** with **List-II**

List-I	List-II
<b>Differential equation</b>	<b>Integrating factor</b>
(A)	(I)
(B)	(II)
(C)	(III)
(D)	(IV)

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

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

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

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

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

Q39. Let . Then number of relations containing and which are reflexive and transitive but not symmetric is

(a) 1

(b) 2

(c) 3

(d) 4

Q40. Consider the LPP: Maximize  $z = 4x + 3y$  subject to the constraints  $x + y \leq 1$ ,  $x \geq 0$ ,  $y \geq 0$ . The optimal feasible solution is

- (a)  $x = 1, y = 0$
- (b)  $x = 0, y = 1$
- (c)  $x = 0.5, y = 0.5$
- (d)  $x = 1, y = 1$

Q41. Let E and F are events associated with an experiment. If  $P(E) = 0.4$  and  $P(F) = 0.2$ , then  $P(E \cap F)$  is

- (a) 0.4
- (b) 0.2
- (c) 0.3
- (d) 0.5

Q42.  $\int \frac{1}{x^2} dx$  is equal to

- (a)  $-\frac{1}{x} + C$ , Where C is constant of integration
- (b)  $\frac{1}{x} + C$ , Where C is constant of integration
- (c)  $-\frac{1}{x^2} + C$ , Where C is constant of integration
- (d)  $\frac{1}{x^2} + C$ , Where C is constant of integration

Q43. Let  $A$  and  $B$  are square matrices of order 3 such that  $A^2 = B^2$ . If  $A$  is a symmetric matrix, then the value of  $\det(A - B)$  is

- (a) 0
- (b) 1
- (c) 3
- (d) 27

Q44. The vector equation of the line passing through points  $(1, 2, 3)$  and  $(2, 3, 4)$  is

- (a)  $\frac{x-1}{1} = \frac{y-2}{1} = \frac{z-3}{1}$
- (b)  $\frac{x-1}{1} = \frac{y-2}{1} = \frac{z-3}{2}$
- (c)  $\frac{x-1}{1} = \frac{y-2}{2} = \frac{z-3}{1}$
- (d)  $\frac{x-1}{2} = \frac{y-2}{1} = \frac{z-3}{1}$

Q45. If a line makes angles  $\alpha, \beta, \gamma$  with the positive directions of  $x$ -axis,  $y$ -axis,  $z$ -axis respectively, then the value of  $\cos^2 \alpha + \cos^2 \beta + \cos^2 \gamma$  is equal to

- (a) 1
- (b) -1
- (c) 0
- (d) 2

Q46. Consider two lines  $L_1$  and  $L_2$  with cartesian equations  $\frac{x-1}{2} = \frac{y-2}{2} = \frac{z-3}{1}$  and  $\frac{x-2}{1} = \frac{y-3}{2} = \frac{z-4}{1}$  respectively. Which of the following is/are true?

- (A) Direction ratio of  $L_1$  are 2, 2, 1
- (B) Direction cosines of  $L_1$  are  $\frac{2}{3}, \frac{2}{3}, \frac{1}{3}$
- (C) Direction ratio of  $L_2$  are 1, 2, 1
- (D) Angle between  $L_1$  and  $L_2$  is  $\frac{\pi}{2}$

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

- (a) (B), (C) and (D) only
- (b) (A) and (B) only
- (c) (C) and (D) only
- (d) (A) only

Q47. Match List-I with List-II

List-I	List-II
Type of matrix	Conditions

(A) Square matrix A	(I) where , where is constant.
(B) Scalar Matrix A	(II)
(C) Diagonal matrix A	(III) where
(D) Identity matrix A	(IV) where

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

- (a) (A) - (II), (B) - (IV), (C) - (I), (D) - (III)
- (b) (A) - (II), (B) - (IV), (C) - (III), (D) - (I)
- (c) (A) - (II), (B) - (I), (C) - (III), (D) - (IV)
- (d) (A) - (II), (B) - (I), (C) - (IV), (D) - (III)

Q48. Let  $f$  be a function defined as  $f(x) = \sin(x)$ . Which one of the following is true?

- (a)  $f$  is one-one and onto
- (b)  $f$  is one-one but not onto.
- (c)  $f$  is onto but not one-one.
- (d)  $f$  is neither one-one nor onto.

Q49. If  $\theta$  is an acute angle and the vector  $\vec{u}$  is perpendicular to the vector  $\vec{v}$  then  $\cos(\theta)$  is equal to

- (a)
- (b)
- (c)
- (d)

Q50. For the function  $f(x) = x^2 - 4x + 4$ , which one of the following is correct?

- (a) Point of absolute maxima is 4
- (b) Absolute maximum value is 4
- (c) Absolute minimum value is 0
- (d) Point of absolute maxima is 0

**Solutions:**

S1. Ans. (b)

Sol. We have to given

Comparing both sides

Solving above equations we get

Now,

S2. Ans. (b)

Sol. We have

S3. Ans. (a)

Sol. Given function is

For maxima or minima

Now,

So, has local maxima at .

S4. Ans. (c)

Sol. Given

Integrating

S5. Ans. (b)

Sol. Given

Corner points are and .

Corner points	Value of Z
(0, 0)	Z = 0
(3, 0)	Z = 12
(0, 3)	Z = 21 (maximum)

S6. Ans. (a)

Sol. Given curve

Area of the bounded region

For :

For :

S7. Ans. (a)

Sol. Given function is

Intervals are & .

We have

in

So, is increasing on .

S9. Ans. (b)

Sol. Let the degree and order of the differential equation

be and , respectively.

Highest order derivative: Order

Degree of is Degree

So,

S10. Ans. (a)

Sol. We have sum of probability is equal to 1.

Now,

S11. Ans. (b)

Sol. Given system of equations are

Which is of the form

Here,

If the system does not possess a unique solution. Then

S12. Ans. (a)

Sol. (A) We have

(B) We have

Here, is an odd function.

(C) We have

(D) Let

Using property

Adding equation (i) & (ii)

S13. Ans. (d)

Sol. We have

S14. Ans. (c)

Sol. We have

Convert inequality into equation

From equation (i), we get coordinates are  $(20, 0)$  &  $(0, 80)$

From equation (ii), we get coordinates are  $(115, 0)$  &  $(0, 23)$

From equation (iii), we get coordinates are  $(50, 0)$  &  $(0, 75)$

Only Region C lies above the first two lines and below the third, and is in the first quadrant.

S15. Ans. (b)

Sol. (A) We have

(true)

(B) We have

so, given statement is incorrect.

(C) We have

(true)

(D) We have

S16. Ans. (b)

Sol. Let

Agreement means both speak truth or both lie:

S17. Ans. (d)

Sol. We have to given

Put

Now,

S18. Ans. (a)

Sol. (A) Given function is

LHL

RHL

is not continuous at .

(B) We have

Which is continuous but not differentiable at .

(C) We have

Which is continuous but not differentiable at .

(D) We have

Which is continuous but not differentiable at .

S19. Ans. (b)

Sol. Given curve

and

Required area

S20. Ans. (c)

Sol. We have

The greatest integer function  $[x]$  is discontinuous at all integer points and continuous at all non-integer points.

So, is continuous at 2.9 and 6.5.

S21. Ans. (d)

Sol. Given equation is

To find the area enclosed by the ellipse, we first convert the given equation to the standard form of an ellipse

This is the standard form:

Here,

Area of ellipse

S22. Ans. (c)

Sol. Given

and

S23. Ans. (c)

Sol. We are given that are three mutually perpendicular unit vectors. That means:

(since they are perpendicular)

Now,

S24. Ans. (d)

Sol. Given differential equation is

Integrating factor

Solution is

S25. Ans. (a)

Sol. Given function is

For maxima or minima

(minima)

(maxima)

Minimum value

Maximum value

S26. Ans. (b)

Sol. Given vectors are

Projection of on is

S27. Ans. (a)

Sol. We are given that the first throw is 5, and we are to find the probability that the sum of all three throws is 14.

This is a conditional probability problem.

Let:

A = event that the total sum of the three throws is 14

F = event that the first throw is 5

If first throw is 5, then sum of numbers appearing on last two throws must be equal to nine. That means last two throws are (3, 6), (4, 5), (5, 4) & (6, 3).

All possible outcomes of two dice = 36

Favorable outcomes

Required probability

S28. Ans. (d)

Sol. We have

If the points and are collinear. Then

S29. Ans. (b)

Sol. We have

Strict inequalities define open half-planes, which do not include the boundary line.

Hence, the line  $2x+3y=4$  is not included in the solution.

So, it is an open half-plane.

We check whether the origin lies in the solution region by substituting:

(false)

So, the origin is not part of the solution region.

The solution region is the half-plane not containing the origin.

S30. Ans. (b)

Sol. Given and are matrices of same order.

Now,

So, is a skew symmetric matrix.

S31. Ans. (a)

Sol. We have

S32. Ans. (a)

Sol. Given

Option (A) is correct but (B) is incorrect.

We have

Minimum value = 2

Maximum value = 4

S33. Ans. (d)

Sol. Given integral can be written as

Adding equation (i) & (ii)

S34. Ans. (b)

Sol. Given

S35. Ans. (a)

Sol. Given function is

So,  $f(x)$  is decreasing in .

S36. Ans. (a)

Sol. (A) Given vectors are

and

Angle between the vectors is

(B) Given vectors are

and

Angle between the vectors is

(C) Angle between and is

(D) Angle between and

S37. Ans. (a)

Sol. (A) If and are independent events then (True).

(B) If and are mutually exclusive events, then (False)

Since, If and are mutually exclusive events. Then

(C) The conditional probability of an event , given the occurrence of the event is given by (True)

(D) If E and F be the events associated with the sample space S of an experiment, then (False).

Since,

S38. Ans. (c)

Sol. (A) Given

(B) Given

(C) Given

(D) Given

S39. Ans. (c)

Sol. We have

For transitivity

So,

This relation is Reflexive & Transitive but Not symmetric.

Now, adding

Also, this is Reflexive & Transitive but Not symmetric.

Now, add

is Reflexive & Transitive but Not symmetric.

So, There are exactly **3** such relations satisfying the given conditions.

S40. Ans. (d)

Sol. Given

Maximize subject to the constraints

From (i), we get (70, 0) & (0, 35)

From (ii), we get

Point of intersection are (40, 15)

Corner points of the feasible region are .

Corner points	Value of Z
(0, 0)	Z = 0
(0, 35)	Z = 35
(40, 15)	Z = 55 (maximum)

S41. Ans. (c)

Sol. Given

and

We have

Now,

S42. Ans. (c)

Sol. We have

S43. Ans. (a)

Sol. We are given

is symmetric:

Any square matrix  $C$  can be uniquely written as:

Where,

is the **skew-symmetric** part

Since  $A$  is symmetric and  $A+B=C$ ,

$A=P$  (symmetric part)

$B=K$  (skew-symmetric part)

S44. Ans. (b)

Sol. Equation of line passing through points and is

S45. Ans. (b)

Sol. We have

Now,

S46. Ans. (a)

Sol. Given equations of line are

and

(A) We have

Direction ratio of are 2, -2, 1.

(B) We have

Direction cosines of are

Or

(C) Direction ratio of are .

(D) Angle between and is

S47. Ans. (d)

Sol. (A) We have a square matrix  $A$  is given by

(B) Scalar Matrix  $A$  is given by

where , where is constant.

(C) Diagonal matrix  $A$  is given by

where

(D) Identity matrix  $A$  is given by

where

S48. Ans. (d)

Sol. A function is one-one if:

Check with:

Here, , but .

So, not one-one.

A function is onto if every real number has a pre-image in .

Here,

So, negative real numbers (e.g., -1 ) are not in the range of .

Hence, not onto.

S49. Ans. (b)

Sol. Given vectors are

It is given that vectors are perpendicular. Then,

S50. Ans. (b)

Sol. Given function is

For maxima or minima

Now,

So, Absolute maximum value is .