

MTH401

Ahmad

Complete paper

Long Questions
Short Questions
Mcqs

Consider a power series $\sum_{n=1}^{\infty} a_n = \sum_{n=1}^{\infty} \frac{1}{\sqrt{n}} x^n$ then power series clearly diverges for the values of x where

Answer (Please select your correct option)

☐ $|x| < 1$

☐ $|x| = 1$

☒ $|x| > 1$

☐ None of them

The matrix $A = \begin{bmatrix} 1 & -2 & -2 \\ -2 & 1 & -2 \\ 2 & -2 & 1 \end{bmatrix}$ has eigen values $\lambda = -1, -1, 5$ where $\lambda = -1$ is a

Answer (Please select your correct option)

Single root of A

☐

triple root of A

☐

double root of A

☒

None of them

☐



The points other than $x = \pm 1$ of the differential equation $(x^2 - 1)y'' + 2xy' + 6y = 0$ are called

Answer (Please select your correct option)

☐ Singular points

☒ Ordinary points

☐ Limits points

☐ None of them

Solution of the D Equation $4y'' + y = 0$ is

Answer (Please select your correct option)

☒ $y(x) = c_1 \cos \frac{x}{2} + c_2 \sin \frac{x}{2}$

☐ $y(x) = c_1 \cos \frac{x}{2}$

☐ $y(x) = c_1 \sin \frac{x}{2}$

☐ None of them

Operator method is the method of the solution of a system of linear homogeneous or linear non-homogeneous differential equations which is based on the process of systematic elimination of the

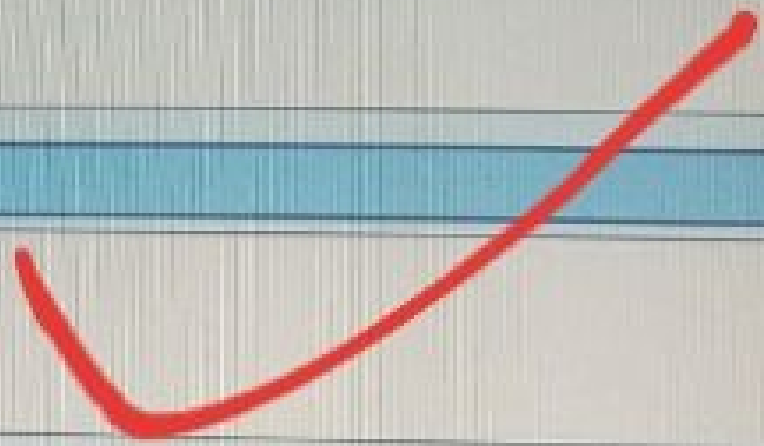
Answer (Please select your correct option)

☒ Dependent variables

☐ Independent variable

☐ Choice variable

☐ None of them



The differential equation $2\frac{dx}{dt} - 5x + \frac{dy}{dt} = e^t$ in terms of differential operator is:

Answer (Please select your correct option)

☐

$$(2D - 5)x + Dy = e^{2t}$$

☐

$$(2D - 5)x + Dy = e^{-t}$$

☐

$$(2D + 5)x + Dy = e^t$$

☒

$$(2D - 5)x + Dy = e^t$$



$$\frac{d}{dt} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 3 & -7 \\ 1 & 1 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} + \begin{pmatrix} 4 \\ 8 \end{pmatrix} e^{-t} u$$

Answer: (Please select your correct option)

C $\frac{dx}{dt} = 3x - 7y + 4\sin 2t$; $\frac{dy}{dt} = x + y + 8\cos 2t$

C $\frac{dx}{dt} = 3x - 7y + 4e^{-t}$, $\frac{dy}{dt} = x + y + 8e^{-t}$

$$C \quad \frac{dx}{dt} = 3x - 7y + 4e^t; \quad \frac{dy}{dt} = -x + y + 8e^{-t}$$

None of them

If wroskian of the solution vectors X_1 & X_2 is zero, then vectors are _____

Answer (Please select your correct option)

Linearly Independent

☐

Linearly dependent

☒

None of them

☐

Parallel

☐

Irregular singular point of the equation $(x^2 - 4)^2 y'' + (x - 2)y' + y = 0$ is

Answer (Please select your correct option)

☐ $x=2$

☐ $x=-2$

☐ $x=-2, 2$

☐ None of them



The matrix $A = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ has _____

Answer (Please select your correct option)

☐ Real and unequal value

☐ Repeated & real eigen value

☐ Complex eigen value

☐ None of them



For eigen values $\lambda = 5, 5$ of a matrix $A = \begin{pmatrix} 3 & 4 \\ -1 & 7 \end{pmatrix}$, there exists _____ eigen vectors.

Answer (Please select your correct option)

☐ infinite

☒ one

☐ two

☐ three

Eigen values of the following homogeneous system of Differential equation $\frac{dx}{dt} = x$, $\frac{dy}{dt} = 2x + 2y$ with coefficient matrix $\begin{bmatrix} 1 & 0 \\ 2 & 2 \end{bmatrix}$

Answer (Please select your correct option)

☒ $\lambda = 1, 2$

☐ $\lambda = 2, 2$

☐ $\lambda = 1, 1$

Let λ be an eigen value of a non zero square matrix A . Then the equation $\det(A - \lambda I) = 0$ is called

Answer (Please select your correct option)

Trivial equation

☐

Characteristic equation

☒

Non-trivial equation

☐

None of them

☐

For $x < 0$, the wronskian $W(x, |x|) =$ _____.

Answer (Please select your correct option)

0

☐

1

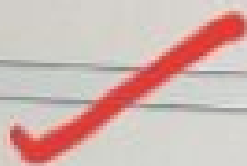
☐

$2x$

☐

$-2x$

☒



$x = 0$ is a(n) _____ point of the differential equation $y'' + xy' + 2y = 0$.

Answer (Please select your correct option)

☐ Singular

☐ Regular singular

☐ Irregular singular

☒ Ordinary

Singular points of the differential equation: $|\sin x| y'' + xy' + 2y = 0$, are $x = n\pi$, where $n \in$ -----

Answer (Please select your correct option)

☒ $\mathbb{R}$ - the set of reals

☐ $\mathbb{Z}$ - the set of integers

☐ $\mathbb{Z}^+$ - the set of non-negative integers

☐ $\mathbb{Z}^-$ - the set of negative integers

For $x < 0$, the wronskian $W(x, |x|) = \text{---}$

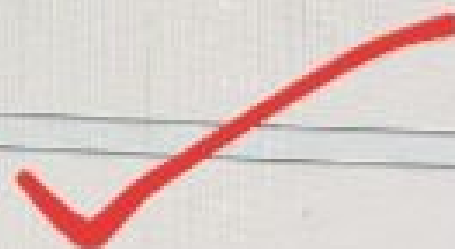
Answer (Please select your correct option)

☐ 0

☐ 1

☒ $2x$

☐ $-2x$



Eigen values will be equal, if the determinant of the corresponding characteristic equation is

Answer (Please select your correct option)

greater than zero

☐

less than zero

☐

equal to zero

☒

rational

☐



The constant solution of the differential equation $\frac{dy}{dx} = e^x$ _____

Answer (Please select your correct option)

☐ is the set of positive real numbers

☒ is the set of negative real numbers

☐ is the set of all real numbers

☐ does not exist

If there exists a non-zero solution vector X of the system of linear differential equations such that $AX = \lambda X$. Then the number λ is said to be the:

Answer (Please select your correct option)

☐ Random value

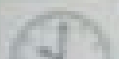
☒ Eigen value

☐ Matrix value

☐ None of them

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The reactance and impedance both are measured in

Answer (Please select your correct option)

Newton

☐

Ohms

☒



Volts

☐

None of them

☐

Question No : 24 of 25

Functions $f(x)=1$ and $g(x)=|x|$ are linearly _____

Answer (Please select your correct option)

Independent

☒

Dependent

☐

Question No: 22 of 33

Marks: 1 (Budgeted Time 30s)

The linear normal form of $y'' - y' + 6y = 0$, by using $y = x_1$, $y' = x_1' - x_2$ and $y'' = x_2'$, is

Answer (Please select your correct option)

☒ $x_1' = x_2, x_2' = x_2 - 6x_1$

☐ $x_1 = x_2, x_2' = x_2 + x_1$

☐ $x_2' = x_2$

☐ $x_2' = x_2, x_2' = x_2 - 6$

If $A = [a_{ij}]$ is an $m \times n$ matrix and $B = [b_{ij}]$ is an $n \times p$ matrix, the product AB is an _____ matrix.

Answer (Please select your correct option)

☐ $m \times n$

☐ $n \times p$

☒ $m \times p$

☐ $n \times n$

Consider the auxiliary equation of the free damped motion $m^2 + 2\lambda m + \omega^2 = 0$ and its roots $m = -\lambda \pm \sqrt{\lambda^2 - \omega^2}$. If $\lambda^2 - \omega^2 > 0$ then the system is said to be

Answer (Please select your correct option)

☐ Under damped

☒ Over damped

☐ Neither under nor over damped

☐ None of these

The vectors $X_1 = \begin{pmatrix} 1 \\ -1 \end{pmatrix} e^{-2t}$, $X_2 = \begin{pmatrix} 3 \\ 5 \end{pmatrix} e^{6t}$ are

Answer (Please select your correct option)

☒ linearly dependent

☐ linearly independent

Singular points of the differential equation: $y'' + xy' + 2y = 0$ —

Answer (Please select your correct option)

☐ is the set of all real numbers

☐ is $x = 0$

☒ is $x = 1$

☐ does not exist

Write the following system in matrix form and also mention the coefficient matrix:

$$\frac{dx}{dt} = 10x - 7y$$

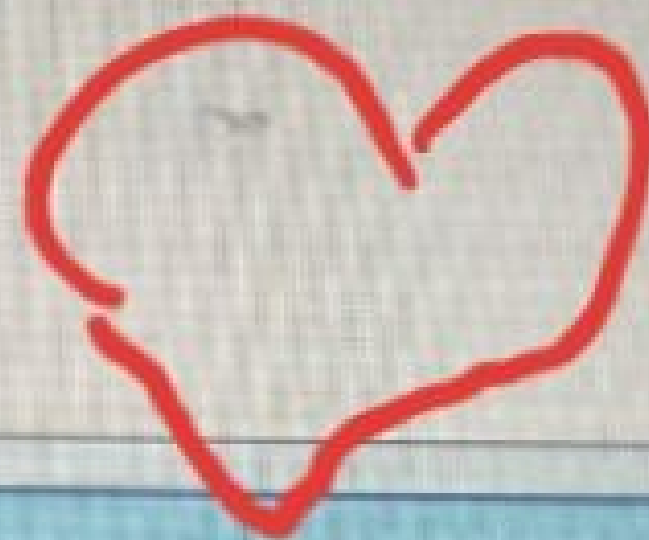
$$\frac{dy}{dt} = 5x + 8y$$

Answer ([Please click here to Add Answer](#))

Write any two examples of Cauchy Euler Differential Equation?

Find eigen vector of

$$A = \begin{pmatrix} -3 & 1 \\ 2 & -4 \end{pmatrix}, \text{corresponding eigen value } \lambda = -2.$$



Answer ([Please click here to Add Answer](#))

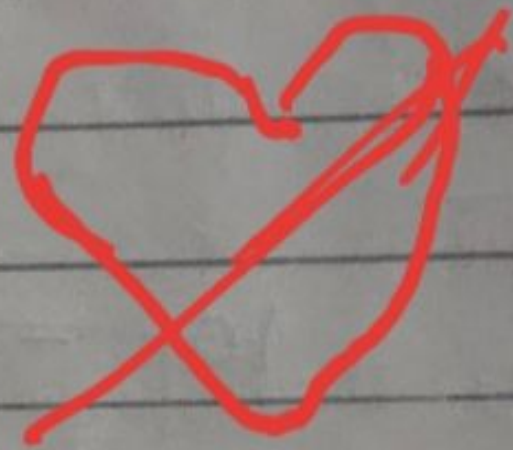


$$\begin{bmatrix} D+1 & D-1 \\ 3 & D+2 \end{bmatrix} \begin{bmatrix} 2 \\ 1 \end{bmatrix}$$

$$\cancel{D+1+2} \quad \cancel{D-1+1}$$

6

$$\begin{vmatrix} 2D+2 & D-1 \\ 6 & D+2 \end{vmatrix}$$



$$\begin{aligned} &= (2D+2)(D+2) - 6(D-1) \\ &= 2D^2 + 4D + 2D + 4 - 6D + 6 \\ &= 2D^2 + \cancel{6D} - \cancel{6D} + 10 \\ &= 2D^2 + 10 \\ &= 2m^2 + 10 \end{aligned}$$

Question No : 35 of 39

Marks: 3

For the given system of differential equations

$$(D+1)x + (D-1)y = 2$$

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

Write down its auxiliary equation for 'x'.

(a) The **singular points** of the equation $(x^2 - 1)y'' + 2xy' + 6y = 0$ are the solutions of $x^2 - 1 = 0$ or $x = \pm 1$. All other finite values of x are the ordinary points.

(b) The **singular points** need not be real numbers.

The equation $(x^2 + 1)y'' + 2xy' + 6y = 0$ has the **singular points** at the solutions of $x^2 + 1 = 0$, namely, $x = \pm i$.

All other finite values, real or complex, are ordinary points.

Whether or not all singular points have real numbers if not then give some example?

Answer ([Please click here to Edit Answer](#))