بِسْمِ اللّٰهِ الرَّحْمٰنِ الرَّحِيْمِ

In the Name of Allāh, the Most Gracious, the Most Merciful

**Paper Pattern**

MCQS 40 each 1 mark
Short 4 each 2 marks
Short 4 each 3 marks
long 4 each 5 marks

Question No : 1 of 52 — Marks: 1 (Budgeted Time 1 Min)

The solution of $x^2 \frac{d^2y}{dx^2} = 0$ is

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Answer ( Please select your correct option )

- $y = c_1 + c_2 x$ — correct
- $y = c_1 x + c_2 x^2$
- $y = c_1 x + c_2 x^3$
- None of them

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Question No : 2 of 52 — Marks: 1 (Budgeted Time 1 Min)

The nature of roots of auxiliary equation deduced from Cauchy Euler equation

$$4x^2 \frac{d^2y}{dx^2} + 8x\frac{dy}{dx} + y = 0$$

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Answer ( Please select your correct option )

- Real and unequal
- Real and repeated — correct
- Complex
- None of them

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Question No : 3 of 52 Marks: 1 (Budgeted Time 1 Min)

A function **f** is said to be convergent at a point **a** if it can be represented by the power series in (x-a) which has

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Answer ( Please select your correct option )

- Positive radius of convergence
- Radius of convergence equals zero.
- None of them

  correct
- Negative radius of convergence

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Question No : 4 of 52 Marks: 1 (Budgeted Time 1 Min)

If E(t)=0, $R \neq 0$ (E(t) is thesource voltage & R is the resistance) then electric vibration of the circuit is said to be

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Answer ( Please select your correct option )

- Free damped oscillation

  correct
- Free un-damped oscillation
- Both damped and un-damped oscillation
- None of them

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Question No : 5 of 52 Marks: 1 (Budgeted Time 1 Min)

The quantity $Z = \sqrt{X^2 + R^2}$ is called

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Answer ( Please select your correct option )

- Reactance of circuit
- Impedance of circuit

  correct
- Quasi of circuit
- None of them

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Question No : 6 of 52 Marks: 1 (Budgeted Time 1 Min)

The time interval between two successive maxima of $x(t) = Ae^{-\lambda t}\sin[\sqrt{\omega^2 - \lambda^2} + \phi]$ is called

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Answer ( Please select your correct option )

- None of them
- Both the period
- Quasi-period

correct

- Phase period

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Question No : 7 of 52 Marks: 1 (Budgeted Time 1 Min)

The Quasi-frequency of the solution **x(t)** of free damped motion is given by the number

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Answer ( Please select your correct option )

- $\frac{\sqrt{\omega^2 - \lambda^2}}{2\pi}$
- $\frac{2\pi}{\sqrt{\omega^2 - \lambda^2}}$

correct

- $\sqrt{\omega^2 - \lambda^2}$
- None of them

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Question No : 8 of 52 Marks: 1 (Budgeted Time 1 Min)

For the equation of free damped motion $\frac{d^2x}{dt^2} + 2\lambda\frac{dx}{dt} + \omega^2 x = 0$ the roots are $m_1 = -\lambda + \sqrt{\lambda^2 - \omega^2}$ & $m_1 = -\lambda - \sqrt{\lambda^2 - \omega^2}$ If $\lambda^2 - \omega^2 < 0$ then system is said to be

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Answer ( Please select your correct option )

- Over damped
- Critically damped
- Under damped

correct

- None of them

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Question No : 9 of 52 Marks: 1 (Budgeted Time 1 Min)

The general solution of the equation $x^2\frac{d^2y}{dx^2}+x\frac{dy}{dx}+(x^2-\frac{1}{25})=0$ is

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Answer ( Please select your correct option )

- $y=c_1J_{\frac{1}{3}}(x)+c_2J_{-\frac{1}{3}}(x)$
- $y=c_1J_{\frac{1}{4}}(x)+c_2J_{-\frac{1}{4}}(x)$
- $y=c_1J_{\frac{1}{3}}(x)+c_2J_{-\frac{1}{3}}(x)$ correct
- $y=c_1J_{\frac{1}{25}}(x)+c_2J_{-\frac{1}{25}}(x)$

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Question No : 10 of 52 Marks: 1 (Budgeted Time 1 Min)

$J_{-\frac{2}{3}}(x)-J_{\frac{4}{3}}(x)=$

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Answer ( Please select your correct option )

- $2J'_{\frac{1}{3}}(x)$ correct
- $2J'_{\frac{2}{3}}(x)$
- $2J'_{\frac{4}{3}}(x)$
- None of them

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Question No : 11 of 52 Marks: 1 (Budgeted Time 1 Min)

If $A=\begin{bmatrix}1 & 2 & 3\\ 5 & 6 & 7\end{bmatrix}$ & $B=\begin{bmatrix}x & y & z & a\\ p & q & r & b\\ l & mn & o\end{bmatrix}$ then the order of *matirx* $A\times B$ is

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Answer ( Please select your correct option )

- $2\times4$ correct
- $2\times3$
- $3\times3$
- None of them

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Question No : 12 of 52 Marks: 1 (Budgeted Time 1 Min)

The order of a matrix which contains 1 rows and m columns is

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Answer ( Please select your correct option )

- $1\times m$ — correct
- $2\times m$
- $m\times 1$
- None of them

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Question No : 13 of 52 Marks: 1 (Budgeted Time 1 Min)

Eigen value of the matirx $A=\begin{pmatrix}3 & 4\\ -1 & 7\end{pmatrix}$ is

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Answer ( Please select your correct option )

- $\lambda=5,3$
- $\lambda=5,5$ — correct
- $\lambda=3,4$
- None of them

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Question No : 14 of 52 Marks: 1 (Budgeted Time 1 Min)

The given system without the use of matrices $\frac{d}{dt}\begin{pmatrix}x\\ y\end{pmatrix}=\begin{pmatrix}3 & -7\\ 1 & 1\end{pmatrix}\begin{pmatrix}x\\ y\end{pmatrix}+\begin{pmatrix}4\\ 8\end{pmatrix}\sin t$ is

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Answer ( Please select your correct option )

- $\frac{dx}{dt}=3x-7y+4\sin 2t\,;\ \frac{dy}{dt}=x+y+8\cos 2t$
- $\frac{dx}{dt}=3x-7y+4\sin t;\ \frac{dy}{dt}=x+y+8\cos t$
- $\frac{dx}{dt}=3x-7y+4\sin t;\ \frac{dy}{dt}=x+y+8\sin t$ — correct
- None of them

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Question No : 15 of 52 Marks: 1 (Budgeted Time 1 Min)

The given system without the use of matrices $\frac{d}{dt}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 3 & -7 \\ 1 & 1 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} + \begin{pmatrix} 4 \\ 8 \end{pmatrix} e^{-t}$ is

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Answer ( Please select your correct option )

- $\frac{dx}{dt} = 3x - 7y + 4\sin 2t$ ; $\frac{dy}{dt} = x + y + 8\cos 2t$
- $\frac{dx}{dt} = 3x - 7y + 4e^{-t}$; $\frac{dy}{dt} = x + y + 8e^{-t}$ correct
- $\frac{dx}{dt} = 3x - 7y + 4e^{t}$; $\frac{dy}{dt} = x + y + 8e^{-t}$
- None of them

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Question No : 16 of 52 Marks: 1 (Budgeted Time 1 Min)

The coefficient matrix of the following homogeneous system of differential equation $\frac{dx}{dt} = 3x + 2y$ , $\frac{dy}{dt} = x + 2y$ *is*

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Answer ( Please select your correct option )

- $\begin{bmatrix} 3 & 2 \\ 2 & 2 \end{bmatrix}$
- $\begin{bmatrix} 3 & 1 \\ 2 & 2 \end{bmatrix}$
- $\begin{bmatrix} 3 & 2 \\ 1 & 2 \end{bmatrix}$ correct
- None of them

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Question No : 17 of 52 Marks: 1 (Budgeted Time 1 Min)

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

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Answer ( Please select your correct option )

- Single root of A
- triple root of A correct
- double root of A
- None of them

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Question No : 18 of 52 Marks: 1 (Budgeted Time 1 Min)

By applying the Operator method or systematic elimination on a system of linear homogeneous or linear non-homogeneous differential equations we always get a

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Answer ( Please select your correct option )

- Single linear differential equation — correct
- Double linear differential equation
- Partial linear differential equation
- None of them

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Question No : 19 of 52 Marks: 1 (Budgeted Time 1 Min)

If L denote the linear differential operators with constant coefficients, then $L_1L_4 - L_2L_3$ represents the

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Answer ( Please select your correct option )

- $\begin{vmatrix} L_1 & L_2 \\ L_4 & L_3 \end{vmatrix}$
- $\begin{vmatrix} L_1 & L_3 \\ L_4 & L_2 \end{vmatrix}$
- $\begin{vmatrix} L_1 & L_2 \\ L_3 & L_4 \end{vmatrix}$ — correct
- None of them

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Question No : 20 of 52 Marks: 1 (Budgeted Time 1 Min)

The matrix $\begin{bmatrix} 2 & 6 \\ 1 & 3 \end{bmatrix}$ is

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Answer ( Please select your correct option )

- Singular matrix — correct
- Non singular matrix
- Diagonal matrix
- Scalar Matrix

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Question No : 21 of 52 Marks: 1 (Budgeted Time 1 Min)

The Differential Equation $(x^2-4)y''-10xy'+y=0$ has singularity at

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Answer ( Please select your correct option )

- $x=\pm 1$
- $x=\pm 2$ correct
- $x=\pm 3$
- $x=\pm 4$

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Question No : 22 of 52 Marks: 1 (Budgeted Time 1 Min)

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

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Answer ( Please select your correct option )

- Dependent variables correct
- Independent variable
- Choice variable
- None of them

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Question No : 23 of 52 Marks: 1 (Budgeted Time 1 Min)

The non-zero solution of the system exists only when

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Answer ( Please select your correct option )

- $\det(A-\lambda I)=1$
- $\det(A-\lambda I)=0$ correct
- $\det(A-\lambda I)=-1$
- $\det(A-\lambda I)\neq 0$

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Question No : 24 of 52 Marks: 1 (Budgeted Time 1 Min)

The solution of the linear first order differential equation $\frac{dy}{dx} - 2y = 0$ is

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Answer ( Please select your correct option )

- $y = e^{2x+c}$ correct
- $y = \sum_{n=0}^{\infty} \frac{x^n}{4n!}$
- Both 1) and 2)
- None of them

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Question No : 25 of 52 Marks: 1 (Budgeted Time 1 Min)

Ordinary points of $(x^2 - 64)(x^2 - 36)y'' + xy' - y = 0$ are

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Answer ( Please select your correct option )

- 0,1
- 8,-8
- 6,-6
- None of others. correct

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Question No : 26 of 52 Marks: 1 (Budgeted Time 1 Min)

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

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Answer ( Please select your correct option )

- x = 2
- x = -2 correct
- x= -2, 2
- None of them

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Question No : 27 of 52 Marks: 1 (Budgeted Time 1 Min)

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

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Answer ( Please select your correct option )

- Real and unequal value
- Repeated & real eigen value

  correct
- Complex eigen value
- None of them

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Question No : 28 of 52 Marks: 1 (Budgeted Time 1 Min)

If $A = \begin{bmatrix} 1 & 0 \\ 0 & 2 \end{bmatrix}$, then eigen values are

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Answer ( Please select your correct option )

- 1,2

  correct
- 0,1
- 0,2
- None of them

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Question No : 29 of 52 Marks: 1 (Budgeted Time 1 Min)

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

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Answer ( Please select your correct option )

- Trivial equation
- Characteristics equation
- Non-trivial equation

  correct
- None of them

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Question No : 30 of 52 Marks: 1 (Budgeted Time 1 Min)

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

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Answer ( Please select your correct option )

- $\lambda = 1, 2$ correct
- $\lambda = 2, 2$
- $\lambda = 1, 1$
- None of them

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Question No : 31 of 52 Marks: 1 (Budgeted Time 1 Min)

Which of the following may not be considered as integration technique

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Answer ( Please select your correct option )

- By Parts
- By substitutions
- By Partial Fractions correct
- None of these

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Question No : 32 of 52 Marks: 1 (Budgeted Time 1 Min)

Which of the following equations satisfy the differential equation $\frac{dy}{dx} = x$

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Answer ( Please select your correct option )

- $2y = x^2 + c$ correct
- $y = x^2 + c$
- $y = x^2$
- $y = x + c$

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Question No : 33 of 52 Marks: 1 (Budgeted Time 1 Min)

The differential equation $(3x^2y+2)\,dx + (x^3+y)\,dy = 0$ is -------.

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Answer ( Please select your correct option )

- Exact — correct
- Non-exact
- Separable
- Homogenous

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Question No : 34 of 52 Marks: 1 (Budgeted Time 1 Min)

In order to change the Bernoulli Equation

$$\frac{dy}{dx} + p(x)y = q(x)y^n$$

into linear differential equation, we choose ----.

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Answer ( Please select your correct option )

- $v = y^{n-1}$
- $v = y^{1-n}$ — correct
- $v = y^n$
- $v = y'$

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Question No : 35 of 52 Marks: 1 (Budgeted Time 1 Min)

A differential equation of the form $\frac{dy}{dx} = f(x,y)$ is said to be homogeneous if $f(tx,ty) =$ ----.

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Answer ( Please select your correct option )

- $f(x,y)$ — correct
- $f(x)$
- $f(y)$
- $C$

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Question No : 36 of 52 Marks: 1 (Budgeted Time 1 Min)

The differential equation ---------- is separable.

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Answer ( Please select your correct option )

- $x(x+y)\frac{dy}{dx}=4$
- $\frac{dy}{dx}=\frac{x^2}{x+xy}$ correct
- $\frac{dy}{dx}=\frac{y}{1+xy^3}$
- $\frac{dy}{dx}=\frac{xy+3}{1+2xy}$

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Question No : 37 of 52 Marks: 1 (Budgeted Time 1 Min)

The differential equation ---------- is not separable.

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Answer ( Please select your correct option )

- $\frac{dy}{dx}=\frac{2xy+3}{3+4xy^2}$ correct
- $\frac{dy}{dx}=\frac{x+1}{x+xy^2}$
- $\frac{dy}{dx}=\frac{1}{x^2y+4y}$
- $\frac{dy}{dx}=1+y+x+xy$

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Question No : 38 of 52 Marks: 1 (Budgeted Time 1 Min)

If the equation $M(x,y)dx+N(x,y)dy=0$ is not exact and $\mu=\frac{N_x-M_y}{M}$ is a function of $y$ only, then the integrating factor is given by----------.

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Answer ( Please select your correct option )

- $I.F=e^{\int \mu dy}$ correct
- $I.F=e^{\int 2\mu dy}$
- $I.F=e^{\int \frac{1}{2}\mu dy}$
- $I.F=e^{-\int \mu dy}$

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Question No : 39 of 52 Marks: 1 (Budgeted Time 1 Min)

For the solution of the equation $\frac{-1}{y-1} = x + c$ *with* $y(0) = 3$, *the value of* $c$ *is* - - -.

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Answer ( Please select your correct option )

- 0
- 1
- -1/2 correct
- -1

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Question No : 40 of 52 Marks: 1 (Budgeted Time 1 Min)

If $e^{2x}\left(c_1 \cos 3x + c_2 \sin 3x\right)$ is the solution of $\frac{d^2y}{dx^2} - 4\frac{dy}{dx} + 13y = 0$, then which of the following is the most accurate option for $\frac{d^2y}{dx^2} - 4\frac{dy}{dx} + 13y = e^{2x}\sin 3x$ ?

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Answer ( Please select your correct option )

- Its general form of the particular solution will be $Ae^{2x} + B\sin x + C\cos x$.
- Its general form of the particular solution will be $e^{2x}\left(A\sin x + B\cos x\right)$. correct
- Its general form of the particular solution will be $e^{2x}\left(Ax\sin x + Bx\cos x\right)$.
- Its general form of the particular solution will be $e^{2x}\left(Ax\sin 3x + Bx\cos 3x\right)$.

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Question No : 41 of 52 Marks: 2 (Budgeted Time 4 Min)

Find the eigenvalues of the following system

$$X' = \begin{pmatrix} 3 & -9 \\ 4 & -3 \end{pmatrix} X$$

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Answer ( Please click here to Add Answer )

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Question No : 42 of 52 Marks: 2 (Budgeted Time 4 Min)

Is generally in matrices following laws hold or not?

1- Associative Law
2- Distributive Law
3- Commutative Law

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Answer ( Please click here to Add Answer )

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Question No : 43 of 52 Marks: 2 (Budgeted Time 4 Min)

Define regular and irregular singular points?

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Answer ( Please click here to Add Answer )

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Question No : 44 of 52 Marks: 2 (Budgeted Time 4 Min)

Solve the differential equation:

$$\frac{dy}{dx} = \frac{x^2}{2y}$$

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Answer ( Please click here to Add Answer )

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Question No : 45 of 52 Marks: 3 (Budgeted Time 6 Min)

Find the complementry solution for the DE $y''-4y'+4y=2e^{2x}$ ?

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Answer ( Please click here to Add Answer )

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Question No : 46 of 52 Marks: 3 (Budgeted Time 6 Min)

When roots of indicial equation differ by a positive integer then explain the case when $r_1 = r_2$, where $r_1$ and $r_2$ are roots of the indicial equation.

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Answer ( Please click here to Add Answer )

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Question No : 47 of 52 Marks: 3 (Budgeted Time 6 Min)

State Principal of superposition of set of solution vectors of a homogeneous system.

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Answer ( Please click here to Add Answer )

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Question No : 48 of 52 Marks: 3 (Budgeted Time 6 Min)

Write down the procedure of solution of the system of differential equations by "Operator Method".

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Answer ( Please click here to Add Answer )

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Question No : 49 of 52 Marks: 5 (Budgeted Time 10 Min)

Find the general solution of the given differential equation on$(0,\infty)$

$$x^2\frac{d^2y}{dx^2}+x\frac{dy}{dx}+(x^2-\frac{1}{64})y=0$$

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Answer ( Please click here to Add Answer )

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Question No : 50 of 52 Marks: 5 (Budgeted Time 10 Min)

Write the following system in matrix form

$$\frac{dx}{dt}=x-y+z+t-1$$

$$\frac{dy}{dt}=2x+y-z-3t^2$$

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Answer ( Please click here to Add Answer )

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**Question No : 51 of 52** — **Marks: 5 (Budgeted Time 10 Min)**

What is indicial equation and exponent in the differential equation $xy'' + 3y' - y = 0$ with x=0 regular singular point?

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**Answer ( Please click here to Add Answer )**

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**Question No : 52 of 52** — **Marks: 5 (Budgeted Time 10 Min)**

Determine the order and state the linearity of each of the following differential equations.

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

2) $\frac{dy}{\cdot} - 2xy = x^2 - x$

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**Answer ( Please click here to Add Answer )**

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