بسم الله الرحمن الرحيم

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 conversion of Cauchy Euler equation $4x^2\frac{d^2y}{dx^2}+8x\frac{dy}{dx}+y=0$ after putting $x=e^z$ becomes

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Answer (Please select your correct option)

- $(4\Delta^2-4\Delta-1)y=0$
- $(4\Delta^2+4\Delta+1)y=0$
- $(4\Delta^2+8\Delta+1)y=0$
- None of them

correct

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

Consider a power series $\sum_{n=1}^{\infty}a_n=\sum_{n=1}^{\infty}(x-1)^n$ then power series clearly converges for the value of x lies in

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Answer (Please select your correct option)

- 0<x<1
- 0<x<2

correct

- 0<x<3
- None of them

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

Consider a power series $\sum_{n=1}^{\infty} a_n = \sum_{n=1}^{\infty} \frac{1}{\sqrt{n}} x^n$ then power series gives an inconclusive result if

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Answer (Please select your correct option)

- $|x| \le 1$
- $|x| = 1$ correct
- $|x| > 1$
- None of them

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

Suppose that a power series $\sum_{n=1}^{\infty} a_n (x-a)^n$ is represented by a function "f" whose domain is the interval of the convergence of the power series. That function "f" is continuous, differentiable and integrable on

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Answer (Please select your correct option)

- (a + R, a - R)
- (R -a, R + a)
- (a - R, a + R)
- None of them

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

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

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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

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Question No : 6 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)

- Divergent series
- Convergent series
- Both of the Ist and 2nd option
- None of them

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

If E(t)=0, $R \neq 0$ (E(t) is the source 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 : 8 of 52 Marks: 1 (Budgeted Time 1 Min)

If E(t)=0, $R = 0$ (E(t) is the source 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
- Free un-damped oscillation
- Both damped and un-damped oscillation
- None of them

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Question No : 9 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 : 10 of 52 Marks: 1 (Budgeted Time 1 Min)

Since $x(t) = \frac{2\sqrt{10}}{3} e^{-t} \sin[3t + 4.391]$ is the solution of $\frac{d^2x}{dt^2} + 2\frac{dx}{dt} + 10x = 0$ $with\ x(0) = -2$, $x'(0) = 0$ .So the phase angle is

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Answer (Please select your correct option)

- 4.193
- 4.391 correct
- 4.931
- None of them

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

The standard unit for measurement of inductance is

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Answer (Please select your correct option)

- Volt
- Ohms
- Henry correct
- None of them

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

The second order linear differential equation $x^2\frac{d^2y}{dx^2}+x\frac{dy}{dx}+(x^2-49)=0$ is a Bessel equation of degree

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Answer (Please select your correct option)

- 5
- 6
- 7
- None of them

correct

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Question No : 13 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)

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

correct

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

Which of the rule in matrices under multiplication does not hold true?

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Answer (Please select your correct option)

- Commutative law
- Associative law
- Identity law
- None of them

correct

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

If a matrix has 3 rows and 2 columns then the given matrix is called

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Answer (Please select your correct option)

- Column matrix
- Square Matrix
- Inverse matrix
- Rectangular matrix — correct

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Question No : 16 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)

- 2×4 — correct
- 2×3
- 3×3
- None of them

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Question No : 17 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 : 18 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)

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

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Question No : 19 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)

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

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

$\begin{vmatrix} 4-\lambda & 1 & 0 \\ 0 & 4-\lambda & 1 \\ 0 & 0 & 4-\lambda \end{vmatrix} = 0$ *gives*

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Answer (Please select your correct option)

- $\lambda = 4$ of multiplicity of 1
- $\lambda = 4$ of multiplicity of 2
- $\lambda = 4$ of multiplicity of 3

  correct
- None of them

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Question No : 21 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 : 22 of 52 Marks: 1 (Budgeted Time 1 Min)

For the system of differential equations $\frac{dy}{dt} = 2x$, $\frac{dx}{dt} = 3y$ the independent variable(s) is (are)

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Answer (Please select your correct option)

- x, t
- y, t
- x, y
- t

correct

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

The differential equation $2\frac{dy}{dx} + x^2 y = 2x + 3, y(0) = 5$ is

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Answer (Please select your correct option)

- Linear
- Nonlinear

  correct

- Linear with fixed constants
- Undeterminable to be linear or nonlinear

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

If A is a square matrix and its determinant is zero, then

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Answer (Please select your correct option)

- A is singular matrix.

  correct

- A is non singular matrix.
- A is scalar matrix.
- A is diagonal matrix.

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

The Period of oscillator in the solution X=50Sin (20t+8.5) is

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Answer (Please select your correct option)

- 0.17643
- 0.32045
- 0.31400

  correct

- 0.58000

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

An electronic component of an electronic circuit that has the ability to store charge and opposes any change of voltage in the circuit is called

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Answer (Please select your correct option)

- Inductor
- Resistor
- Capacitor

  correct

- None of them

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

If determinant $\begin{vmatrix} D-3 & 1 \\ -1 & D-1 \end{vmatrix} = 0$, then .....

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Answer (Please select your correct option)

- $D^2 - 4D + 1 = 0$
- $D^2 - 4D + 3 = 0$
- $D^2 - 4D + 4 = 0$ correct
- None of them

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

A rectangular arrangement of numbers or functions enclosed in the square brackets is called

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Answer (Please select your correct option)

- Equation
- derterminant
- Matrix correct
- None of them

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

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

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Answer (Please select your correct option)

- Linearly Independent
- Linearly dependent correct
- None of them
- Parallel

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Question No : 30 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 : 31 of 52 Marks: 1 (Budgeted Time 1 Min)

Let λ 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 : 32 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)

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

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

The equation $\frac{dy}{dx} = \frac{x(x+1)}{y(y-1)}$ is a/an ----------

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Answer (Please select your correct option)

- partial differential equation.
- ordinary differential equation. correct
- polynomial equation.
- transcendental equation.

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

The differential equation $dx + (\frac{x}{y} - \sin y)\, dy = 0$ is ----------

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Answer (Please select your correct option)

- Exact.
- Non-exact. correct
- Homogenous.
- Linear.

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

If $f(x)$ and $g(x)$ are linearly dependent on I, then-----.

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Answer (Please select your correct option)

- $W(f,g)(x) \neq 0$ (Wronskian) for all x in the interval I.
- $W(f,g)(x) = 0$ (Wronskian) for all x in the interval I.
- $W(f,g)(x)$ *may or may not be* zero for all x in the interval I. correct
- $W(f,g)(x)$ is not defined for all x in the interval I.

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

If the auxiliary equation has roots $-2, -2$, then the general solution of the differential equation is_____

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Answer (Please select your correct option)

- $y = c_1 e^{-2x} + c_2 e^{-2x}$
- $y = c_1 e^{-2+2x}$
- $y = c_1 e^{2x} + c_2 e^{-2x}$
- $y = (c_1 + c_2 x) e^{-2x}$ correct

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

If the annihilator operator of $2x$ is D^2 and of xe^{3x} is $(D-3)^2$, then which of the following is the correct option?

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Answer (Please select your correct option)

- The annihilator operator of $2x + xe^{3x}$ is $(D-3)^2$.
- The annihilator operator of $2x + xe^{3x}$ is D^2.
- The annihilator operator of $2x + xe^{3x}$ is $D^2 + (D-3)^2$.
- The annihilator operator of $2x + xe^{3x}$ is $D^2 (D-3)^2$. correct

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

If $y_1 = x$ and $y_2 = xe^x$ are the first and second solution of $x^2 \frac{d^2y}{dx^2} - x(x+2)\frac{dy}{dx} + (x+2)y = 0$ on $(0, \infty)$, then which of the following is the most accurate option?

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Answer (Please select your correct option)

- $y_1 = x$ and $y_2 = xe^x$ may or may not be linearly dependent.
- $y_1 = x$ and $y_2 = xe^x$ must be linearly independent. correct
- $y_1 = x$ and $y_2 = xe^x$ may or may not be linearly independent.
- $y_1 = x$ and $y_2 = xe^x$ must be linearly dependent.

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

If $y_1 = xe^{-x}$ is the first solution of the differential equation $\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + y = 0$, then which of the following is true for it?

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Answer (Please select your correct option)

- Its second solution is $xe^{-x}\int \frac{2}{e^{-2x}}dx$
- Its second solution is $xe^{-x}\int \frac{2}{x^2e^{-2x}}dx$
- Its second solution is $xe^{-x}\int \frac{1}{x^2e^{-2x}}dx$
- Its second solution is $xe^{-x}\int \frac{1}{x^2}dx$ correct

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

If $x^2\frac{d^2y}{dx^2} - 2\frac{dy}{dx} = 0$ is the particular form of $\frac{d^2y}{dx^2} + P(x)\frac{dy}{dx} + Q(x)y = 0$, then which of the following is the most accurate option?

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Answer (Please select your correct option)

- $P(x) = \frac{2}{x^2}$ and $Q(x) = 0$
- $I.F = e^x$ $P(x) = -2$ and $Q(x) = x^2$
- $P(x) = \frac{-2}{x^2}$ and $Q(x) = 0$ correct
- $P(x) = 0$ and $Q(x) = \frac{-2}{x^2}$

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

For differential equation $x(x-1)y'' + (3x-1)y' + y = 0$ if $y_1 = \sum_{k=0}^{\infty} x_k = 1 + x + x^2 + \ldots\ldots\ldots = \frac{1}{1-x}$; $|x| < 1$ is one solution about regular singularity $x = 0$, then which method will be use to find 2nd solution?

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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)

Discuss the linearly dependence of solution vectors.

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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)

What is Legendre's differential equation

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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)

If the complementary solution of the following differential equation is $c_1 \sin 2x + c_2 \cos 2x$, then what will be the general form of its particular solution:

$$\frac{d^2y}{dx^2} + 4y = \cos 2x$$

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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)**

Can the power series method be directly applied if the coefficients P(x) and Q(x) for the differential equations $y'' + P(x)y' + Q(x)y = 0$ are not polynomials?
If P(x) = Sin x and Q(x) = Cos x, then how we solve it?

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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)**

Write the homogenous system of differential equations

$$2\frac{dx}{dt} - 5x + \frac{dy}{dt} = 5e^{t}$$

$$\frac{dx}{dt} - x + \frac{dy}{dt} = e^{t}$$

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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)**

Find the characteristic equation of coefficient matrix of the following system

$$\frac{dx}{dt} = -3x - 2y$$

$$\frac{dy}{dt} = 5x + 7y$$

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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)**

Determine whether the following functions are linearly dependent or linearly Independent ?

$$y_1 = 9\cos(2x),\ y_2 = 2\cos^2 x - 2\sin^2 x$$

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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)**

Find the wronskian of the Differential equation $y''' - 2y'' - 21y' - 18y = 3 + 4e^{-t}$ using variation of parameter and the root of the auxiliary equation is $m_1 = -3, m_2 = -1, m_3 = 6$?

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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)**

Write the following system in matrix form

$$\frac{dx}{dt} = -3x + 4y + e^{-t}\sin 2t$$

$$\frac{dy}{dt} = 5x + 9y + 4e^{-t}\cos 2t$$

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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)**

As x=0 is regular singular point of the differential equation $10xy'' + 10y' - y = 0$, find the relation of C_{k+1} and C_k in the process of finding solution.

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Answer (Please click here to Add Answer)

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